

Validation documentation
APIs & excipients, liquid/semi-solid (other)

HiperScan GmbH

March 12, 2020

Contents

Introduction	7
Context of this document	7
Criteria for the inclusion of substances	8
Validation concept	9
Model creation procedure and validation runs	9
Particularities of individual substance classes	12
Significance of testing with <i>Apo-Ident</i>	13
Conclusion	13
Explanation of terminology	14
Summary	19
Validation samples	19
Validation results	19
Validation reports	21
Alfason Basis Cresa®	21
Allergika evening primrose oil cream 20% / Dermifant® kids cream	27
alpha-bisabolol (racemic) at least 85%	33
Angelica root oil	37
Anise oil, organic	41
Argan oil	47
Balm Bio Nature	51
Banana aroma	55
Basil oil	59
Benzoin siam oil 20%	63
Bepanthen® Wund- und Heilsalbe	69
Bergamot oil	73
Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil	79
Camphor oil	87
Cardamom oil	91
Carrot seed oil	95
Cedar wood oil	99
Chamomile (essential oil)	105
Cinnamon bark oil, Ceylon	109
Citric oil / Lime oil	113
Citronella oil	119
Citus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil	123
Clove oil	129
Common wormwood oil	133
Contramarum aroma	137
Cumin oil	143
Cypress oil	147
Dermatop® base ointment	153
Dexeryl®	157
Dichloroacetic acid	163
Dimeticone ointment 10% SR / Optiderm® lotion	167
Dwarf pine oil	173
Ethanol 70% pure / denatured	177
Excipial® almond oil ointment	187
Fat ointments	193
Fenistil® Gel	203
Fennel oil	207
Ginger oil	211
Grapefruit oil organic / Orange oil / Blood orange oil	217
Hydrophilic ointments	223

Immortelle oil	249
Juniper oil	253
La Roche-Posay Cold Cream Naturel	257
La Roche-Posay Toleriane	261
Lemon grass oil	267
Liniment ointments	273
Linola® fat creme / Linola® H fat N / Alfason® Repair	281
Lipolotio urea 5% F body lotion	287
Lygal® head ointment N 3%	291
Lygal® ointment base	295
Mandarin oil, green	301
Manuka oil	305
Marjoram oil	309
Matricaria oil, morrocan	315
Matricaria oil, roman	319
Melissa oil	323
Melissa oil 30%	327
Myrrh oil	331
Neroli oil	335
Neuroderm® moisturising cream lipo	339
Nicotine	343
Ointment ash basis / Neribas®	347
Orange aroma	355
Oregano oil	361
Palmarosa oil, organic	365
Panthenol ointment Lichtenstein	369
Patchouli oil	373
Peppermint oil	377
Perfume oil vanilla	383
Raspberry aroma	387
Ravensara oil	393
Rose-geranium oil, organic	399
Rosemary camphor oil	405
Rosewood oil	409
Sage oil	413
Salicylic white paraffin 10%	419
Salmon oil	423
Sandalwood oil	427
Savory herb	431
Sebexol® formula basis / Sebexol® cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver	435
Siam benzoin	445
Solutio Cordes®	449
Spearmint oil	455
Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver fir oil	459
Stomahesive® adhesive paste	465
Strawberry aroma	469
Swiss pine oil	475
Tea tree oil	479
Thuja oil	483
Thyme oil, red	487
Thyme oil, white / Coriander oil	493
Vetiver bourbon oil	499
Wart ointment InfectoPharm® (NRF 11.31)	503
Water and aqueous solutions	509
Wax ointment (stabilised)	517
White paraffin oil	525

Wintergreen oil	529
Yarrow oil	533
Ylang-ylang oil	537
Appendix	541
Additional calibration samples (<i>Type A</i>)	541
Additional validation samples (<i>Type B</i>)	543
Additional validation samples (<i>Type C</i>)	545
Requirements of validation	547
Conformity of <i>Apo-Ident</i> with the <i>European pharmacopeia</i>	548
References	549
Index	551

Introduction

The unequivocal proof of the identity of pharmaceutical raw materials based on a monograph or traditional alternative methods is work-intensive, time-intensive and economically often no longer makes sense. Near-infrared spectroscopy (NIR) provides a new means here. It enables relatively easy, fast and nonetheless safe identity testing via the preparation and evaluation of spectra.

The analysis system *Apo-Ident* was developed specially for pharmacy use. Pharmacists have the duty to check the identity of all raw materials for extemporaneous products in their pharmacies. This normally takes place based on the monographs for the respective substances in the European Pharmacopoeia. But also NIR spectroscopy is described in the European Pharmacopoeia as an identification method which, as opposed to the methods incorporated in the respective monographs, is approved for testing [1] (quotation translated)

with the prerequisite that the same results (“namely the determination of the identity” [2]), (quotation translated) are achieved as with the described methods and instruments.

The *Apo-Ident* analysis system serves to identify raw materials for prescriptions in the defined manner according to *ApBetrO* [Pharmacies Rules and Regulations] §§ 6 and 11 at pharmacies (NIR spectroscopy as an alternative testing method). *Apo-Ident* consists of three components:

- An *NIR spectrometer*, which records the spectra of non-preprocessed raw materials in a measuring glass in diffuse reflection or transfection.
- The *QuickStep* spectroscopy software controls the instrument and records the spectra and user inputs via a pharmacy-specific software plug-in. It also generates the test protocol for documentation of the testing and storage of the printout to be signed in the pharmacy.
- The software module *IdentModule* incorporates *reference databases*. The spectra from the *QuickStep* software are presented to it for evaluation.

NIR spectroscopy is a very powerful analytical method. It is also able to establish the identity of several chemical compounds and mixes in as far as an appropriate database (technically correct: a [chemometric model](#)) was created. Identity testing with *Apo-Ident* is a very safe, very fast and easy to operate analytical method for testing a large number of raw materials.

Context of this document

The suitability of the instrument, method and database is proven as follows:

- *NIR spectroscopy as a method for identity testing*: The *Ph. Eur.* [3] describes NIR spectroscopy in *Section 2.2.40* as an analytical method which is also suitable for the identification of raw materials. Therefore, validation of the method as such is not necessary.
- *Performance of the instrument*: The *Ph. Eur.* [3] furthermore describes the apparatus and the testing of its performance in *Section 2.2.40*. The document *Erfüllung von 2.2.40 Ph. Eur. durch Apo-Ident* [4] compares the implementation by *Apo-Ident* with this monograph in order to prove that *Apo-Ident* meets the specifications of the Pharmacopoeia. Each individual instrument delivered to a pharmacy is qualified in accordance with the tests described in “*Control of Instrument Performance*”. In this test, the unit consisting of analysis instrument hardware and the *QuickStep* spectroscopy software is assessed. The result is documented in a test protocol which is kept at the pharmacy.
- *Validation of the database* is documented separately for each substance class. The report at hand documents the substance class *APIs & excipients, liquid/semi-solid (other)*.

The *Arbeitsgemeinschaft der Pharmazieräte Deutschlands (APD)* [Working Group of German Pharmacy Inspectors] has clarified the following in its resolution dated October 16, 2013 ([5], quotation translated):

NIR is a testing method incorporated in the Pharmacopoeia. The testing quality depends on the quality of the database stored. The APD views the use of NIR instruments in case of ensured validation of the databases used in conjunction with it as one of several options for identity testing.

The APD defined more precisely ([6], quotation translated) on October 1, 2014:

The use of near-infrared is a recognised testing method according to Ph. Eur. 8. For the use of NIR instruments in pharmacies for testing the identity of raw materials, sufficient and verifiable validation of the instrument used is required. The quality of the database stored by the instrument manufacturer is decisive for quality. Batch-specific differences with the same original substances must be taken into account if present.

So NIR is basically suitable. The validity of the reference database is proven with the existing validation documentation.

Criteria for the inclusion of substances

This validation documentation describes the results of the validation of the reference database for the substance class *APIs & excipients, liquid/semi-solid (other)*. Validation documentation is created for each published version of the reference database for all substance classes incorporated.

The reference database is incorporated in the software module *IdentModule*. During identification testing with *Apo-Ident*, spectra which are used for evaluation purposes are presented to it by the *QuickStep* software. In the same manner, the *IdentModule* is presented all validation spectra successively during the validation runs for evaluation purposes. The *IdentModule* responds respectively (without taking the initial assumption into account) with the identified substance or rejects it as unknown. The correctness of this response is checked for each possible initial assumption and counted.

The results are summarised for each substance and reproduced in this document. The core statement of this validation report is that the following criteria must be fulfilled for each database entry, so that *Apo-Ident* offers verification of identity by means of NIR for the relevant substance/substance group:

- The database is exclusively generated from spectra which have been recorded by *HiperScan GmbH* on traceable samples in pharmaceutical quality.
 - The samples are procured via typical pharmacy sources (*DAC III.2.: Bezugsquellennachweis für Rezepturbestandteile [reference source for prescription components]* [7]).
 - A valid manufacturer's certificate exists (content, purity and identity of the batch).
 - The identity was confirmed by a certified test laboratory or *HiperScan GmbH*.
- Each version of the reference database (every update) is validated in-full.
 - Calibration spectra (*Type A*), other spectra recorded under the control of *HiperScan GmbH* (*Type B*), and spectra from the field (*Type C*) are presented to the *IdentModule* for evaluation in three separately evaluated validation runs.
 - Here, no single *false positive* result may arise.
 - Here, the various substance classes are also tested for reciprocal rejection, where this is objectively justified (see *Summary* section).
- In the validation with spectra recorded under the control of *HiperScan GmbH*, spectra of at least one independent sample must be considered, i.e. spectra from a batch whose spectra have not been used for the generation of the database. In addition, the set of *Type A* and *Type B* spectra must originate from at least three different batches.
- Spectra of additional substances may be used for the generation of the database even though they will not be offered for identification by this database. The purpose is the reliable distinction from these substances.

- Any positive result of *Apo-Ident* confirms the identity of the substance/substance group and distinguishes it from all other substances of the database. In the case of substance groups, the result is ambiguous: Distinction from all substances not belonging to the group is proven. The substance is identified as a member of this group. However, within the substance group, it is not possible to reliably classify which substance has been tested.
- The criteria for clear identifiability are a [specificity](#) of 100 % ([true negative rate](#)) and a minimum distance in the distance matrix. See 2. d) under [Model creation procedure and validation runs](#).

Validation concept

[Chemometrics](#) is a statistical technique for the extraction of relevant chemical information from spectra. In mathematics, this method is described as *multivariate data analysis*. Chemometrics proceeds here as follows:

1. Collection of spectra for the *calibration sample*. The results (identities) of the calibration sample must be known. The calibration samples must be representative for the samples which are to be evaluated later. Therefore, they must take the various possible (physical) compositions into account. (Therefore, sourcing calibration samples for NIR from the specialist trade is superior to the use of CRS reference substances.)
2. The first mathematical step is *calibration*. Here, the [chemometric model](#) is calculated from the *calibration sample spectra* ([reference spectra](#)) and limits as well as some parameters are stipulated. The chemometric model is used later to calculate the analysis result (*prediction*).
3. Collection of further spectra for the *validation sample* which should be independent of the *calibration sample*. The results (identities) of the *validation sample* must also be known. The textbook suggests a random sample with a normal scope of 25 % to 50 % of the *calibration sample* [8].
4. The second technical data step is *validation*. Here, the [chemometric model](#) created is evaluated based on the spectra of the *validation samples*. As validation parameters for the identification, the *Ph. Eur. Section 2.2.40* [3] specifies the [specificity](#) and [robustness](#).

The validation step according to the textbook has the target of estimating the performance capability of the model created based on a random sample. In order to achieve the best possible precision, attention is paid to the calibration sample. In the field of pharmaceuticals, the safety of the method has priority. In order to be able to [validate](#) the model within the regulatory scope, the validation step must include probative force. For this purpose, the validation sample must be *representative and complete* in order to enable the testing of all cases.

A *sufficient number of batches* must be secured for validation because validation finally proves whether the number of batches in calibration suffices.

Each substance is validated individually. The validation results are documented per substance in this document. Moreover, the documents show how many and which batches have been used for creating the model or model validation.

At least one certificate is taken in for each substance from an accredited test laboratory for the independent testing of identity of the sample. The identification number of the corresponding test certificate is listed in the report, enabling traceability of a substance tested according to the monographs in the Pharmacopoeia.

Model creation procedure and validation runs

The safety of the [chemometric models](#) is guaranteed by several measures during model creation, of which the validation step is the final one. Normally, the procedure is as follows. It is in particular valid for the active pharmaceutical ingredients (APIs) *solid API excipients, liquid/semi-solid API excipients (with a test certificate), narcotics - solid medicinal substances and drugs*. If, for individual substance classes, variations are required, they are depicted in the section [Particularities of individual substance classes](#).

1. Collecting the reference spectra (calibration sample)

- a) Procurement of the samples from the same sources from which pharmacies source their raw material for compounding (Caelo, Fagron, Euro-OTC, ..., see also *DAC III.2. Bezugsquellen-nachweis für Rezepturbestandteile* [Sources of supply for compounding] [7]).
- b) Testing the suitability according to *ApBetrO* [Pharmacies Rules and Regulations] §§ 6, 11, that is to say the availability of a valid manufacturer certificates via identity, purity and contents of the batch.
- c) Recording standard 40 spectra of the sample in different positions, as a standard on four instruments. Here, handling and presentation of the samples as later in the pharmacy.
- d) Visual checking for anomalies in the spectra. In case of indications of measurement errors, measurement must be repeated. If a signature is missing in the spectrum, the substance may be excluded from the start as not promising (the spectra are nonetheless entered in the database validation as independent *Type B* spectra).
- e) Testing identity. For each substance, a certificate of correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the respective following substance page of this validation documentation the *Mahalanobis distance* to this reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance. Such samples underline the statistical spread of the original reference substance, but cannot add any new characteristics of the substance.

HiperScan GmbH cooperates with some suppliers as follows: the raw materials supplier takes a sufficiently large sample in his incoming goods area so that part of it can be used for recording the NIR spectra. The remainder of the sample goes to analytics for market approval. The manufacturer's batch certificate emerges from these identity, contents and purity tests, which consequently also prove the correct identity of the NIR reference sample. Therefore, the NIR spectra are suitable for structuring the database (*Type A*) and can also optionally be used for validation (*Type B*). The samples which this applies to are marked in the validation report with a footnote.

- f) If the identity of the new sample is proven, it is declared as a reference sample and the spectra are approved for structuring the database.

2. Generating the chemometric models (calibration)

- a) Determination of the transformation matrix from the reference spectra using variance maximisation [8, 9]. (All reference spectra are always included, even if only a few spectra are added for an update.) All reference spectra receive the same data pre-treatment, which is also later applied to all measurement spectra in the field (in the pharmacies).
- b) Checking that the number of principal components used is still sufficient.
- c) Calculating the limits for each substance from the spread of the reference spectra. The calculation regulation is identical for each substance in a substance class.
- d) Überprüfen der Abstände zwischen den Grenzen der trennbaren Substanzen: Die Distanzmatrix enthält die *Mahalanobis-Abstände* von jeder Substanz zu jeder anderen. Die Werte hin und zurück sind jeweils unterschiedlich, weil die Streuung der Ausgangssubstanz eingeht. Ist eine Distanz kleiner als der Mindestabstand, so gelten die Substanzen als nicht sicher trennbar. Der Mindestabstand ist auf 9 festgelegt. Der Entwickler des Modells darf einen größeren Mindestabstand festlegen (ein Wert für das gesamte *chemometrische Modell*), um die Trennschärfe zu erhöhen.
- e) Überprüfung des Modells anhand der Referenzspektren. Es sind keine *falsch-positiven* Ergebnisse erlaubt.

f) Wird eines der Kriterien verletzt (d) *Unterschnittener Mindestabstand zwischen zwei Substanzen* oder (e) *Eine Substanz wird als eine andere identifiziert*, entscheidet der Entwickler der Datenbank, welche der folgenden Optionen er anwendet:

- Er nimmt beide Substanzen aus der Datenbank. (Die Spektren bleiben in der Validierung und dürfen auch in den Aufbau eingehen. Sie werden aber nicht zur Prüfung angeboten.)
- Er bildet eine Substanzgruppe mehrerer nicht sicher trennbarer Substanzen. Dann ist das Ergebnis mehrdeutig: Das chemometrische Modell stellt fest, dass es sich bei der Probe um eine der Substanzen aus der Gruppe handelt und dass es sich um keine andere Substanz handelt. Es kann aber nicht sagen, um welche der Substanzen es sich handelt. Um die eindeutige Identität festzustellen, muss der Anwender eine geeignete ergänzende Prüfung durchführen.
- Er erstellt ein weiteres *chemometrisches Modell* mit geringerem Umfang, in das mindestens alle Substanzen der nicht sicher trennbaren Substanzgruppe eingehen (Zweite-Stufe-Modell). Zweite-Stufe-Modelle werden nur aufgerufen, wenn die erste Stufe festgestellt hat, dass es sich nur um eine der Substanzen handeln kann, die in den Aufbau der Zweiten Stufe eingegangen ist.

3. Set of validation spectra (validation samples)

The following is provided for validation:

- a) *Type A*: The reference spectra = calibration spectra from which the database was generated. These also include spectra from substances which the *chemometric model* should not identify, but were also recorded during generation in order to increase selectivity. (As a result, the model “learns” to differentiate from other substances which are actually unknown to it.)
- b) *Type B*: Spectra recorded under the control of *HiperScan GmbH* and not used for the generation of the database. These also include reference spectra of other substance classes, and spectra that are not used as reference spectra. Samples are considered to be independent, if they originate from a batch, of which no spectra have been used for the generation of the database. (Up to *IdentModule 2018-01*, samples were still considered independent if the sampling was done independently, i.e. if they originate from another sales container.)
- c) *Type C*: Spectra from the field, which have not been recorded under the control of *HiperScan GmbH* and have not been used for the generation of the database. The spectra include not only substances of the substance class to be tested, but also substances from other classes.

All manufacturers’ batches from which spectra are used for the validation are listed by substance in this document: for substances included in the substance class *APIs & excipients, liquid/semi-solid (other)* in the respective validation reports; otherwise in attachments *A*, *B* and *C*.

Furthermore remains valid: validation spectra may only be removed if a error in the spectrum can be proven. Here, the spectra are not deleted, but instead placed on a *blacklist* incorporating the reason, date and initials in the commentary.

The section *Particularities of individual substance classes* treats the other substance classes from which *Type B* and *Type C* spectra are cited for validation purposes.

4. Validation runs and approval

- a) Validation spectra are transferred holistically to the *IdentModule* for evaluation in the same way as the spectroscopy software *QuickStep* transfers measured spectra.
- b) Following the provision of each spectrum, the *IdentModule* responds as to whether it has recognised a substance and which substance was recognised.
- c) The correctness of this response is checked for each possible initial assumption (each measurable substance with the substance class) and counted according to *true negative*, *false negative*, *true positive* and *false positive*. These figures are provided for each substance and additionally in the section *Summary*, separated according to types *A*, *B* and *C*.

- d) No *false positive* results whatsoever are permissible.
- e) If the criterion is also met for all substance classes, the *IdentModule* is approved.

Particularities of individual substance classes

Basically, *HiperScan GmbH* procures and tests the manufacturer's certificate for the batch, commissions external testing of the identity of the sample or carries it out independently and stores the certificates. As described, this process is established for the Pharmacopoeia substances, that is to say for substance classes **APIs & excipients, solid**, **APIs & excipients, liquid/semi-solid (with analysis certificate)**, **Narcotic substances, liquid/semi-solid** and **Drugs**. Therefore, *HiperScan GmbH* is able to furnish proof of the identity of the reference samples. In case of manufacturer-specific substance classes and others, individual steps are organised differently in-part:

The substance class **APIs & excipients, liquid/semi-solid (other)** (often described as cosmetics) incorporates substances for which no specification of the requirements of the pharmaceutical quality is determined, neither in a Pharmacopoeia monograph, a DAC/NRF monograph nor via a manufacturer's specification. Consequently, neither the identity nor contents can be tested independently. No certificates whatsoever exist for the reference samples. So here, merely the matching of the sample with former samples of this product is established and confusion with the other substances is ruled-out. (If the manufacturer of such a substance prepares a specification, determines testing methods and provides manufacturer's certificates in accordance with *ApBetrO* [Pharmacies Rules and Regulations] §§ 6, 11, *HiperScan GmbH* can assign the substance to the substance class *APIs & excipients, liquid/semi-solid (with analysis certificate)* again in the future).

Substance class **HCK – nutritional supplements (Hepart)** contains the HCK micro-nutrients from the Swiss company *Hepart AG*. *HiperScan GmbH* receives the reference samples directly from the manufacturer. For each reference sample, *HiperScan GmbH* also receives manufacturer's certificates and keeps these. New checking of the identity of the reference sample is not carried out by *HiperScan GmbH*. The identity of the reference samples is therefore documented by *Hepart AG*. The spectra of all batches provided by *Hepart AG* are recorded by *HiperScan GmbH* and entered in the database.

All the manufacturer's batches are used for the generation and validation of the substance class **HCK**. The expected variation is also represented in the generation and validation if there are less than three batches.

Also, for the substance class **PhytoComm** (TCM-Granulated herbal extracts of the manufacturer *PhytoComm*) spectra for all useable batches are recorded by *HiperScan GmbH* and entered in the database. The supplier organises the respective tests themselves and keeps the test certificates.

A new evaluation option was created for the class *PhytoComm* with the update 2016-01. As the risks are considerably fewer than those from chemical agents, the pharmacist can specify a reasonable criterion for the *specificity* in accordance with internal risk estimation. The database for this is created without taking safety distances into account and no criterion is determined in advance for the *specificity*. Instead, the *specificity* for testing the identity with this concrete substance is calculated in the validation for each substance and provided with the measurement result. The pharmacist then judges himself whether this safety is reasonable with regard to the risk of the substance.

Additionally, a statistical forecast is provided for the *specificity* which is determined according to the *Rule of Three* [10, 11]. For this forecast, it is assumed that there would have been three wrong results more and is provided with a lower limit for *specificity*. This value has a special meaning if a *specificity* of 100 % is achieved for a substance during validation. In this case, the lower limit allows conclusions regarding the scale of existing safety for which with an endless number of validation spectra a value of less than 100 % is to be assumed.

If, for example 14 000 spectra not belonging to the substance are presented and no *false positive* classification is made, a hypothetical number of three *false positive* results is assumed (*Rule of Three* [10, 11]) and the *specificity* is defined with 100.0000 % (> 99.9786 %). Here, it applies that the higher the number of validation spectra which form the statistical basis, the better the *specificity* calculated via the lower *specificity* limit will be approximated.

The positive result of the identity test using *Apo-Ident* establishes that the sample spectrum is in accordance with a batch of the specified granulate from the supplier *PhytoComm*, whereby all useable batches from the supplier are known.

The *PhytoComm* class can only confirm the identity of batches that have been used for the generation of the database. As a consequence there cannot be any validation spectra of other batches. Therefore, the criterion reads that two samples (from different sales containers) from each batch must exist, one for the structure of the database (*Type A*) and one for the validation (*Type B*).

Significance of testing with *Apo-Ident*

The analysis result is determined using sophisticated statistical methods according to state-of-the-art science and technology. Chemical and pharmaceutical knowledge is applied for the selection of the samples from which the calibration spectra and validation spectra are recorded. Otherwise it does not influence the further steps of model creation.

Verbally, the statement of the analysis result can be expressed as follows. Here “*the spectra match*” means that the criteria *Mahalanobis distance*, *outlier analysis* and *correlation* are met as shown in *Erfüllung von 2.2.40 Ph. Eur. durch Apo-Ident* [4]. “The spectra do not match”, on the other hand, means that at least the criterion *Mahalanobis distance* is not met.

The positive analysis result “*was identified as ...*” is very meaningful because both the quantity of substances to be taken into account and the number of underlying samples is very comprehensive.

1. The spectrum of the sample measured matches spectra of the defined substance.
2. The spectrum of the sample measured does not match any spectrum of any other substance in this substance class. Therefore, all other substances can be clearly ruled-out.
3. As the spectra from other substance classes were used for validation, it is proven that no spectrum of one of these other substances matches the defined substance. (All substance classes with which a spectrum comparison is possible and makes sense are used for validation. This is documented for each substance class in the section *Summary*.)
4. If the defined substance belongs to a *substance group* which in itself is not clearly separable with *Apo-Ident*, matching with the spectra of one or several substances in this group is confirmed. Which of these substances it actually is cannot be determined clearly. All other substances are excluded analogous to 2 and 3.

On the other hand, a negative analysis result “*was not identified as ...*” means:

1. The substance offered could not be recognised based on the spectrum of this sample.
2. The identity of this sample is not confirmed.
3. Testing must be repeated in accordance with the specifications of the Pharmacopoeia.

Conclusion

NIR spectroscopy is a testing method incorporated in the Pharmacopoeia. In case of successful database validation, it is a possible method for identity testing [5]. *Apo-Ident* meets the criteria of the *European Pharmacopoeia* as a near-infrared spectrometer and proves the validity of the reference database with the existing validation documentation. This means that *Apo-Ident* can be used as an alternative testing method for testing raw materials at pharmacies.

Explanation of terminology

The following section serves to explain or define specialist terminology which is required in order to understand this document. If necessary, definitions for the analysis system *Apo-Ident* are defined more precisely.

The term database is used in this document exactly as in the *Ph. Eur. Section 2.2.40* [3] synonymous with [chemometric model](#). In order to differentiate the databases which are relatively independent of each other, *HiperScan GmbH* frequently also uses the term [substance class](#) (primarily in the plural). On the other hand, the spectra used to structure the database are termed spectrum collection and not database.

Substance classes are units of the organisational structure of the *IdentModule*. The substance classes are substance [databases](#) which are also broadly independently subscribable. On the one hand, the liquid and semi-solid substances are separated from the solid powders because they are measured against different references and therefore the spectra cannot be compared. On the other hand, for example the Pharmacopoeia substances are kept separated from the manufacturer-specific database *PhytoComm* for TCM (traditional Chinese medicine) raw materials.

The individual substance classes need only be limited against each other in-part. Often, no risk of confusion exists because they can only be procured from different sources. On the other hand, in several cases we handle substances which need not be distinguished. For example, em Huang Qi granulate from the company *PhytoComm* neither needs to be delimited from *Huang Qi* granulate from the company *HerbaSinica* nor is matching required. Respectively one single [chemometric model](#) is behind a substance class. (Even if several reciprocally secured chemometric models would be permissible.) The terms *substance class*, *chemometric model* and *databases* are mostly used here as synonyms.

A substance group respectively summarises all the substances within a [substance class](#) which cannot safely be distinguished from one another based on their NIR spectra. However, all the other substances in the database can be excluded.

The formation of subgroups is mentioned in the *Ph. Eur. Section 2.2.40* [3]. In this manner, technical restrictions in case of extensive databases can be avoided and it is possible to prepare individual subgroups with different spectrum pre-treatment. Validation of the subgroups against each other is required. *HiperScan GmbH* has solved these technical restrictions and doesn't use any subgroups within a substance class any longer.

Principal component analysis (PCA) [8, 9] is a multivariate statistics process or multivariate data analysis. It serves to structure, simplify and illustrate comprehensive data records by describing a large number of statistical variables by describing a lower number of linear combinations (the *principal components*) which are as significant as possible. In the *Apo-Ident IdentModule*, *PCA* is used to evaluate the recorded spectrum data (corresponding with *Ph. Eur. 2.2.40* [3]).

The term validation is defined in both relevant contexts here with different (even if related) meanings.

Within the sense of the expert discipline of *chemometrics*, validation is a process step when creating a [chemometric model](#): after a transformation matrix, limits and various parameters have been calculated or determined from a set of reference spectra during the course of the calibration step [8, 9], the validation step determines the performance capability of the model (selectivity, precision, ...) based on the validation spectra. Normally, random sampling is planned here. In order for the validation to gain strength of proof, the validation spectrum set must be selected with an appropriately wide scope (*representative* and *complete*). The terms *validation run* and *validation step* always actually mean the process step in this sense.

In the regulatory sense (of pharmaceutical production), validation is the documented proof that a process or system meets the previously specified requirements reproducibly when applied practi-

cally. In this sense, the *Apo-Ident* databases only become validated databases with the validation documentation, which this document is part of.

The *European Pharmacopeia* uses the term validation in *Section 2.2.40* within the sense of the specialist discipline of *chemometrics* [3].

The robustness of a process is the property of only being influenced by environmental fluctuations (e.g. temperature or humidity) a little. A method is robust if the environmental conditions do not or hardly falsify the final result.

The specificity of a classification (of a [chemometric model](#)) is the [true negative rate](#).

The recognition rate (also sensitivity) is the [true positive rate](#). It defines in how many percent of cases a correctly set up substance is actually confirmed.

The true negative rate describes the share of spectra correctly classified as non-identity during validation. This is equivalent to correct classification. It means that a substance *A* within identity checking as substance *B* is judged as “*not identified*”. The *true negative rate* is equivalent to the conditional frequency

$$h(\text{rejected}|\text{genuinely no identity}) = \frac{r_n}{r_n + f_p}$$

with r_n as the total number of *true negative* classifications and f_p as the total number of *false positive* classifications. For successful validation of an *IdentModule*, all spectra presented belonging to this category must be classified as *not in accordance*.

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of this number. The weight of each spectrum of a substance/substance group *i* therefore results as

$$w_i = \frac{1}{n_i}$$

with n_i number of spectra in this substance/substance group. This weighting ensures that the overall result cannot be enhanced by adding especially large numbers of spectra from easily separable substances.

The true positive rate describes the share of spectra correctly classified as identity during validation. This is equivalent to correct classification. It means that a substance *A* within identity checking as substance *A* is judged as “*identified*”. The *true positive rate* is equivalent to the conditional frequency

$$h(\text{identified}|\text{genuine identity}) = \frac{r_p}{r_p + f_n}$$

with r_p as the total number of *true positive* classifications and f_n as the total number of *false negative* classifications. The *true positive rate* is a measure for the recognition rate of the validated *Apo-Ident IdentModule*.

In order to ensure that each substance is received with the same weight, the spectra are weighted as described for the [true negative rate](#).

The true negative result describes a spectrum correctly classified as non-identity during validation. It is equivalent to correct classification. It means that a substance *A* within identity checking as substance *B* is judged as “*not identified*”.

The false positive result describes a spectrum falsely classified as non-identity during validation. This is the most critical type of possible false classification. It means that a substance *A* within identity checking as substance *B* is judged as “*identified*”. For successful validation of an *IdentModule*, a number of false positive events of zero are demanded for all spectra entering the validation. The exception to this restriction is the class of TCM granulates from the company *PhytoComm* as described under [Particularities of individual substance classes](#).

The true positive result describes a spectrum correctly classified as identity during validation. It is equivalent to correct classification. It means that a substance *A* within identity checking as substance *A* is judged as “*identified*”.

The false negative result describes a spectrum falsely classified as non-identity during validation. It is equivalent to false classification. It means that a substance *A* within identity checking as substance *A* is judged as “*not identified*”.

The ‘Rule of Three’ says that with a probability of 95 % the next random sample of the same size no more than three false results are to be expected if no false result existed in the existing random sample [10, 11].

The *specificity* and *recognition rate* are determined both globally and from the validation runs for all substances. The information is supplemented with the hypothetical value if there had been three false results more. The percent information is provided in parentheses with the “greater than” symbol ‘>’, e.g. *specificity* 100.000 % (>99.983 %) if 17 567 false spectra have been presented without one single *false positive* result. The larger the statistical basis, the lower the influence of the hypothetical false results.

The Mahalanobis distance is a distance measure between two points in *n*-dimensional vector space. Here, the respective direction component of the distance to *standard deviation* [12] of an *n*-dimensional distribution is standardised. In case of the *principal component analysis* [8, 9] this standardisation relates to the distribution of the respective calibration data set for a classification (substance/substance group) in the *principal component space* [8]. The *Mahalanobis distance* of a point (mapping of a spectrum) $\vec{y}$ in the *n*-dimensional principal component space to the expected value of an *n*-dimensional distribution $\mathbf{X}$ then results as

$$d(\mathbf{X}, \vec{y}) = \sqrt{(\bar{\mathbf{X}} - \vec{y})^T \mathbf{S}^{-1} (\bar{\mathbf{X}} - \vec{y})} \quad \text{with} \quad \mathbf{X} \in \mathbb{R}^{m \times n}, \vec{y} \in \mathbb{R}^m$$

[13]. Here, *m* is equivalent to the number of principal components used (dimension of the principal component space) and *n* the number of measurements existing in the calibration data set (spectra). $\bar{\mathbf{X}}$ is the expected value of the resulting distribution for the calibration data set (the average value of *n* measurements received). $\mathbf{S}^{-1}$ is the inverse covariance matrix [12] for distribution $\mathbf{X}$.

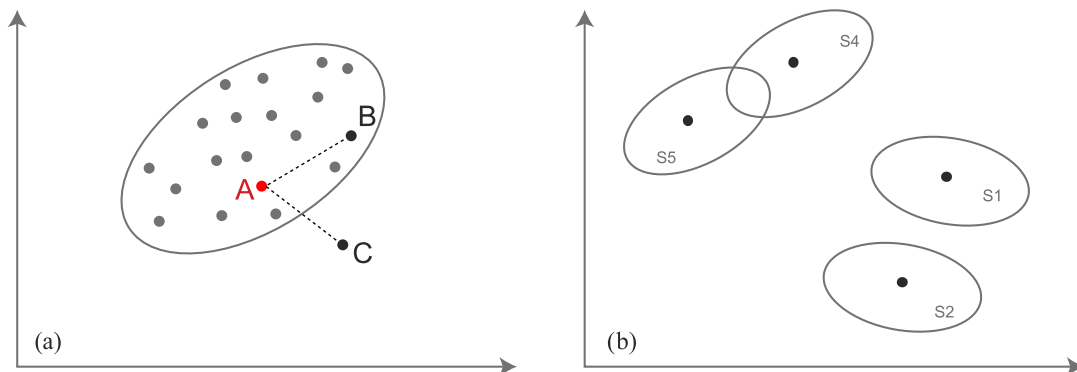


Figure 1: (a) The *Mahalanobis distance* from *A* to *B* is less than from *A* to *C*. However, the Euclidean distances are identical. (b) The *Mahalanobis distance* between the two measurement series *S4* and *S5* is smaller than between *S1* and *S2*. However, the Euclidean distances are identical.

The *Mahalanobis distance* offers advantages compared to the *Euclidean distance*: For the calculation of the distance it takes the statistical properties of a data point distribution (measurement series), i.e. average value, variance and covariance of the data points [14] into account. The *Mahalanobis distance* is applied while creating the reference database for evaluating the spectra from different samples of a substance.

A chemometric model is a classifier based on statistical methods [8, 9]. Through the respective algorithm used (e.g. *Principal Component Analysis*, *Cluster Analysis*), a maximum of chemical information is extracted from measurement data. Here, systematical or physical disturbances are eliminated using appropriate data pre-processing [15, 16].

At several places in this document, in order to simplify understanding, the term **database** is used instead of *chemometric model* – in the same manner as in the *Ph. Eur. Section 2.2.40* [3].

A sample (with its own sample ID) refers to substance in a sales container. Repeated sampling from the same sales container is listed under the same sample ID. (The suffix “SI” is not part of the sample ID.) Several samples may originate from the same batch. Samples are called “independent”, if they originate from a batch, of which no spectra have been used for the generation of the database. (Up to *IdentModule 2018-01*, samples from different sales packages were considered to be independent.) The information above the list of validation spectra now includes also the number of batches that deliver independent samples for the validation (for both *Type B* and *Type C*).

In case a supplier takes a sample for testing from its incoming goods and splits it to multiple laboratory containers, the substance in all laboratory containers will still be ascribed to the same sample. *HiperScan GmbH* only uses one of the subsamples.

Reference samples are used to structure the database. The *reference spectra* originate from these samples. In chemometric technical jargon you would normally say: For *calibration*, a **chemometric model** is generated from the *calibration spectra* recorded from the *calibration samples*, whose quality is subsequently assessed in **validation**.

Reference samples are procured via typical pharmacy sources. Their identity is tested. The *reference spectra* are recorded by *HiperScan GmbH*. The documentation also includes the manufacturer’s name and batch number.

Reference samples are clearly identified by a sample ID. Samples without sample ID may not be used as *reference samples*.

Summary

A total of 49 973 spectra from 3532 different batches for a total of 208 substances were used to validate the substance class *APIs & excipients, liquid/semi-solid (other)*.

Validation samples

The validation samples can be categorised as follows:

Typ A Calibration spectra. These are the spectra used to generate the chemometric model. They were recorded by *HiperScan GmbH*. Detailed information regarding the batches or samples can be found in the following validation reports under *calibration samples* and under *Type A*. Further information is listed in [Appendix A](#).

Substance class	Substances	Batches	Spectra
APIs & excipients, liquid/semi-solid (other)	160	493	23 965

From category *A* a total of 23 965 spectra from 493 batches for a total of 160 substances were taken into account for validation.

Typ B Spectra from independent samples which are not included in database generation. These spectra were recorded by *HiperScan GmbH*. Detailed information regarding the batches or samples can be found in the following validation reports in the section *Type B* or in [Appendix B](#).

Substance class	Substances	Batches	Spectra
APIs & excipients, liquid/semi-solid (other)	204	437	20 461

From category *B* a total of 20 461 spectra from 437 batches for a total of 204 substances were taken into account for validation.

Typ C Spectra from independent samples which are not included in database generation. *Apo-Ident* customers carried out the measurements. Detailed information regarding the batches or samples can be found in the following validation reports in the section *Type C* or in [Appendix C](#).

Substance class	Substances	Batches	Spectra
APIs & excipients, liquid/semi-solid (other)	143	2768	5547

From category *C* a total of 5547 spectra from 2768 batches for a total of 143 substances were taken into account for validation.

Validation results

The validation runs checked whether all substances/substance groups in the substance class *APIs & excipients, liquid/semi-solid (other)* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, the matching of all relevant spectra of various substances with the substances/substance groups in the substance class *APIs & excipients, liquid/semi-solid (other)* was checked and the correctness of the results was evaluated. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	23 965	0	2 348 570
Type B	0	16 055	1076	2 007 385
Type C	0	5153	252	543 710

All substances/substance groups in the substance class *APIs & excipients, liquid/semi-solid (other)* can be clearly distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Typ A	100.000 00 % (> 99.999 60 %)	100.000 00 % (> 99.960 40 %)
Typ B	100.000 00 % (> 99.999 44 %)	92.316 14 % (> 92.283 73 %)
Typ C	100.000 00 % (> 99.987 75 %)	92.850 59 % (> 92.194 96 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Alfason Basis Cresa[®]**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30723-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Alfason Basis Cresa[®]

Special notes

When selecting the *Alfason Basis Cresa[®]* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Alfason Basis Cresa [®]	4	1	30

Second-stage model

For differentiation of the substance/substance group *Alfason Basis Cresa*® the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Alfason Basis Cresa*®:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Astellas Pharma	Alfason Basis Cr...	12B11/77	30723	54	not required
Astellas Pharma	Alfason Basis Cr...	13D06/75	31071	40	not required
Astellas Pharma	Alfason Basis Cr...	15I46/79	32064	60	not required
Astellas Pharma	Alfason Basis Cr...	16D35/77	32815	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 194 spectra of 4 reference samples from the substance/substance group *Alfason Basis Cresa*®. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 771 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Alfason Basis Cresa*®.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
LEO Pharma GmbH	Alfason Basis Cresa®	17B27/75	33487	40
Astellas Pharma	Alfason Basis Cresa®	16D35/77	32840	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 52 spectra from 15 *Apo-Ident* customers from 31 batches from the substance/substance group *Alfason Basis Cresa*[®].
- Among them are spectra of independent samples from 30 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
A.H.D.	Alfason Basis Cresa [®]	12/05/75	1
AHD	Alfason Basis Cresa [®]	13A18/76	1
anzag	Alfason Basis Cresa [®]	18I13/76	2
Astellas	Alfason Basis Cresa [®]	13A16/76	1
Astellas	Alfason Basis Cresa [®]	14c32-78	1
Astellas	Alfason Basis Cresa [®]	14J02/77	1
AStellas	Alfason Basis Cresa [®]	14J02/77	1
Astellas / Anzag	Alfason Basis Cresa [®]	15J3/79	1
Astellas / Noweda	Alfason Basis Cresa [®]	14J02/77	1
Astellas / Noweda	Alfason Basis Cresa [®]	15D1179	1
Astellas / Noweda	Alfason Basis Cresa [®]	15D11/79	2
Astellas / Noweda	Alfason Basis Cresa [®]	15J35/76	1
Astellas Pharma	Alfason Basis Cresa [®]	13K15/75	2
Astellas Pharma	Alfason Basis Cresa [®]	14C32/78	1
Astellas Pharma	Alfason Basis Cresa [®]	14J02/77	2
Astellas Pharma	Alfason Basis Cresa [®]	15D11/79	3
Astellas Pharma	Alfason Basis Cresa [®]	16A06/76	1
Astellas Pharma	Alfason Basis Cresa [®]	15H06/80	1
Astellas Pharma GmbH/ A...	Alfason Basis Cresa [®]	16D35/77	1
Astellas Pharma/Noweda	Alfason Basis Cresa [®]	15J38/79	1
Astellas/Gehe	Alfason Basis Cresa [®]	16G03/75	1
Caelo	Alfason Basis Cresa [®]	15J35/75	1
Caelo	Alfason Basis Cresa [®]	17EB/75	1
Caeo/Noweda	Alfason Basis Cresa [®]	15H06/80	1
devesa/Phönix	Alfason Basis Cresa [®]	17F08/76	2
Ichtyol/Phönix	Alfason Basis Cresa [®]	13E08/75	1
Lamotte/ Noweda	Alfason Basis Cresa [®]	16A06/76	2
LEO Pharma / Alliance H...	Alfason Basis Cresa [®]	17F20/76	1
Leo Pharma/Gehe	Alfason Basis Cresa [®]	18A29/75	1
Leo/ Phönix	Alfason Basis Cresa [®]	17F46/76	2
Leo/Alliance	Alfason Basis Cresa [®]	18D20/75	2
LEO/Alliance Healthcare	Alfason Basis Cresa [®]	18D19/76	1
Leo/Gehe	Alfason Basis Cresa [®]	17C17/76	1
Leo/Gehe	Alfason Basis Cresa [®]	17F44/76	1
Leo/Gehe	Alfason Basis Cresa [®]	18J36/75	1
Leo/Phönix	Alfason Basis Cresa [®]	18A29/75	1
Leopharm/Alliance hc	Alfason Basis Cresa [®]	18D20/75	2
Noweda-Astella	Alfason Basis Cresa [®]	15A01/79	1
Sanacorp	Alfason Basis Cresa [®]	12F23/76	1
Sanacorp	Alfason Basis Cresa [®]	13A16/76	1
Sanacorp	Alfason Basis Cresa [®]	13E08/75	1

- 5495 spectra from 489 *Apo-Ident* customers from a total of 2687 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Alfason Basis Cresa*[®] can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Alfason Basis Cresa*[®] and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	194	0	23 771
Type B	0	80	0	20 381
Type C	0	52	0	5495

The substance/substance group *Alfason Basis Cresa*[®] can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.9072 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7733 %)	100.0000 % (> 88.4615 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Alfason Basis Cresa*[®] in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Alfason [®] Repair	14.57	—
Linola [®] H fat N	17.45	—
Linola [®] fat cream	18.13	—
Neribas [®] ointment	25.56	—
Asche Basis [®] ointment	33.30	—
Dermatop [®] base ointment	36.23	—
Bepanthen [®] Wund- und Heilsalbe	40.11	—
Excipial [®] lipo cream	77.42	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Alfason Basis Cresa*® is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30723	30723	0.00	20.63
31071	31071	0.00	19.07
32064	32064	0.00	24.18
32815	32815	0.00	17.44

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Allergika evening primrose oil cream 20% / Dermifant [®] kids cream
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30970-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Allergika evening primrose oil cream 20% / Dermifant[®] kids cream; Allergika evening primrose oil cream 20%; Dermifant[®] kids cream

Special notes

When selecting the *Allergika evening primrose oil cream 20% / Dermifant[®] kids cream* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5	<i>European Pharmacopoeia 9th Edition, Basic Version 2017</i> [3]
Komm2.2.40	<i>Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident</i> [4]
AA004	<i>Erstellung und Validierung eines IdentModul-Updates</i>

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Allergika evening primrose oil cream 20%	3	2	0
Dermifant [®] kids cream	3	2	7

Second-stage model

For differentiation of the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Allergika	Allergika evenin...	1504021	31725	60	not required
Allergika	Allergika evenin...	1511051	31871	60	not required
Allergika	Allergika evenin...	1609043	33486	40	not required
Allergika	Dermifant® kids ...	1210082	30970	80	not required
Allergika	Dermifant® kids ...	1303033	31062	40	not required
Allergika	Dermifant® kids ...	1705043	33639	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 320 spectra of 6 reference samples from the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 6 different batches.
- 23 645 spectra from a total of 484 batches from further 158 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Allergika	Allergika evening primrose o...	1607031	32756	40
Allergika	Allergika evening primrose o...	1410062	32909	40
Allergika	Dermifant® kids cream	1607032	32754	40
Allergika	Dermifant® kids cream	1801010	34033	40

- 20 301 spectra from a total of 433 batches from further 202 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 13 spectra from 2 *Apo-Ident* customers from 8 batches from the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream*.
- Among them are spectra of independent samples from 7 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Allergika Pharma GmbH	Dermifant® kids cream	1410072	1
Gehe	Dermifant® kids cream	1407053	1
Phönix	Dermifant® kids cream	1312102	2
Phönix EK:10,19 EUR ...	Dermifant® kids cream	1703024	1
Sanacorp WE: 01.09.17 ...	Dermifant® kids cream	1705043	1
Sanacorp WE: 09.11.17 1...	Dermifant® kids cream	1708063	2
Sanacorp7Mida WE:13.01...	Dermifant® kids cream	1711094	4
WE:Phoenix 10.12.2016 ...	Dermifant® kids cream	1609042	1

- 5534 spectra from 490 *Apo-Ident* customers from a total of 2710 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Allergika evening primrose oil cream 20% / Dermifant® kids cream* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	320	0	23 645
Type B	0	160	0	20 301
Type C	0	13	0	5534

The substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream* can be clearly distinguished from all other substances. In order to make these figures comparable,

the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 98.1250 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 96.2500 %)
Type C	100.0000 % (> 98.7774 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Excipial® U Lipolotio	13.99	—
Lipoderm® lotion	21.50	—
DMS® base cream high classic	21.72	—
Lipolotio urea 5% F body lotion	23.81	—
DMS® base cream high classic plus	26.87	—
Abitima® clinic body cream	30.53	—
Dermatest base ointment	32.18	—
Neuroderm® moisturising cream lipo	37.05	—
Excipial® U10 Lipolotio	39.18	—
Eucerinum W/O basis	42.27	—
Neuroderm® moisturising cream	44.15	—
DMS® base cream classic	48.34	—
Hans Karrer Lipocream MicroSilver	49.65	—
Fabitop® base cream	64.12	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Allergika evening primrose oil cream 20% / Dermifant® kids cream* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33639	33639	0.00	18.64
31725	31725	0.00	19.46
31871	31871	0.00	17.85
33486	33486	0.00	18.19
31062	31062	0.00	21.48
30970	30970	0.00	17.75

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **alpha-bisabolol (racemic) at least 85%**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31464-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

alpha-bisabolol (racemic) at least 85%

Special notes

When selecting the *alpha-bisabolol (racemic) at least 85%* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
alpha-bisabolol (racemic) at least 85%	1	3	5

Second-stage model

For differentiation of the substance/substance group *alpha-bisabolol (racemic)* at least 85% the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *alpha-bisabolol (racemic)* at least 85%:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	alpha-bisabolol ...	13360114	31464	60	not required
Caelo	alpha-bisabolol ...	13360114	31465	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 2 reference samples from the substance/substance group *alpha-bisabolol (racemic)* at least 85%. These samples are listed above in the [calibration samples](#) section. The reference samples come from 1 different batches.
- 23 845 spectra from a total of 489 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *alpha-bisabolol (racemic)* at least 85%.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	alpha-bisabolol (racemic) at...	16271902	32782	40
Caelo	alpha-bisabolol (racemic) at...	17065801	33417	40
Caelo	alpha-bisabolol (racemic) at...	180585	34227	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 5 spectra from 3 *Apo-Ident* customers from 5 batches from the substance/substance group *alpha-bisabolol (racemic) at least 85%*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	alpha-bisabolol (racemic) at...	14322713	1
Caelo	alpha-bisabolol (racemic) at...	18306002	1
Caelo	alpha-bisabolol (racemic) at...	18306001	1
Caelo	alpha-bisabolol (racemic) at...	18058504	1
Caelo	alpha-bisabolol (racemic) at...	18058506	1

- 5542 spectra from 490 *Apo-Ident* customers from a total of 2713 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *alpha-bisabolol (racemic) at least 85%* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *alpha-bisabolol (racemic) at least 85%* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	120	0	20 341
Type C	0	5	0	5542

The substance/substance group *alpha-bisabolol (racemic) at least 85%* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7861 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *alpha-bisabolol (racemic) at least 85%* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citronella oil	49.84	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *alpha-bisabolol (racemic) at least 85%* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31464	31464	0.00	51.38
31465	31465	0.00	51.23

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Angelica root oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30535-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Angelica root oil; Oleum angelicae (e radice)

Special notes

When selecting the *Angelica root oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Angelica root oil	4	2	8

Second-stage model

For differentiation of the substance/substance group *Angelica root oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Angelica root oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Angelica root oil	33019-109871BAG90451	30964	40	not required
Taoasis	Angelica root oil	4053-116078	31682	60	not required
Taoasis	Angelica root oil	2829199-122587	31780	60	not required
Taoasis	Angelica root oil	3029209-123992	32068	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 220 spectra of 4 reference samples from the substance/substance group *Angelica root oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 745 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Angelica root oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Angelica root oil	3029209-125059	32477	40
Taoasis	Angelica root oil	1839219-127663	33644	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 8 spectra from 5 *Apo-Ident* customers from 8 batches from the substance/substance group *Angelica root oil*.
- Among them are spectra of independent samples from 8 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Angelica root oil	11352706	1
Caelo	Angelica root oil	11352704	1
Taoasis	Angelica root oil	33019-110236BAG904	1
Taoasis	Angelica root oil	4053-117762	1
Taoasis	Angelica root oil	32229229-1384	1
Taoasis	Angelica root oil	3629209-126289	1
Taoasis	Angelica root oil	129271	1
Taoasis	Angelica root oil	1049239-3525	1

- 5539 spectra from 490 *Apo-Ident* customers from a total of 2710 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Angelica root oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Angelica root oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	220	0	23 745
Type B	0	80	0	20 381
Type C	0	6	2	5539

The substance/substance group *Angelica root oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.2727 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7808 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Angelica root oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Frankincense oil	26.85	—
Swiss pine oil	30.21	—
Marjoram oil	31.37	—
Silver fir oil	38.01	—
Spruce needle oil	39.70	—
Citrus oil	41.45	—
Camphor oil	43.49	—
Dwarf pine oil	44.89	—
Cumin oil	44.99	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Angelica root oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30964	30964	0.00	30.59
31682	31682	0.00	26.85
31780	31780	0.00	31.91
32068	32068	0.00	27.03

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Anise oil, organic**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30670-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Anise oil, organic; Oleum Anisi stellati

Special notes

When selecting the *Anise oil, organic* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Anise oil, organic	2	3	22

Second-stage model

For differentiation of the substance/substance group *Anise oil, organic* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Anise oil, organic*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Anise oil, organic	2241027-120475	31681	60	not required
Taoasis	Anise oil, organic	1492-125379	32794	40	not required
Taoasis	Anise oil, organic	1492-125379	32935	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Anise oil, organic*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 825 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Anise oil, organic*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Anise oil, organic	B080009-99431BAG90451	30670	40
Taoasis	Anise oil, organic	42803-290	33622	40
Taoasis	Anise oil, organic	42803-3438	34288	40
Taoasis	Anise oil, organic	42803-290	33875	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 29 spectra from 13 *Apo-Ident* customers from 24 batches from the substance/substance group *Anise oil, organic*.
- Among them are spectra of independent samples from 22 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Anise oil, organic	12322503	1
Caelo	Anise oil, organic	15148901	1
Caelo	Anise oil, organic	12322507	1
Caelo	Anise oil, organic	13056105	1
Schubert	Anise oil, organic	1236E0-1518	1
Taoasis	Anise oil, organic	26735-108555	1
Taoasis	Anise oil, organic	26735-110455	1
Taoasis	Anise oil, organic	26735-111137	2
Taoasis	Anise oil, organic	26735-113054	1
Taoasis	Anise oil, organic	130910-113040	1
Taoasis	Anise oil, organic	26569-115911	2
Taoasis	Anise oil, organic	2241027-120196	1
Taoasis	Anise oil, organic	1492-121627	1
Taoasis	Anise oil, organic	1492-123225	1
Taoasis	Anise oil, organic	1492-125315	1
Taoasis	Anise oil, organic	42803-127333	1
Taoasis	Anise oil, organic	42803-290	1
Taoasis	Anise oil, organic	42803-772	1
Taoasis	Anise oil, organic	42803-1177	1
Taoasis	Anise oil, organic	2336-5388	1
Taoasis/Noweda	Anise oil, organic	1465-121083h08	1
Taoasis/Sanacorp	Anise oil, organic	26735-111137	2
Taoasis/Sanacorp	Anise oil, organic	26735-112250	1
Apotheker S Bauer&Comp	Anise oil, organic		1
Taoasis	Anise oil, organic	1492-125379	2

- 5518 spectra from 488 *Apo-Ident* customers from a total of 2694 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Anise oil, organic* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Anise oil, organic* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The

following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	134	26	20 261
Type C	0	26	3	5518

The substance/substance group *Anise oil, organic* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9444 %)	83.7500 % (> 81.8750 %)
Type C	100.0000 % (> 98.7744 %)	89.6552 % (> 79.3103 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Anise oil, organic* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Fennel oil	44.16	—
Basil oil	87.03	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Anise oil, organic* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31681	31681	0.00	44.16
32794	32794	0.00	46.14
32935	32935	0.00	49.27

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Argan oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 32168-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Argan oil; Oleum Arganiae

Special notes

When selecting the *Argan oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Argan oil	2	2	0

Second-stage model

For differentiation of the substance/substance group *Argan oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Argan oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Argan oil	161443	32168	60	-*
Caelo	Argan oil	16035101	32571	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 100 spectra of 2 reference samples from the substance/substance group *Argan oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 865 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Argan oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Argan oil	162759	32679	40
Caelo	Argan oil	190980	34461	40
Caelo	Argan oil	16035101	32306	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Argan oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Argan oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Argan oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	100	0	23 865
Type B	0	120	0	20 341
Type C	0	0	0	5547

The substance/substance group *Argan oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 94.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Argan oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Balm Bio Nature	10.76	—
Excipial [®] almond oil ointment	24.95	—
Wax ointment (stabilised)	59.28	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Argan oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32168	32168	0.00	17.86
32571	32571	0.00	14.42

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Balm Bio Nature**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31645-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Balm Bio Nature

Special notes

When selecting the *Balm Bio Nature* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Balm Bio Nature	3	2	0

Second-stage model

For differentiation of the substance/substance group *Balm Bio Nature* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Balm Bio Nature*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Balm Bio Nature	150422-5106	31645	60	not required
Taoasis	Balm Bio Nature	150422-5106	31724	60	not required
Taoasis	Balm Bio Nature	151210-5337	32994	40	not required
Taoasis	Balm Bio Nature	180515-8060	34115	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Balm Bio Nature*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 765 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Balm Bio Nature*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Balm Bio Nature	160401-6083	32786	40
Taoasis	Balm Bio Nature	170403-7087	33436	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 12 spectra from 2 *Apo-Ident* customers from 1 batches from the substance/substance group *Balm Bio Nature*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Balm Bio Nature	151210-5337	12

- 5535 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Balm Bio Nature* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Balm Bio Nature* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	80	0	20 381
Type C	0	12	0	5535

The substance/substance group *Balm Bio Nature* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7779 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Balm Bio Nature* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Excipial [®] almond oil ointment	10.84	–
Argan oil	14.03	–
Wax ointment (stabilised)	43.14	–
Salicylic white paraffin 10%	52.55	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Balm Bio Nature* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32994	32994	0.00	10.84
34115	34115	0.00	19.90
31645	31645	0.00	16.14
31724	31724	0.00	20.13

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Banana aroma**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31105-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Banana aroma; Banana flavour

Special notes

When selecting the *Banana aroma* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Banana aroma	3	1	5

Second-stage model

For differentiation of the substance/substance group *Banana aroma* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Banana aroma*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Banana aroma	12302509	31105	40	1404166
Caelo	Banana aroma	14353702	31606	60	not required
Caelo	Banana aroma	171890	33687	40	20170707*

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Banana aroma*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Banana aroma*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Banana aroma	16089305	33496	40
Caelo	Banana aroma	16089305	33608	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 7 spectra from 5 *Apo-Ident* customers from 6 batches from the substance/substance group *Banana aroma*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Banana aroma	14353707	1
Caelo	Banana aroma	14353709	1
Caelo	Banana aroma	16089304	2
Caelo	Banana aroma	17189001	1
Caelo	Banana aroma	16089305	1
Caelo	Banana aroma	12302509	1

- 5540 spectra from 490 *Apo-Ident* customers from a total of 2712 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Banana aroma* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Banana aroma* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	7	0	5540

The substance/substance group *Banana aroma* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7821 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Banana aroma* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Nicotine	116.12	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Banana aroma* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31105	31105	0.00	173.51
31606	31606	0.00	172.73
33687	33687	0.00	171.41

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Basil oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30751-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Basil oil; Oleum ocimum basilicum

Special notes

When selecting the *Basil oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Basil oil	2	2	0

Second-stage model

For differentiation of the substance/substance group *Basil oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Basil oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Basil oil	561-119057	31755	60	not required
Taoasis	Basil oil	1500312-128851	33725	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 100 spectra of 2 reference samples from the substance/substance group *Basil oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 865 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Basil oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Basil oil	21022-108746BAG90451	30751	40
Taoasis	Basil oil	1500312-126393	32972	40
Taoasis	Basil oil	1500312-126393	32973	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Basil oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Basil oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Basil oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	100	0	23 865
Type B	0	120	0	20 341
Type C	0	0	0	5547

The substance/substance group *Basil oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 94.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Basil oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Anise oil, organic	85.96	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Basil oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31755	31755	0.00	146.57
33725	33725	0.00	162.83

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Benzoin siam oil 20%**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30456-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Benzoin siam oil 20%; Oleum styrax tonkinensis

Special notes

When selecting the *Benzoin siam oil 20%* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Benzoin siam oil 20%	5	1	13

Second-stage model

For differentiation of the substance/substance group *Benzoin siam oil 20%* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Benzoin siam oil 20%*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Benzoin siam oil...	12990-114892	31256	40	not required
Taoasis	Benzoin siam oil...	51939-123084	31843	60	not required
Taoasis	Benzoin siam oil...	63287-126233	32974	40	not required
Taoasis	Benzoin siam oil...	2161-1395	33855	40	not required
Taoasis	Benzoin siam oil...	32105-119788BAG90451	33944	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 220 spectra of 5 reference samples from the substance/substance group *Benzoin siam oil 20%*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 5 different batches.
- 23 745 spectra from a total of 485 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Benzoin siam oil 20%*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Benzoin siam oil 20%	2010-836	33724	40
Taoasis	Benzoin siam oil 20%	63287-126233	33028	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 16 spectra from 7 *Apo-Ident* customers from 15 batches from the substance/substance group *Benzoin siam oil 20%*.
- Among them are spectra of independent samples from 13 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Benzoin siam oil 20%	518434-108321	1
Taoasis	Benzoin siam oil 20%	541389-111081	1
Taoasis	Benzoin siam oil 20%	548481-111780	1
Taoasis	Benzoin siam oil 20%	548442-113119	1
Taoasis	Benzoin siam oil 20%	23478-116955	2
Taoasis	Benzoin siam oil 20%	17578-116819	1
Taoasis	Benzoin siam oil 20%	41242-120661	1
Taoasis	Benzoin siam oil 20%	31343-118365	1
Taoasis	Benzoin siam oil 20%	41242-121512	1
Taoasis	Benzoin siam oil 20%	59023-125420	1
Taoasis	Benzoin siam oil 20%	54125	1
Taoasis	Benzoin siam oil 20%	62330-124547	1
Taoasis	Benzoin siam oil 20%	474084-96350	1
Taoasis	Benzoin siam oil 20%	51939-123084	1
Taoasis	Benzoin siam oil 20%	63287-126233	1

- 5531 spectra from 490 *Apo-Ident* customers from a total of 2703 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Benzoin siam oil 20%* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Benzoin siam oil 20%* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	220	0	23 745
Type B	0	67	13	20 381
Type C	0	15	1	5531

The substance/substance group *Benzoin siam oil 20%* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.2727 %)
Type B	100.0000 % (> 99.9443 %)	83.7500 % (> 80.0000 %)
Type C	100.0000 % (> 98.7764 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Benzoin siam oil 20%* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Oregano oil	91.70	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Benzoin siam oil 20%* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33855	33855	0.00	99.23
31256	31256	0.00	91.99
31843	31843	0.00	91.70
32974	32974	0.00	96.83
33944	33944	0.00	101.31

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at

least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Bepanthen® Wund- und Heilsalbe
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	31048-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Bepanthen® Wund- und Heilsalbe

Special notes

When selecting the *Bepanthen® Wund- und Heilsalbe* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Bepanthen® Wund- und Heilsalbe	3	2	2

Second-stage model

For differentiation of the substance/substance group *Bepanthen[®] Wund- und Heilsalbe* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Bepanthen[®] Wund- und Heilsalbe*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Bayer	Bepanthen [®] Wund-...	GP00LB9	31048	40	not required
Bayer	Bepanthen [®] Wund-...	GP012SS	31758	60	not required
Bayer	Bepanthen [®] Wund-...	GP01CTH	33613	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Bepanthen[®] Wund- und Heilsalbe*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Bepanthen[®] Wund- und Heilsalbe*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Bayer	Bepanthen [®] Wund- und Heilsalbe	GP018T5	32720	40
Bayer	Bepanthen [®] Wund- und Heilsalbe	GP019ZF	32948	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 2 *Apo-Ident* customers from 2 batches from the substance/substance group *Bepanthen® Wund- und Heilsalbe*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bayer	Bepanthen® Wund- und Heilsalbe	GP01AUE	1
Bombastus	Bepanthen® Wund- und Heilsalbe	GP01-DR9	1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Bepanthen® Wund- und Heilsalbe* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Bepanthen® Wund- und Heilsalbe* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	2	0	5545

The substance/substance group *Bepanthen® Wund- und Heilsalbe* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Bepanthen*[®] *Wund- und Heilsalbe* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Asche Basis [®] ointment	14.13	—
Neribas [®] ointment	19.92	—
Alfason Basis Cresa [®]	35.88	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Bepanthen*[®] *Wund- und Heilsalbe* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31048	31048	0.00	31.67
31758	31758	0.00	34.77
33613	33613	0.00	35.02

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Bergamot oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30307-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Bergamot oil; Oleum citrus bergamia

Special notes

When selecting the *Bergamot oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Bergamot oil	2	2	16

Second-stage model

For differentiation of the substance/substance group *Bergamot oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Bergamot oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Bombastus	Bergamot oil	290998	31641	60	not required
Bombastus	Bergamot oil	290998	31760	60	not required
Taoasis	Bergamot oil	3221028-121642	31784	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 3 reference samples from the substance/substance group *Bergamot oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 785 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Bergamot oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Bergamot oil	00189A27	34387	40
Taoasis	Bergamot oil	1968-128263	33437	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 17 spectra from 13 *Apo-Ident* customers from 16 batches from the substance/substance group *Bergamot oil*.
- Among them are spectra of independent samples from 16 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Bergamot oil	264008	1
Bombastus	Bergamot oil	280260	1
Bombastus	Bergamot oil	53731-125890	1
Caelo	Bergamot oil	12020702	1
Caelo	Bergamot oil	13141501	2
Kaders	Bergamot oil	130564	1
Noweda	Bergamot oil	271858	1
Taoasis	Bergamot oil	32338-109135	1
Taoasis	Bergamot oil	B130301-110610	1
Taoasis	Bergamot oil	96243	1
Taoasis	Bergamot oil	33110-110701	1
Taoasis	Bergamot oil	32579-111866	1
Taoasis	Bergamot oil	33697-112408	1
Taoasis	Bergamot oil	d01be14m-121110bag90	1
Taoasis	Bergamot oil	73340-506	1
Taoasis	Bergamot oil	77879-3984	1

- 5530 spectra from 489 *Apo-Ident* customers from a total of 2702 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Bergamot oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Bergamot oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	13	4	5530

The substance/substance group *Bergamot oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7761 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Bergamot oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Chamomile (essential oil)	25.65	–
Spearmint oil	36.10	–
Dwarf pine oil	55.75	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Bergamot oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31641	31641	0.00	34.06
31760	31760	0.00	32.10
31784	31784	0.00	30.16

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical

variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30966-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil; Cajeput (essentiell oil); Eucalyptus oil; Niaouli oil; Oleum Cajeputi artificiale; Oleum eucalypti; Oleum niaouli; Oleum rosmarini; Rosemary oil

Special notes

When selecting the *Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5	<i>European Pharmacopoeia 9th Edition, Basic Version 2017</i> [3]
Komm2.2.40	<i>Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident</i> [4]
AA004	<i>Erstellung und Validierung eines IdentModul-Updates</i>

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cajeput (essentiell oil)	4	1	29
Eucalyptus oil	4	4	34
Niaouli oil	5	1	6
Rosemary oil	4	1	16

Second-stage model

For differentiation of the substance/substance group *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Cajeput (essenti...	00012A27	34401	40	not required
Taoasis	Cajeput (essenti...	130829-112094BAG90451	31136	40	not required
Taoasis	Cajeput (essenti...	1662-124326	32173	40	not required
Taoasis	Cajeput (essenti...	1724-127033	33657	40	not required
Primavera	Eucalyptus oil	00178A27	34374	40	not required
Taoasis	Eucalyptus oil	527885-109705A	30966	40	not required
Taoasis	Eucalyptus oil	7271001-121014	31694	60	not required
Taoasis	Eucalyptus oil	043127A-125381	32903	40	not required
Caelo	Niaouli oil	13099606	31420	60	AR-14-FG-012561-01
Primavera	Niaouli oil	00410K26	34380	40	not required
Taoasis	Niaouli oil	34167-116962	31548	60	not required
Taoasis	Niaouli oil	40428-124242	32174	40	not required
Taoasis	Niaouli oil	1500450-125771	32970	40	not required
Taoasis	Rosemary oil	3231031-117639	31551	60	not required
Taoasis	Rosemary oil	1921019-120666	31691	60	not required
Taoasis	Rosemary oil	1862-126630	32933	40	not required
Taoasis	Rosemary oil	2150-2819	34104	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 780 spectra of 17 reference samples from the substance/substance group *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 17 different batches.
- 23 185 spectra from a total of 473 batches from further 156 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples.

Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 400 spectra of 10 reference samples from the substance/substance group *Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil*.
- Among them are spectra of independent samples from 7 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Cajeput (essentiel oil)	2216-2921	34114	40
Primavera	Eucalyptus oil	00650K25	33808	40
Primavera	Eucalyptus oil	00256A26	33955	40
Primavera	Eucalyptus oil	00710C26	34172	40
Taoasis	Eucalyptus oil	41192-129138	33621	40
Taoasis	Niaouli oil	1500450-1985	34040	40
Taoasis	Rosemary oil	1614-125089	32802	40
Taoasis	Cajeput (essentiel oil)	1724-127033	33022	40
Taoasis	Cajeput (essentiel oil)	1724-127033	33023	40
Taoasis	Niaouli oil	1500450-125771	32971	40

- 20 061 spectra from a total of 428 batches from further 200 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 124 spectra from 40 *Apo-Ident* customers from 87 batches from the substance/substance group *Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil*.
- Among them are spectra of independent samples from 85 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Aurica	Cajeput (essentiel oil)	11024710	1
Bombastus	Cajeput (essentiel oil)	18001011	1
PVL	Cajeput (essentiel oil)	150712	1
Taoasis	Cajeput (essentiel oil)	24077-106468	1
Taoasis	Cajeput (essentiel oil)	L201323018-113057	1
Taoasis	Cajeput (essentiel oil)	130829-113045	1
Taoasis	Cajeput (essentiel oil)	131010-115487	2
Taoasis	Cajeput (essentiel oil)	131010-117241	2
Taoasis	Cajeput (essentiel oil)	661027-117257	2
Taoasis	Cajeput (essentiel oil)	131010-117257	1
Taoasis	Cajeput (essentiel oil)	6781012-119058	1
Taoasis	Cajeput (essentiel oil)	661027-118368	1
Taoasis	Cajeput (essentiel oil)	1301-121889	1
Taoasis	Cajeput (essentiel oil)	1301-32758	1
Taoasis	Cajeput (essentiel oil)	1518-122790	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Cajeput (essentiell oil)	1518-122691	1
Taoasis	Cajeput (essentiell oil)	1662-124870	1
Taoasis	Cajeput (essentiell oil)	1724-125910	1
Taoasis	Cajeput (essentiell oil)	1724-126425	1
Taoasis	Cajeput (essentiell oil)	1724-127010	2
Taoasis	Cajeput (essentiell oil)	1724-127654	1
Taoasis	Cajeput (essentiell oil)	1724-129091	1
Taoasis	Cajeput (essentiell oil)	1989-955	3
Taoasis	Cajeput (essentiell oil)	1989-1032	2
Taoasis	Cajeput (essentiell oil)	1989-956	1
Taoasis	Cajeput (essentiell oil)	2490-5372	2
Taoasis	Cajeput (essentiell oil)	2490-4102	2
Taoasis	Cajeput (essentiell oil)	2490-6100	1
TAOASIS GmbH D-32758 De...	Cajeput (essentiell oil)	1989-2818	1
Taoasis/Sanacorp	Cajeput (essentiell oil)	L201323018-113057	1
Bombastus	Eucalyptus oil	289701	1
Bombastus	Eucalyptus oil	297737	1
Bombastus	Eucalyptus oil	303336	1
Bombastus	Eucalyptus oil	305628	1
Bombastus	Eucalyptus oil	303327	1
Caelo	Eucalyptus oil	11324112	1
Caelo	Eucalyptus oil	13106407LOT	1
Caelo	Eucalyptus oil	300881	1
Caelo	Eucalyptus oil	15063309	1
Caelo	Eucalyptus oil	15400217	1
Caelo	Eucalyptus oil	15400202	3
Caelo	Eucalyptus oil	16351301	1
Caelo	Eucalyptus oil	14039603	1
Caesar & Loretz GmbH Hi...	Eucalyptus oil	15063312	1
Caesar & Loretz GmbH Hi...	Eucalyptus oil	15400203	1
Euro OTC	Eucalyptus oil	1412030-01	1
Bombastus	Eucalyptus oil	305608	1
Kögl	Eucalyptus oil	397311160117	1
Caelo	Eucalyptus oil	15400203	1
Caelo	Eucalyptus oil	16351312	1
Taoasis	Eucalyptus oil	130205-111868	1
Taoasis	Eucalyptus oil	33364-110871	1
Taoasis	Eucalyptus oil	543495-112704	1
Taoasis	Eucalyptus oil	43703-122178	1
Taoasis	Eucalyptus oil	43703-122404	1
Taoasis	Eucalyptus oil	52046-124692	2
Taoasis	Eucalyptus oil	67253-127038	2
Taoasis	Eucalyptus oil	75793-129093	2
Taoasis	Eucalyptus oil	79948-858	1
Taoasis	Eucalyptus oil	82675-1874	1
Taoasis	Eucalyptus oil	98837-4013	1
Taoasis	Eucalyptus oil	98937-4013	1
Taoasis	Eucalyptus oil	91092-3355	2
Taoasis	Eucalyptus oil	98937-5299	2
Taoasis	Eucalyptus oil	107371-6271	1
Bauer	Niaouli oil	6558611608	1
Taoasis	Niaouli oil	22553-120413	1
Taoasis	Niaouli oil	22553-120482	1
Taoasis	Niaouli oil	22553-121510	1
Taoasis	Niaouli oil	40428-123092	1
Taoasis	Niaouli oil	40428-128260	4
Bombastus	Rosemary oil	301449	2
Caelo	Rosemary oil	15442017	2
Caelo	Rosemary oil	16276905	1
Caelo	Rosemary oil	16276903	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Rosemary oil	306506	1
Taoasis	Rosemary oil	26057-119164	1
Taoasis	Rosemary oil	1526-123355	1
Taoasis	Rosemary oil	26057-122996	1
Taoasis	Rosemary oil	1526-125088	1
Taoasis	Rosemary oil	1614-125089	12
Taoasis	Rosemary oil	1862-127716	1
Taoasis	Rosemary oil	1972-773	2
Taoasis	Rosemary oil	1862-128861	1
Taoasis	Rosemary oil	1972-2523	2
Taoasis	Rosemary oil	2331-2821	2
Taoasis	Rosemary oil	2331-6428	1
Taoasis	Cajeput (essentiel oil)	1724-127033	1
Taoasis	Niaouli oil	1500450-125771	1

- 5423 spectra from 488 *Apo-Ident* customers from a total of 2631 batches from a further 139 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	780	0	23 185
Type B	0	400	0	20 061
Type C	0	123	1	5423

The substance/substance group *Cajeput oil* / *Eucalyptus oil* / *Niaouli oil* / *Rosmary oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.2308 %)
Type B	100.0000 % (> 99.9440 %)	100.0000 % (> 98.5000 %)
Type C	100.0000 % (> 98.7725 %)	99.1935 % (> 96.7742 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Rosemary camphor oil	11.19	—
Citus oil	25.94	—
Ravensara oil	28.83	—
Hyssop oil	28.92	—
Myrtle oil	31.64	—
Marjoram oil	39.82	—
Vetiver bourbon oil	42.59	—
Sage oil	47.23	—
Angelica root oil	47.35	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31691	31691	0.00	16.68
31551	31551	0.00	21.47
34104	34104	0.00	23.55
32174	32174	0.00	39.95
32173	32173	0.00	65.74
33657	33657	0.00	67.42
30966	30966	0.00	38.27
34374	34374	0.00	33.97
31420	31420	0.00	28.92
31694	31694	0.00	35.89
32903	32903	0.00	30.69
32970	32970	0.00	45.83
32933	32933	0.00	29.27
31548	31548	0.00	50.27
34380	34380	0.00	45.30
31136	31136	0.00	56.99
34401	34401	0.00	61.43

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all

substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Camphor oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33826-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Camphor oil

Special notes

When selecting the *Camphor oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Camphor oil	2	1	0

Second-stage model

For differentiation of the substance/substance group *Camphor oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Camphor oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Camphor oil	74521-140	33826	40	not required
Taoasis	Camphor oil	944	33827	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Camphor oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Camphor oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Camphor oil	78793-2563	34039	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Camphor oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Camphor oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Camphor oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Camphor oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Camphor oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Angelica root oil	22.57	—
Marjoram oil	25.11	—
Hyssop oil	32.41	—
Citus oil	38.35	—
Cumin oil	41.10	—
Silver fir oil	41.58	—
Swiss pine oil	41.77	—
Cypress oil	43.61	—
Spruce needle oil	48.35	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Camphor oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33826	33826	0.00	31.09
33827	33827	0.00	30.62

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Cardamom oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33813-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cardamom oil; Cardamom (essential oil)

Special notes

When selecting the *Cardamom oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cardamom oil	2	1	0

Second-stage model

For differentiation of the substance/substance group *Cardamom oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cardamom oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Cardamom oil	00897G25	33813	40	not required
Primavera	Cardamom oil	00080M25	33961	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Cardamom oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Cardamom oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Cardamom oil	00498H26	34291	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Cardamom oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cardamom oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cardamom oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Cardamom oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cardamom oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citrus oil	30.52	—
Vetiver bourbon oil	42.06	—
Manuka oil	44.92	—
Sage oil	46.59	—
Matricaria oil, roman	47.21	—
Cumin oil	52.43	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cardamom oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33813	33813	0.00	46.62
33961	33961	0.00	46.59

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Carrot seed oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31555-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Carrot seed oil; Oleum daucus carota

Special notes

When selecting the *Carrot seed oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Carrot seed oil	3	2	0

Second-stage model

For differentiation of the substance/substance group *Carrot seed oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Carrot seed oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Carrot seed oil	937-117443	31555	60	not required
Taoasis	Carrot seed oil	1775-125361BAG90451	32812	40	not required
Taoasis	Carrot seed oil	3496IN-K08	34282	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Carrot seed oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 140 spectra of 3 reference samples from the substance/substance group *Carrot seed oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Carrot seed oil	26058-119083BAG90451	31636	60
Taoasis	Carrot seed oil	2037	33995	40
Taoasis	Carrot seed oil	1775-125361BAG90451	33203	40

- 20 321 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Carrot seed oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Carrot seed oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Carrot seed oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	140	0	20 321
Type C	0	0	0	5547

The substance/substance group *Carrot seed oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Carrot seed oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Marjoram oil	22.81	—
Tea tree oil	27.29	—
Patchouli oil	40.17	—
Thyme oil, white	48.26	—
Lemon grass oil	53.98	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Carrot seed oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31555	31555	0.00	35.21
34282	34282	0.00	59.31
32812	32812	0.00	64.62

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Cedar wood oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30654-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cedar wood oil; Oleum cedrus deodara

Special notes

When selecting the *Cedar wood oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cedar wood oil	3	3	21

Second-stage model

For differentiation of the substance/substance group *Cedar wood oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cedar wood oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Apotheker Bau...	Cedar wood oil	2.880926.1507	31851	60	not required
Taoasis	Cedar wood oil	7891018-121034	31777	60	not required
Taoasis	Cedar wood oil	1627-125061	33199	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Cedar wood oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Cedar wood oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Cedar wood oil	26473-83914BAG90451	30750	40
Taoasis	Cedar wood oil	1627-124623	32268	40
Taoasis	Cedar wood oil	1802-1975	34102	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 31 spectra from 3 *Apo-Ident* customers from 22 batches from the substance/substance group *Cedar wood oil*.
- Among them are spectra of independent samples from 21 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Biofrid / Noweda	Cedar wood oil	17066	1
Taoasis	Cedar wood oil	32812-113008	3
Taoasis	Cedar wood oil	381008-116967	1
Taoasis	Cedar wood oil	7711023-120348	1
Taoasis	Cedar wood oil	7891019-121034	1
Taoasis	Cedar wood oil	831018-122540	1
Taoasis	Cedar wood oil	831018-123089	2
Taoasis	Cedar wood oil	7891018-120108	1
Taoasis	Cedar wood oil	831018-124172	1
Taoasis	Cedar wood oil	1627-125917	1
Taoasis	Cedar wood oil	1627-127827	1
Taoasis	Cedar wood oil	18302-128288	1
Taoasis	Cedar wood oil	1802-128288	3
Taoasis	Cedar wood oil	1802-750	3
Taoasis	Cedar wood oil	1802-972	1
Taoasis	Cedar wood oil	1802-1975	1
Taoasis	Cedar wood oil	2339-3615	2
Taoasis	Cedar wood oil	2339-3450	1
Taoasis	Cedar wood oil	SAP709-5143	1
Taoasis	Cedar wood oil	461016-6429	1
Taoasis/Phönix	Cedar wood oil	3292687	1
Taoasis	Cedar wood oil	1627-125061	2

- 5516 spectra from 490 *Apo-Ident* customers from a total of 2697 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cedar wood oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cedar wood oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	40	20 341
Type C	0	31	0	5516

The substance/substance group *Cedar wood oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	66.6667 % (> 64.1667 %)
Type C	100.0000 % (> 98.7742 %)	100.0000 % (> 80.6452 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cedar wood oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citrus oil	15.52	—
Hyssop oil	20.54	—
Vetiver bourbon oil	22.72	—
Ginger oil	24.42	—
Marjoram oil	25.07	—
Myrtle oil	34.48	—
Yarrow oil	38.08	—
Salmon oil	41.90	—
Immortelle oil	43.02	—
Angelica root oil	43.83	—
Cypress oil	45.74	—
Rosemary camphor oil	49.92	—
Niaouli oil	49.94	—
Tea tree oil	65.84	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cedar wood oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31777	31777	0.00	68.28
33199	33199	0.00	65.43
31851	31851	0.00	20.54

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Chamomile (essential oil)**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33811-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Chamomile (essential oil)

Special notes

When selecting the *Chamomile (essential oil)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Chamomile (essential oil)	4	2	0

Second-stage model

For differentiation of the substance/substance group *Chamomile (essential oil)* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Chamomile (essential oil)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Chamomile (essen...	00888G25	33811	40	not required
Primavera	Chamomile (essen...	00715L25	33963	40	not required
Taoasis	Chamomile (essen...	934	33825	30	not required
Taoasis	Chamomile (essen...	2132-1981	33952	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 150 spectra of 4 reference samples from the substance/substance group *Chamomile (essential oil)*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 815 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 90 spectra of 3 reference samples from the substance/substance group *Chamomile (essential oil)*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Chamomile (essential oil)	00139C26	34167	40
Taoasis	Chamomile (essential oil)	100477-850	33824	40
Taoasis	Chamomile (essential oil)	934	33825 [†]	10

- 20 371 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Chamomile (essential oil)*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Chamomile (essential oil)* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Chamomile (essential oil)* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	150	0	23 815
Type B	0	67	23	20 371
Type C	0	0	0	5547

The substance/substance group *Chamomile (essential oil)* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.0000 %)
Type B	100.0000 % (> 99.9442 %)	74.4444 % (> 71.1111 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

[†]These spectra were recorded from material of the same package as the corresponding calibration spectra (*Type A*). Hence, these spectra are not independent and are not of *Type B*.

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Chamomile (essential oil)* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Bergamot oil	19.33	—
Spearmint oil	33.71	—
Carrot seed oil	43.83	—
Lemon grass oil	49.34	—
Marjoram oil	51.49	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Chamomile (essential oil)* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33825	33825	0.00	22.26
33952	33952	0.00	24.36
33811	33811	0.00	50.00
33963	33963	0.00	50.71

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Cinnamon bark oil, Ceylon**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30957-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cinnamon bark oil, Ceylon; Oleum cinnamomi ceylanici

Special notes

When selecting the *Cinnamon bark oil, Ceylon* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cinnamon bark oil, Ceylon	4	1	1

Second-stage model

For differentiation of the substance/substance group *Cinnamon bark oil, Ceylon* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cinnamon bark oil, Ceylon*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Cinnamon bark oi...	00221A27	34375	40	not required
Taoasis	Cinnamon bark oi...	121108-109782BAG90451	30957	40	not required
Taoasis	Cinnamon bark oi...	1311130547-119819	31648	60	not required
Taoasis	Cinnamon bark oi...	415-770	34107	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Cinnamon bark oil, Ceylon*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Cinnamon bark oil, Ceylon*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Cinnamon bark oil, Ceylon	415-126411	32791	40
Taoasis	Cinnamon bark oil, Ceylon	415-126411	33202	40

- 20381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 4 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Cinnamon bark oil, Ceylon*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Cinnamon bark oil, Ceylon	415-129078	4

- 5543 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cinnamon bark oil, Ceylon* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cinnamon bark oil, Ceylon* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	4	0	5543

The substance/substance group *Cinnamon bark oil, Ceylon* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7897 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cinnamon bark oil, Ceylon* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Siam benzoin	105.73	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cinnamon bark oil, Ceylon* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30957	30957	0.00	224.39
31648	31648	0.00	176.51
34107	34107	0.00	178.64
34375	34375	0.00	105.73

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Citric oil / Lime oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31544-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Citric oil / Lime oil; Citric oil; Lime oil; Oleum citri; Oleum citrus aurantifolia

Special notes

When selecting the *Citric oil / Lime oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Citric oil	3	2	31
Lime oil	4	1	3

Second-stage model

For differentiation of the substance/substance group *Citric oil* / *Lime oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Citric oil* / *Lime oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Citric oil	D04LI14M-117513	31558	60	not required
Taoasis	Citric oil	3681027-122724	31838	60	not required
Taoasis	Citric oil	127939-ITJ04	33611	40	not required
Primavera	Lime oil	00182A27	34393	80	not required
Taoasis	Lime oil	059-117571	31544	60	not required
Taoasis	Lime oil	15506-1458	33874	40	not required
Taoasis	Lime oil	15506-1762	33942	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 380 spectra of 7 reference samples from the substance/substance group *Citric oil* / *Lime oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 7 different batches.
- 23 585 spectra from a total of 483 batches from further 158 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 260 spectra of 6 reference samples from the substance/substance group *Citric oil* / *Lime oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Citric oil	00011A27	34379	40
Taoasis	Citric oil	03LI16M-125453I09	32771	40
Taoasis	Lime oil	867-124956	32800	40
Taoasis	Citric oil	03LI16M-125453I09	32941	40
Taoasis	Lime oil	059-117571	31654	60
Taoasis	Lime oil	867-124956	32976	40

- 20 201 spectra from a total of 433 batches from further 202 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 43 spectra from 36 *Apo-Ident* customers from 35 batches from the substance/substance group *Citric oil / Lime oil*.
- Among them are spectra of independent samples from 34 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
bergland	Citric oil	K703167	1
Bergland	Citric oil	K603901	1
Bombastus	Citric oil	302311	1
Bombastus	Citric oil	301912	1
Bombastus	Citric oil	18006427	1
Bombastus	Citric oil	304030	1
Bombastus	Citric oil	15F29-B04-325354	1
Bombastus	Citric oil	12268005-1-0	1
Bombastus	Citric oil	19003199	1
Caelo	Citric oil	16028719	2
Caelo	Citric oil	16275202	1
Caelo	Citric oil	16275216	2
Caelo	Citric oil	16028702	3
Caelo	Citric oil	91(18092216)	1
Caelo	Citric oil	14365212	2
Caelo	Citric oil	15182703	2
Caelo	Citric oil	14385201	1
Caelo	Citric oil	W373	1
Fagron	Citric oil	14H06-B02-308273	1
Fagron	Citric oil	13K14-B03-294704	1
Fagron	Citric oil	14H06-B02-299949	1
Fagron	Citric oil	15F29-804	1
Fagron	Citric oil	15f29-b04-325354	1
Fagron	Citric oil	17B14-B04-334835	1
Fagron	Citric oil	15F29-B04	1
Fagron	Citric oil	15F29-B04-322985	1
Kögl	Citric oil	182006163916	1
Caelo	Citric oil	18092202	1
Fagron	Citric oil	17B14B04341736	1
Sanacorp	Citric oil	15182703	1
Taoasis	Citric oil	3681003-124333	1
Taoasis	Citric oil	E160576-127218	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Citric oil	W160567-127218	1
Taoasis	Lime oil	867-124956	2
Taoasis	Lime oil	867-127657	1
Taoasis/Sanaorp	Lime oil	867_124704I05	1

- 5504 spectra from 486 *Apo-Ident* customers from a total of 2683 batches from a further 141 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Citric oil / Lime oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Citric oil / Lime oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	380	0	23 585
Type B	0	239	21	20 201
Type C	0	42	1	5504

The substance/substance group *Citric oil / Lime oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 98.4211 %)
Type B	100.0000 % (> 99.9440 %)	91.9231 % (> 90.7692 %)
Type C	100.0000 % (> 98.7736 %)	97.6744 % (> 90.6977 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Citric oil / Lime oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Mandarin oil, green	17.66	—
Grapefruit oil, organic	20.03	—

continued on the next page

continued from previous page

Substanz	Distance in main model	Distance in second-stage model
Orange oil	33.06	—
Silver fir oil	38.10	—
Tea tree oil	47.98	—
Blood orange oil	56.77	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Citric oil* / *Lime oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31558	31558	0.00	17.70
31838	31838	0.00	17.40
33611	33611	0.00	17.08
33874	33874	0.00	41.38
33942	33942	0.00	40.70
31544	31544	0.00	38.10
34393	34393	0.00	30.53

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Citronella oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31550-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Citronella oil; Oleum cymbopogon winterianus

Special notes

When selecting the *Citronella oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Citronella oil	4	2	3

Second-stage model

For differentiation of the substance/substance group *Citronella oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Citronella oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Citronella oil	00671A27	34409	40	not required
Taoasis	Citronella oil	140121-115623	31550	60	not required
Taoasis	Citronella oil	1291021-122850	31840	60	not required
Taoasis	Citronella oil	1794-373	33728	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Citronella oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Citronella oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Citronella oil	108494-126305	32798	40
Taoasis	Citronella oil	108494-126776	33047	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 3 spectra from 3 *Apo-Ident* customers from 3 batches from the substance/substance group *Citronella oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Apotheker Bauer und Cie...	Citronella oil	7444171705	1
Kögl	Citronella oil	228107163016	1
Taoasis	Citronella oil	5211028-120284	1

- 5544 spectra from 490 *Apo-Ident* customers from a total of 2715 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Citronella oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Citronella oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	80	0	20 381
Type C	0	3	0	5544

The substance/substance group *Citronella oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7956 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Citronella oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Rose-geranium oil, organic	30.41	—
alpha-bisabolol (racemic) at least 85%	41.12	—
Palmarosa oil, organic	42.44	—
Lemon grass oil	43.15	—
Marjoram oil	47.13	—
Tea tree oil	48.39	—
Carrot seed oil	54.92	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Citronella oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31550	31550	0.00	35.22
31840	31840	0.00	39.09
33728	33728	0.00	34.72
34409	34409	0.00	39.37

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30961-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil; Citrus oil; Clary sage oil; Hyssop oil; Lavender oil; Myrtle oil; Oleum citrus aurantium; Oleum hyssopus officinalis; Oleum lavendula officinalis; Oleum salviae sclarea; Petitgrain oil

Special notes

When selecting the *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5	<i>European Pharmacopoeia 9th Edition, Basic Version 2017</i> [3]
Komm2.2.40	<i>Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident</i> [4]
AA004	<i>Erstellung und Validierung eines IdentModul-Updates</i>

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Citrus oil	4	2	2
Clary sage oil	3	3	6
Hyssop oil	4	2	1
Lavender oil	4	4	36
Myrtle oil	3	2	0
Petitgrain oil	3	2	0

Second-stage model

For differentiation of the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Citrus oil	00438D25	33760	40	not required
Primavera	Citrus oil	00621G26	34294	40	not required
Primavera	Citrus oil	00673L26	34395	40	not required
Taoasis	Citrus oil	788	33816	40	not required
Primavera	Clary sage oil	00529M26	34367	40	not required
Taoasis	Clary sage oil	2098-115222	31669	60	not required
Taoasis	Clary sage oil	1834-127059	33033	40	not required
Apotheker Bau...	Hyssop oil	13.201345120.16.02	31850	60	not required
Taoasis	Hyssop oil	31823-118643	31649	60	not required
Taoasis	Hyssop oil	33065-122200	31782	60	not required
Taoasis	Hyssop oil	1616260-125049	32980	40	not required
Primavera	Lavender oil	00684K25	33804	40	not required
Taoasis	Lavender oil	L16812DN-108661BAG90451	30961	40	not required
Taoasis	Lavender oil	110186BAG90451	30962	40	not required
Taoasis	Lavender oil	22015-121843	31756	60	not required
Primavera	Myrtle oil	00401D25	33797	40	not required
Primavera	Myrtle oil	00877L25	33957	40	not required
Taoasis	Myrtle oil	013	33830	40	not required
Apotheker Bau...	Petitgrain oil	6.56267.16.02	31852	60	not required
Taoasis	Petitgrain oil	26056-120864	31778	60	not required
Taoasis	Petitgrain oil	4031015-126048	33024	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 980 spectra of 21 reference samples from the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 21 different batches.
- 22 985 spectra from a total of 469 batches from further 154 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 720 spectra of 18 reference samples from the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil*.
- Among them are spectra of independent samples from 15 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Citrus oil	00348C26	34178	40
Taoasis	Citrus oil	1510-135	33817	40
Taoasis	Clary sage oil	487962-107805BAG90451	30749	40
Taoasis	Clary sage oil	10140-145	33871	40
Taoasis	Clary sage oil	1834-129098	34284	40
Apotheker Bauer & Cie	Hyssop oil	13.201604082.17.01	32923	40
Taoasis	Hyssop oil	1616260-1982	34110	40
Primavera	Lavender oil	00793A26	33953	40
Primavera	Lavender oil	00184G26	34165	40
Taoasis	Lavender oil	2/2015-125808I09	33015	40
Taoasis	Lavender oil	22015-125925I10	33016	40
Primavera	Myrtle oil	00971J25	33807	40
Primavera	Myrtle oil	00392M26	34384	40
Taoasis	Petitgrain oil	29551-105402BAG90451	30752	40
Taoasis	Petitgrain oil	4031015-147	34108	40
Taoasis	Clary sage oil	2098-115222	32797	40
Taoasis	Clary sage oil	10140-145	33943	40
Taoasis	Petitgrain oil	4031015-126048	33025	40

- 19741 spectra from a total of 420 batches from further 198 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 79 spectra from 25 *Apo-Ident* customers from 46 batches from the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil*.
- Among them are spectra of independent samples from 45 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Citrus oil	1510-1171	1
Taoasis	Citrus oil	2345-2578	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Clary sage oil	487962-106655	1
Taoasis	Clary sage oil	10140-146	1
Taoasis	Clary sage oil	2098-119159	1
Taoasis	Clary sage oil	1700-125289	2
Taoasis	Clary sage oil	13304-5798	2
Taoasis	Clary sage oil	13304-6656	1
Taoasis	Hyssop oil	31095-105392	1
Bergland	Lavender oil	K502790	1
Bombastus	Lavender oil	300666	1
Bombastus	Lavender oil	19001102	1
Bombastus	Lavender oil	80311204	1
Caelo	Lavender oil	15278105	1
Caelo	Lavender oil	17132711	4
Caelo	Lavender oil	16292214	1
Caelo	Lavender oil	16292216	1
Caelo	Lavender oil	18128202	1
Caelo	Lavender oil	18128203	1
Caelo	Lavender oil	1010548	2
Cordes/Noweda	Lavender oil	16023002	1
Fagron	Lavender oil	17G20-B07-342691	1
Bombastus	Lavender oil	305279	1
Bombastus	Lavender oil	303303	1
Primavera/Noweda	Lavender oil	378E25	1
Primavera/Phoenix	Lavender oil	326C26	1
Taoasis	Lavender oil	4651010	1
Taoasis	Lavender oil	22015-125927	2
Taoasis	Lavender oil	34/151/16	1
Taoasis	Lavender oil	2/2015-125808I09	12
Taoasis	Lavender oil	22015-126998	3
Taoasis	Lavender oil	22015-128587	1
Taoasis	Lavender oil	22015-508	5
Taoasis	Lavender oil	2015-2394	3
Taoasis	Lavender oil	16082301/2016-2908	1
Taoasis	Lavender oil	16082301/2016-2909	4
Taoasis	Lavender oil	16082301/2016/2908	1
Taoasis	Lavender oil	106082301/2016-2909	1
Taoasis	Lavender oil	170124022016-5298	1
Taoasis	Lavender oil	160802301/2016-1909	1
Taoasis	Lavender oil	96336-5473	2
Taoasis	Lavender oil	170001022016-5298	1
Taoasis	Lavender oil	S05-18-6464	3
Taoasis	Lavender oil	109744-6805	1
Taoasis/Noweda	Lavender oil	16716-126380/11	1
Taoasis	Clary sage oil	2098-115222	1

- 5468 spectra from 484 *Apo-Ident* customers from a total of 2672 batches from a further 139 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Citrus oil* / *Lavender oil* / *Clary sage oil* / *Myrtle oil* / *Petitgrain oil* / *Hyssop oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Citrus oil* / *Lavender oil* / *Clary sage oil* / *Myrtle oil* / *Petitgrain*

oil / Hyssop oil and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	980	0	22 985
Type B	0	710	10	19 740
Type C	0	79	0	5468

The substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.3878 %)
Type B	100.0000 % (> 99.9443 %)	98.6111 % (> 98.1944 %)
Type C	100.0000 % (> 98.7729 %)	100.0000 % (> 92.4051 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Ravensara oil	20.15	—
Neroli oil	28.93	—
Melissa oil 30%	30.17	—
Marjoram oil	31.22	—
Cedar wood oil	31.28	—
Cypress oil	31.73	—
Angelica root oil	32.18	—
Rosemary camphor oil	34.75	—
Thyme oil, white	37.94	—
Sage oil	39.16	—
Vetiver bourbon oil	39.40	—
Yarrow oil	41.49	—
Ginger oil	44.04	—
Niaouli oil	45.75	—
Coriander oil	46.59	—
Ylang-ylang oil	50.75	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the

second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30962	30962	0.00	65.79
31756	31756	0.00	72.90
34367	34367	0.00	78.65
31852	31852	0.00	33.98
32980	32980	0.00	20.15
33804	33804	0.00	72.01
33797	33797	0.00	34.57
33957	33957	0.00	35.96
31649	31649	0.00	41.49
31850	31850	0.00	39.91
31669	31669	0.00	50.75
31782	31782	0.00	42.03
33033	33033	0.00	52.21
31778	31778	0.00	72.10
33024	33024	0.00	62.21
33830	33830	0.00	44.40
33760	33760	0.00	38.89
33816	33816	0.00	31.28
34294	34294	0.00	32.43
34395	34395	0.00	33.26
30961	30961	0.00	51.87

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Clove oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31270-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Clove oil; Oleum caryophylli

Special notes

When selecting the *Clove oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Clove oil	4	1	6

Second-stage model

For differentiation of the substance/substance group *Clove oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Clove oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Bombastus	Clove oil	279132	31035	40	not required
Caelo	Clove oil	12380605	31270	40	not required
Taoasis	Clove oil	2891012-116936	31557	60	not required
Taoasis	Clove oil	1426-120481	31683	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Clove oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Clove oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Clove oil	1598-124689	32938	40
Taoasis	Clove oil	1598-124689	32940	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 6 spectra from 6 *Apo-Ident* customers from 6 batches from the substance/substance group *Clove oil*.
- Among them are spectra of independent samples from 6 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Clove oil	15402108	1
Caelo	Clove oil	15316102	1
Caelo	Clove oil	17354205	1
Caelo	Clove oil	15316103	1
Caelo	Clove oil	15119304	1
Primavera	Clove oil	47G24	1

- 5541 spectra from 490 *Apo-Ident* customers from a total of 2712 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Clove oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Clove oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	80	0	20 381
Type C	0	5	1	5541

The substance/substance group *Clove oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7838 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Clove oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Siam benzoin	425.49	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Clove oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31270	31270	0.00	442.85
31035	31035	0.00	442.93
31557	31557	0.00	425.49
31683	31683	0.00	432.41

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Common wormwood oil
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30842-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Common wormwood oil; Oleum artemisia vulgaris

Special notes

When selecting the *Common wormwood oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Common wormwood oil	2	3	1

Second-stage model

For differentiation of the substance/substance group *Common wormwood oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Common wormwood oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
ASAV Apotheke...	Common wormwood ...	10116310555	31637	60	not required
ASAV Apotheke...	Common wormwood ...	10409310558	34209	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 100 spectra of 2 reference samples from the substance/substance group *Common wormwood oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 865 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 200 spectra of 5 reference samples from the substance/substance group *Common wormwood oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Apotheker Bauer & Cie	Common wormwood oil	10815310556	33013	40
ASAV Apotheken-Service	Common wormwood oil	10815310556	32770	40
Taoasis	Common wormwood oil	7.9363	30842	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
ASAV Apotheken-Service	Common wormwood oil	10815310556	33600	40
ASAV Apotheken-Service	Common wormwood oil	10815310556	33851	40

- 20 261 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 1 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Common wormwood oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Common wormwood oil	79363	1

- 5546 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Common wormwood oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Common wormwood oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	100	0	23 865
Type B	0	51	149	20 261
Type C	0	0	1	5546

The substance/substance group *Common wormwood oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 94.0000 %)
Type B	100.0000 % (> 99.9441 %)	25.5000 % (> 24.0000 %)
Type C	100.0000 % (> 98.8428 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Common wormwood oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Thuja oil	57.54	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Common wormwood oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
34209	34209	0.00	85.35
31637	31637	0.00	69.24

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Contramarum aroma**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31007-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Contramarum aroma; Contramarum flavour

Special notes

When selecting the *Contramarum aroma* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Contramarum aroma	3	3	48

Second-stage model

For differentiation of the substance/substance group *Contramarum aroma* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Contramarum aroma*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Contramarum aroma	13141605	31007	40	1403096
Caelo	Contramarum aroma	13411002	31289	40	not required
Caelo	Contramarum aroma	13411007	31398	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *Contramarum aroma*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 845 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Contramarum aroma*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Contramarum aroma	162671	32695	40
Caelo	Contramarum aroma	172230	33701	40
Caelo	Contramarum aroma	181067	34066	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 97 spectra from 44 *Apo-Ident* customers from 49 batches from the substance/substance group *Contramarum aroma*.
- Among them are spectra of independent samples from 48 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Cael	Contramarum aroma	13141603	1
Caelo	Contramarum aroma	11378804	1
Caelo	Contramarum aroma	7071207	1
Caelo	Contramarum aroma	12201407	2
Caelo	Contramarum aroma	13141606	3
Caelo	Contramarum aroma	7091302	1
Caelo	Contramarum aroma	134111002	1
Caelo	Contramarum aroma	2041515	1
Caelo	Contramarum aroma	21051508	1
Caelo	Contramarum aroma	14320005	1
Caelo	Contramarum aroma	15113011	1
Caelo	Contramarum aroma	16083806	1
Caelo	Contramarum aroma	16083805	1
Caelo	Contramarum aroma	16267102	4
Caelo	Contramarum aroma	17223002	4
Caelo	Contramarum aroma	19121701	1
Caelo	Contramarum aroma	12051808	1
Caelo	Contramarum aroma	30081804	1
Caelo	Contramarum aroma	18106703	3
Caelo	Contramarum aroma	13141608	2
Caelo	Contramarum aroma	22(18106701)	1
Caelo	Contramarum aroma	23(19065401)	1
Caelo	Contramarum aroma	17223007	3
Caelo	Contramarum aroma	18106702	1
Caelo	Contramarum aroma	17223005	3
Caelo	Contramarum aroma	13411011	1
Caelo	Contramarum aroma	14320015	3
Caelo	Contramarum aroma	16083801	7
Caelo	Contramarum aroma	14320006	3
Caelo	Contramarum aroma	1315Q-03148	1
Caelo	Contramarum aroma	5315A-03148	1
Caelo	Contramarum aroma	19065401	5
Caelo	Contramarum aroma	21(17223001)	1
Caelo	Contramarum aroma	16267101	3
Caelo	Contramarum aroma	14320001	1
Caelo	Contramarum aroma	16083804	2
Caelo	Contramarum aroma	16267103	4
Caelo	Contramarum aroma	17223001	2
Caelo	Contramarum aroma	14320009	1
Caelo	Contramarum aroma	143200009	1
Caelo	Contramarum aroma	15113003	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Contramarum aroma	16083802	2
Caelo	Contramarum aroma	169267103	1
Caelo	Contramarum aroma	15113002	2
Fagron	Contramarum aroma	16083801	1
Fiebig	Contramarum aroma	11378810	1
Gehe	Contramarum aroma	12201404	1
Caelo	Contramarum aroma	17223004	3
Phoenix Goettin	Contramarum aroma	70401432001	1
VDL; 18.07.15; 6,56EUR	Contramarum aroma	14320005	1
VDL;02.01.15;6,42EUR	Contramarum aroma	14320001	1
Caelo	Contramarum aroma	13411007	4

- 5450 spectra from 487 *Apo-Ident* customers from a total of 2669 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Contramarum aroma* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Contramarum aroma* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	117	3	20 341
Type C	0	80	17	5450

The substance/substance group *Contramarum aroma* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	97.5000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7727 %)	82.4742 % (> 79.3814 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Contramarum aroma* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Raspberry aroma	41.37	—
Strawberry aroma	110.01	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Contramarum aroma* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31007	31007	0.00	59.13
31289	31289	0.00	55.29
31398	31398	0.00	57.97

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Cumin oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30449-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cumin oil; Oleum cuminum cyminum

Special notes

When selecting the *Cumin oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cumin oil	2	2	3

Second-stage model

For differentiation of the substance/substance group *Cumin oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cumin oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Cumin oil	130910-113031BAG90451	31141	40	not required
Taoasis	Cumin oil	51764-124375	32267	40	not required
Taoasis	Cumin oil	51764-124375	32904	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *Cumin oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 845 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Cumin oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Cumin oil	2016109952-127656	33841	40
Taoasis	Cumin oil	2016109952-128855	33873	40
Taoasis	Cumin oil	51764-124375	32266	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 3 spectra from 3 *Apo-Ident* customers from 3 batches from the substance/substance group *Cumin oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Cumin oil	24081-106027	1
Taoasis	Cumin oil	121217-111221	1
Taoasis	Cumin oil	104723-298	1

- 5544 spectra from 490 *Apo-Ident* customers from a total of 2715 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cumin oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cumin oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	120	0	20 341
Type C	0	2	1	5544

The substance/substance group *Cumin oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7956 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cumin oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Marjoram oil	132.64	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cumin oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31141	31141	0.00	145.92
32267	32267	0.00	143.62
32904	32904	0.00	148.84

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Cypress oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30457-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cypress oil; Oleum cupressus sempervirens

Special notes

When selecting the *Cypress oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Cypress oil	4	3	14

Second-stage model

For differentiation of the substance/substance group *Cypress oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Cypress oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Cypress oil	00177G25	33802	40	not required
Primavera	Cypress oil	00403L25	33954	40	not required
Taoasis	Cypress oil	732-119820	31656	60	not required
Taoasis	Cypress oil	43953-129229	33623	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Cypress oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Cypress oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Cypress oil	00586C26	34169	40
Primavera	Cypress oil	00660L26	34394	40
Taoasis	Cypress oil	107527-125443	32806	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Cypress oil	107527-125443	33045	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 24 spectra from 2 *Apo-Ident* customers from 15 batches from the substance/substance group *Cypress oil*.
- Among them are spectra of independent samples from 14 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Cypress oil	487749-107790	1
Taoasis	Cypress oil	487749-108547	1
Taoasis	Cypress oil	514085-111139	1
Taoasis	Cypress oil	33720-115882	1
Taoasis	Cypress oil	33720-118623	1
Taoasis	Cypress oil	33720-118895	2
Taoasis	Cypress oil	1039-121894	3
Taoasis	Cypress oil	1039-122434	1
Taoasis	Cypress oil	341012-123298	1
Taoasis	Cypress oil	107527-125443	2
Taoasis	Cypress oil	107527-125965	1
Taoasis	Cypress oil	107527-27014	1
Taoasis	Cypress oil	107527-127323	6
Taoasis	Cypress oil	45953-129229	1
Taoasis	Cypress oil	43953-129229	1

- 5523 spectra from 490 *Apo-Ident* customers from a total of 2703 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Cypress oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Cypress oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	148	12	20 301
Type C	0	23	1	5523

The substance/substance group *Cypress oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9441 %)	92.5000 % (> 90.6250 %)
Type C	100.0000 % (> 98.7749 %)	95.8333 % (> 83.3333 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Cypress oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Marjoram oil	30.18	—
Citus oil	30.39	—
Myrtle oil	34.39	—
Ginger oil	49.52	—
Tea tree oil	51.42	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Cypress oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31656	31656	0.00	71.62
33623	33623	0.00	69.33
33802	33802	0.00	50.31
33954	33954	0.00	50.76

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Dermatop[®] base ointment
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	31060-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Dermatop[®] base ointment

Special notes

When selecting the *Dermatop[®] base ointment* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Dermatop [®] base ointment	2	2	7

Second-stage model

For differentiation of the substance/substance group *Dermatop[®] base ointment* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Dermatop[®] base ointment*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Sanofi aventis	Dermatop [®] base o...	3F052A	31060	40	not required
Sanofi aventis	Dermatop [®] base o...	5F080A	31717	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 100 spectra of 2 reference samples from the substance/substance group *Dermatop[®] base ointment*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 865 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Dermatop[®] base ointment*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Sanofi aventis	Dermatop [®] base ointment	5F089A	32718	40
Sanofi aventis	Dermatop [®] base ointment	7F106A	33965	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 10 spectra from 9 *Apo-Ident* customers from 8 batches from the substance/substance group *Dermatop[®] base ointment*.
- Among them are spectra of independent samples from 7 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Dermatop [®] base ointment	5F080A	1
Sanacorp/Sanofi WE:22.0...	Dermatop [®] base ointment	5F086A	1
Sanofi	Dermatop [®] base ointment	9F178A	1
Sanofi - Noweda	Dermatop [®] base ointment	5F089A	1
Sanofi / Alliance Healt...	Dermatop [®] base ointment	6F094A	1
Sanofi / Gehe	Dermatop [®] base ointment	6F099A	1
Sanofi/Gehe	Dermatop [®] base ointment	5F078A	1
Sanofi/Kehr	Dermatop [®] base ointment	6F094A	1
Sanofi/Kehr	Dermatop [®] base ointment	6F099A	1
Sanofi-Aventis	Dermatop [®] base ointment	7F103A	1

- 5537 spectra from 490 *Apo-Ident* customers from a total of 2710 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Dermatop[®] base ointment* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Dermatop[®] base ointment* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	100	0	23 865
Type B	0	80	0	20 381
Type C	0	10	0	5537

The substance/substance group *Dermatop[®] base ointment* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 94.0000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7790 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Dermatop[®] base ointment* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Linola [®] H fat N	19.18	—
Excipial [®] lipo cream	20.61	—
Linola [®] fat cream	22.06	—
Alfason Basis Cresa [®]	28.09	—
Alfason [®] Repair	36.40	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Dermatop[®] base ointment* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31060	31060	0.00	21.43
31717	31717	0.00	24.75

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Dexeryl®**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31512-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Dexeryl®

Special notes

When selecting the *Dexeryl®* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Dexeryl®	3	2	4

Second-stage model

For differentiation of the substance/substance group *Dexeryl*[®] the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Dexeryl*[®]:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Pierre Fabre	Dexeryl [®]	G99016	31512	60	not required
Pierre Fabre	Dexeryl [®]	G00419	31630	60	not required
Pierre Fabre	Dexeryl [®]	G00650	33635	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Dexeryl*[®]. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Dexeryl*[®].
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Pierre Fabre	Dexeryl [®]	G00623	32762	40
Pierre Fabre	Dexeryl [®]	G00658	33945	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 4 spectra from 3 *Apo-Ident* customers from 4 batches from the substance/substance group *Dexeryl®*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Noweda	Dexeryl®	G00909	1
PierreFabre/Now	Dexeryl®	G00577	1
Pierre Fabre / phoenix	Dexeryl®	600869	1
Pierre Fabre /Noweda	Dexeryl®	Goo606	1

- 5543 spectra from 489 *Apo-Ident* customers from a total of 2714 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Dexeryl®* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Dexeryl®* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	0	20 381
Type C	0	4	0	5543

The substance/substance group *Dexeryl®* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7897 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Dexeryl*[®] in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Neuroderm [®] moisturising cream	16.46	—
Neuroderm [®] care lotion	19.62	—
Base cream Taoasis	20.49	—
Excipial [®] U10 Lipolotio	22.83	—
Hans Karrer Lipolotion MicroSilver	27.68	—
Dimeticone ointment 10% SR	30.15	—
Eucerinum O/W basis	30.35	—
Neribas [®] cream	32.46	—
Abitima [®] clinic body cream	32.47	—
Asche Basis [®] lotion	32.60	—
DMS [®] base cream high classic plus	35.46	—
DMS [®] base cream high classic	35.55	—
Abitima [®] clinic face cream	37.05	—
La Roche-Posay Toleriane	37.34	—
Fabiotop [®] base cream	38.09	—
DMS [®] base cream classic	39.97	—
Eucerinum W/O basis	41.94	—
Asche Basis [®] cream	42.21	—
Hans Karrer Lipocream MicroSilver	44.23	—
Linola [®] body milk	44.73	—
Optiderm [®] lotion	45.09	—
Allergika [®] Base cream	48.70	—
Excipial [®] U Lipolotio	51.20	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Dexeryl*[®] is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33635	33635	0.00	24.63
31512	31512	0.00	20.45
31630	31630	0.00	27.65

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Dichloroacetic acid**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30417-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Dichloroacetic acid; Acidum dichloroaceticum

Special notes

When selecting the *Dichloroacetic acid* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Dichloroacetic acid	3	1	0

Second-stage model

For differentiation of the substance/substance group *Dichloroacetic acid* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Dichloroacetic acid*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Merck	Dichloroacetic a...	S6674841451	31642	60	not required
Merck	Dichloroacetic a...	S6674841614	32750	40	not required
Merck	Dichloroacetic a...	S7209041737	33794	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Dichloroacetic acid*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Dichloroacetic acid*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Merck	Dichloroacetic acid	S7209241824	34185	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Dichloroacetic acid*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Dichloroacetic acid* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Dichloroacetic acid* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	10	30	20 421
Type C	0	0	0	5547

The substance/substance group *Dichloroacetic acid* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9446 %)	25.0000 % (> 17.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Dichloroacetic acid* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Nicotine	161.70	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Dichloroacetic acid* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33794	33794	0.00	222.17
31642	31642	0.00	212.87
32750	32750	0.00	205.45

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Dimeticone ointment 10% SR / Optiderm® lotion**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31243-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Dimeticone ointment 10% SR / Optiderm® lotion; Dimeticone ointment 10% SR; Optiderm® lotion;
Unguentum dimeticoni 10% SR

Special notes

When selecting the *Dimeticone ointment 10% SR / Optiderm® lotion* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Dimeticone ointment 10% SR	3	1	22
Optiderm® lotion	3	1	0

Second-stage model

For differentiation of the substance/substance group *Dimeticone ointment 10% SR / Optiderm® lotion* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Dimeticone ointment 10% SR / Optiderm® lotion*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
apomix	Dimeticone ointm...	08B041213	31243	30	not required
apomix	Dimeticone ointm...	10A181214	31638	60	not required
apomix	Dimeticone ointm...	11A271216	33041	40	not required
Almirall	Optiderm® lotion	341431	31266	40	not required
Almirall	Optiderm® lotion	511951	31759	60	not required
Almirall	Optiderm® lotion	706961	33268	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 270 spectra of 6 reference samples from the substance/substance group *Dimeticone ointment 10% SR / Optiderm® lotion*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 6 different batches.
- 23 695 spectra from a total of 484 batches from further 158 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 100 spectra of 3 reference samples from the substance/substance group *Dimeticone ointment 10% SR / Optiderm® lotion*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
apomix	Dimeticone ointment 10% SR	10A021117	33870	40
Almirall	Optiderm [®] lotion	633771	32757	20
Almirall	Optiderm [®] lotion	706961	33267	40

- 20 361 spectra from a total of 434 batches from further 202 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 27 spectra from 6 *Apo-Ident* customers from 24 batches from the substance/substance group *Dimeticone ointment 10% SR / Optiderm[®] lotion*.
- Among them are spectra of independent samples from 22 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Apomix	Dimeticone ointment 10% SR	3B180214	1
Apomix	Dimeticone ointment 10% SR	3A220316	1
Apomix	Dimeticone ointment 10% SR	2B150317	1
Apomix	Dimeticone ointment 10% SR	11a271216	1
Apomix	Dimeticone ointment 10% SR	9B041017	1
Apomix	Dimeticone ointment 10% SR	11B031117	1
Apomix	Dimeticone ointment 10% SR	5A210618	3
Apomix	Dimeticone ointment 10% SR	9A051218	1
Apomix	Dimeticone ointment 10% SR	1A150119	1
Apomix	Dimeticone ointment 10% SR	4A230519	2
Apomix	Dimeticone ointment 10% SR	5A200619	1
apomix/Gehe	Dimeticone ointment 10% SR	6A190614	1
apomix/Gehe	Dimeticone ointment 10% SR	10A181214	1
apomix/Holdermann	Dimeticone ointment 10% SR	4A080414	1
apomix/Holdermann	Dimeticone ointment 10% SR	1A150115	1
apomix/Holdermann	Dimeticone ointment 10% SR	8A090915	1
apomix/Holdermann	Dimeticone ointment 10% SR	1A120116	1
apomix/Holdermann	Dimeticone ointment 10% SR	6A300616	1
apomix/Phönix	Dimeticone ointment 10% SR	4A010415	1
apomix/Phönix	Dimeticone ointment 10% SR	7A170816	1
apomix/Phönix	Dimeticone ointment 10% SR	1A070217	1
apomix/Phönix	Dimeticone ointment 10% SR	5A020616	1
Apomix/Phönix	Dimeticone ointment 10% SR	8A041213	1
PKH Halle	Dimeticone ointment 10% SR	1A310118	1

- 5520 spectra from 488 *Apo-Ident* customers from a total of 2694 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Dimeticone ointment 10% SR / Optiderm[®] lotion* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Dimeticone ointment 10% SR / Optiderm[®] lotion* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	270	0	23 695
Type B	0	100	0	20 361
Type C	0	27	0	5520

The substance/substance group *Dimeticone ointment 10% SR / Optiderm[®] lotion* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 97.7778 %)
Type B	100.0000 % (> 99.9442 %)	100.0000 % (> 94.0000 %)
Type C	100.0000 % (> 98.7746 %)	100.0000 % (> 77.7778 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Dimeticone ointment 10% SR / Optiderm[®] lotion* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
DMS [®] base cream classic	10.83	—
Hans Karrer Lipolotion MicroSilver	12.83	—
Asche Basis [®] lotion	17.71	—
Eucerinum W/O basis	19.64	—
Abitima [®] clinic face cream	20.33	—
Base cream Taoasis	26.81	—
Dexeryl [®]	28.52	—
DMS [®] base cream high classic	28.77	—
Excipial [®] U10 Lipolotio	29.09	—
La Roche-Posay Toleriane	29.63	—
Excipial [®] U Lipolotio	30.34	—
Neribas [®] cream	31.38	—
Eucerinum O/W basis	36.20	—
Neuroderm [®] moisturising cream	38.39	—
Abitima [®] clinic body cream	39.05	—
Asche Basis [®] cream	39.60	—
Fabitop [®] base cream	41.82	—

continued on the next page

continued from previous page

Substanz	Distance in main model	Distance in second-stage model
DMS [®] base cream high classic plus	45.01	—
Dermatop [®] base cream	47.11	—
Amciderm [®] Base cream	47.33	—
Hans Karrer Lipocream MicroSilver	47.42	—
Linola [®] body milk	49.05	—
Allergika [®] Base cream	49.53	—
Linola [®] Sept	54.21	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Dimeticone ointment 10% SR / Optiderm[®] lotion* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31266	31266	0.00	17.49
33268	33268	0.00	13.56
31759	31759	0.00	10.83
31243	31243	0.00	20.57
31638	31638	0.00	20.45
33041	33041	0.00	18.91

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Dwarf pine oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31542-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Dwarf pine oil; Oleum pini pumilionis

Special notes

When selecting the *Dwarf pine oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Dwarf pine oil	4	3	5

Second-stage model

For differentiation of the substance/substance group *Dwarf pine oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Dwarf pine oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Dwarf pine oil	586-116867	31542	60	not required
Taoasis	Dwarf pine oil	25599-120877	31689	60	not required
Taoasis	Dwarf pine oil	8783-127273	32937	40	not required
Taoasis	Dwarf pine oil	11148-1980	34109	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Dwarf pine oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Dwarf pine oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Dwarf pine oil	00386M26	34377	40
Taoasis	Dwarf pine oil	8783-125163	32811	40
Taoasis	Dwarf pine oil	13260-3453	34290	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 11 spectra from 3 *Apo-Ident* customers from 6 batches from the substance/substance group *Dwarf pine oil*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Dwarf pine oil	8783-125163	5
Taoasis	Dwarf pine oil	8238-124968	1
Taoasis	Dwarf pine oil	6635-122703	1
Taoasis	Dwarf pine oil	8238-126318	1
Taoasis	Dwarf pine oil	8783-127332	2
Taoasis	Dwarf pine oil	11148-1980	1

- 5536 spectra from 490 *Apo-Ident* customers from a total of 2712 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Dwarf pine oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Dwarf pine oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	104	16	20 341
Type C	0	8	3	5536

The substance/substance group *Dwarf pine oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9441 %)	86.6667 % (> 84.1667 %)
Type C	100.0000 % (> 98.7784 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Dwarf pine oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Spearmint oil	19.92	—
Angelica root oil	26.40	—
Swiss pine oil	34.04	—
Spruce needle oil	36.23	—
Juniper oil	38.73	—
Pine silvestris oil	44.07	—
Silver fir oil	44.26	—
Ginger oil	45.33	—
Citrus oil	48.49	—
Citric oil	52.65	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Dwarf pine oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31542	31542	0.00	34.04
31689	31689	0.00	34.61
32937	32937	0.00	40.28
34109	34109	0.00	34.11

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Ethanol 70% pure / denatured**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30779-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ethanol 70% pure / denatured; Ethanolum 70% rein / vergällt

Special notes

When selecting the *Ethanol 70% pure / denatured* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Ethanol 70% pure / denatured	4	3	268

Second-stage model

For differentiation of the substance/substance group *Ethanol 70% pure / denatured* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Ethanol 70% pure / denatured*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
apomix	Ethanol 70% pure...	54A170613	31055	40	not required
apomix	Ethanol 70% pure...	08A060618	34274	40	not required
Hofmann's	Ethanol 70% pure...	271012	30779	80	1402563
Kremer GmbH &...	Ethanol 70% pure...	171211	34101	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Ethanol 70% pure / denatured*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Ethanol 70% pure / denatured*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
apomix	Ethanol 70% pure / denatured	01A020117	33217	40
Hofmann's	Ethanol 70% pure / denatured	570916	32591	40
Hofmann's	Ethanol 70% pure / denatured	750718	34317	40

- 20341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 340 spectra from 104 *Apo-Ident* customers from 273 batches from the substance/substance group *Ethanol 70% pure / denatured*.
- Among them are spectra of independent samples from 267 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
A. Pflüger GmbH & Co. KG	Ethanol 70% pure / denatured	150209	1
A. Pflüger GmbH & Co. KG	Ethanol 70% pure / denatured	141127	1
A. Pflüger/Jenne	Ethanol 70% pure / denatured	131108	1
A. Pflüger/Phönix	Ethanol 70% pure / denatured	130607	1
A. Pflüger/Phönix	Ethanol 70% pure / denatured	130729	1
A.Pflüger	Ethanol 70% pure / denatured	21111301	1
A.Pflüger GmbH	Ethanol 70% pure / denatured	150730	1
A.Pflüger GmbH & Co.KG/...	Ethanol 70% pure / denatured	130514	1
A.Pflüger GmbH & Co.KG/...	Ethanol 70% pure / denatured	131011	1
A.Pflüger/Noweda	Ethanol 70% pure / denatured	130116	1
Alte Apo Defektur	Ethanol 70% pure / denatured	3019M-02320	1
Anzag/ Otto Fischar GmbH...	Ethanol 70% pure / denatured	7024051	1
apomix	Ethanol 70% pure / denatured	77A310815	1
apomix	Ethanol 70% pure / denatured	15a170918	1
Apomix	Ethanol 70% pure / denatured	6A040213	1
apomix / Alliance Healt...	Ethanol 70% pure / denatured	3A140119	1
Apomix / Alliance Healt...	Ethanol 70% pure / denatured	37A110416	1
Apomix / Phönix	Ethanol 70% pure / denatured	41A180515	1
Apomix/Alliance Healthc...	Ethanol 70% pure / denatured	15A170215	1
Apomix/Alliance Healthc...	Ethanol 70% pure / denatured	56a020715	1
Apomix/Alliance Healthc...	Ethanol 70% pure / denatured	14A310718	1
Apomix/Noweda	Ethanol 70% pure / denatured	58A020715	1
apomix/Phoenix	Ethanol 70% pure / denatured	12A250116	1
Apotärze	Ethanol 70% pure / denatured	2015I-02320	1
Apotheke	Ethanol 70% pure / denatured	70105/51Dre	1
Apotheke	Ethanol 70% pure / denatured	70206/53Dre	1
Apotheke	Ethanol 70% pure / denatured	190723003	1
Apotheke im Forum	Ethanol 70% pure / denatured	150707	1
Apotheke im Forum	Ethanol 70% pure / denatured	300517	1
Bahnhof-Apothek/Bahnhof...	Ethanol 70% pure / denatured	3819A-03043	1
Belous	Ethanol 70% pure / denatured	4613E-02320	1
Berkel AHK	Ethanol 70% pure / denatured	20042012397	1
Berkel AHK/HWA	Ethanol 70% pure / denatured	1410T31040613/70	1
Brinn- Holtz	Ethanol 70% pure / denatured	1234-04/18	1
Brinn- Holtz	Ethanol 70% pure / denatured	1257-06/17	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Ethanol 70% pure / denatured	150730	1
Caelo	Ethanol 70% pure / denatured	46A120617	1
Caelo	Ethanol 70% pure / denatured	3A070918	1
Caelo	Ethanol 70% pure / denatured	7028041	1
Caelo	Ethanol 70% pure / denatured	814E-02320	1
Caelo	Ethanol 70% pure / denatured	20140403	1
Caelo	Ethanol 70% pure / denatured	2614E-03043	1
Caelo	Ethanol 70% pure / denatured	1715E-02320	1
Caelo	Ethanol 70% pure / denatured	19151-02320	1
Caelo	Ethanol 70% pure / denatured	151008	2
Caelo	Ethanol 70% pure / denatured	60307/50La	1
Caelo	Ethanol 70% pure / denatured	171211	1
Caelo	Ethanol 70% pure / denatured	7028111	1
Caelo	Ethanol 70% pure / denatured	7025081	1
Claudia Lange	Ethanol 70% pure / denatured	1234	1
Claudia Lange	Ethanol 70% pure / denatured	60919/50La	1
Claudia Lange	Ethanol 70% pure / denatured	61010/51La	1
Claudia Lange	Ethanol 70% pure / denatured	61107/50La	1
Defektur	Ethanol 70% pure / denatured	50427/52Wlo	1
Defektur	Ethanol 70% pure / denatured	50427/1La	1
Defektur	Ethanol 70% pure / denatured	2015Q-03043	1
Defektur	Ethanol 70% pure / denatured	60209/51Hk	1
Defektur	Ethanol 70% pure / denatured	1716M-03043	1
Defektur	Ethanol 70% pure / denatured	2517A-07097	1
Defektur	Ethanol 70% pure / denatured	2617I-07097	1
Defektur	Ethanol 70% pure / denatured	71016/51Dre	1
Defektur	Ethanol 70% pure / denatured	80316/51Gie	1
Defektur	Ethanol 70% pure / denatured	80321/50Hk	1
Defektur	Ethanol 70% pure / denatured	80611/51Dre	1
Defektur	Ethanol 70% pure / denatured	3098	1
Defektur	Ethanol 70% pure / denatured	4712M-02320	1
Defektur	Ethanol 70% pure / denatured	270613Et0H	1
Defektur	Ethanol 70% pure / denatured	200114Et0H70	1
Defektur	Ethanol 70% pure / denatured	23/14	1
Defektur	Ethanol 70% pure / denatured	4714E-03043	1
Defektur / Wolf-Apotheke	Ethanol 70% pure / denatured	60902/50Hk	1
Defektur/Wolf-Apotheke	Ethanol 70% pure / denatured	50714/51Hk	1
Defektur/Wolf-Apotheke	Ethanol 70% pure / denatured	50714/53Hk	1
Defektur/Wolf-Apotheke	Ethanol 70% pure / denatured	1234567	2
Defektur/Wolf-Apotheke	Ethanol 70% pure / denatured	70227/52Dre	1
Defektur/Wolf-Apotheke	Ethanol 70% pure / denatured	41211/51Hk	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	150114010	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	150126002	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	150219007	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	150504003	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	3013A-02320	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	131227003	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	140303003	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	140630003	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	140927002	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	141029011	1
Doppeleiche Apotheke	Ethanol 70% pure / denatured	141208001	1
Dreikönigen Apotheke	Ethanol 70% pure / denatured	16049021	1
Eigen	Ethanol 70% pure / denatured	616Q-03043	2
Eigen	Ethanol 70% pure / denatured	3216E-03043	1
Eigen	Ethanol 70% pure / denatured	5016E-03043	1
Eigen	Ethanol 70% pure / denatured	Eigen	1
EIGEN	Ethanol 70% pure / denatured	4117I-03043	1
EIGEN	Ethanol 70% pure / denatured	2118I-03043	1
EIGEN	Ethanol 70% pure / denatured	5218M-03043	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Eigen/Defektur	Ethanol 70% pure / denatured	1116E-03043	1
Eigen/Defektur	Ethanol 70% pure / denatured	2516M-03043	1
Eigen/Defektur	Ethanol 70% pure / denatured	2716M-03043	1
Eigen/Defektur	Ethanol 70% pure / denatured	3416E-03043	1
eigene	Ethanol 70% pure / denatured	1018E-02320	1
eigene	Ethanol 70% pure / denatured	219I-02320	1
eigene	Ethanol 70% pure / denatured	2619E-02320	1
eigene herstellung	Ethanol 70% pure / denatured	SPV7026	1
eigene Herstellung	Ethanol 70% pure / denatured	6180115	1
eigene Herstellung	Ethanol 70% pure / denatured	4315Q-07016	1
eigene Herstellung	Ethanol 70% pure / denatured	317E-02320	1
eigene Herstellung	Ethanol 70% pure / denatured	1712904-A	1
eigene Herstellung	Ethanol 70% pure / denatured	4411312106	1
eigene Herstellung	Ethanol 70% pure / denatured	431140218	1
Eigene Herstellung	Ethanol 70% pure / denatured	3618I-02320	1
Eigene Herstellung	Ethanol 70% pure / denatured	SPV7025	1
Eigene Herstellung	Ethanol 70% pure / denatured	SP70140	1
Eigene Herstellung	Ethanol 70% pure / denatured	SPV7029	1
Eigenherstellung	Ethanol 70% pure / denatured	5214A-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	1515I-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	2015E-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	42151-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	4615	1
Eigenherstellung	Ethanol 70% pure / denatured	4715M	1
Eigenherstellung	Ethanol 70% pure / denatured	616Q-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	2216A-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	3416E-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	517Q-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	170828001	1
Eigenherstellung	Ethanol 70% pure / denatured	5318A-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	1313I-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	1823	1
Eigenherstellung	Ethanol 70% pure / denatured	2613I-03043	1
Eigenherstellung	Ethanol 70% pure / denatured	2753	1
Eigenherstellung	Ethanol 70% pure / denatured	3413I-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	4513I-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	4733	1
Eigenherstellung	Ethanol 70% pure / denatured	5131213	1
Eigenherstellung	Ethanol 70% pure / denatured	2124	1
Eigenherstellung	Ethanol 70% pure / denatured	2314I-02320	1
Eigenherstellung	Ethanol 70% pure / denatured	4414A-02320	1
Eigenproduktion	Ethanol 70% pure / denatured	714Q-02320	1
Engel/Engel	Ethanol 70% pure / denatured	39-28715	1
Engel-Apotheke	Ethanol 70% pure / denatured	2319A-07016	1
Euro OTC	Ethanol 70% pure / denatured	77A110917	1
Euro OTC	Ethanol 70% pure / denatured	7028031	2
Euro OTC	Ethanol 70% pure / denatured	15A170918	1
Euro OTC	Ethanol 70% pure / denatured	220713	1
Fagron	Ethanol 70% pure / denatured	7027102	1
Fagron	Ethanol 70% pure / denatured	Probemessung	1
Fagron	Ethanol 70% pure / denatured	40929/52La	1
Fischar	Ethanol 70% pure / denatured	27031501	1
Fischar	Ethanol 70% pure / denatured	7025082	1
Fischar	Ethanol 70% pure / denatured	7028031	1
Fischar	Ethanol 70% pure / denatured	7028011	1
Fischar	Ethanol 70% pure / denatured	7024051	1
Fischar / Alliance Hea...	Ethanol 70% pure / denatured	7026051	1
Fischar / Anzag	Ethanol 70% pure / denatured	7023091	1
Fischar / Noweda	Ethanol 70% pure / denatured	7023111	1
Fischar / Noweda	Ethanol 70% pure / denatured	7024021	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Fischar / Sanacorp	Ethanol 70% pure / denatured	7023091	1
Fischar GmbH	Ethanol 70% pure / denatured	7028062	1
fischar/Phönix	Ethanol 70% pure / denatured	7027032	1
Fischar/Phönix	Ethanol 70% pure / denatured	7026031	1
Fischar/Phönix	Ethanol 70% pure / denatured	7026111	1
Fischar/Phönix	Ethanol 70% pure / denatured	7026092	1
Fischar/Sanacorp	Ethanol 70% pure / denatured	7027102	1
Fischar/Sanacorp	Ethanol 70% pure / denatured	7028062	1
Gehe	Ethanol 70% pure / denatured	3818Q-02320	1
GEHE	Ethanol 70% pure / denatured	180828	1
Gehe 27.2.14	Ethanol 70% pure / denatured	140121	1
Gehe/Pflüger	Ethanol 70% pure / denatured	1204021712	1
Gehe/Pflüger	Ethanol 70% pure / denatured	170308	1
Gehe/Pflüger	Ethanol 70% pure / denatured	170208	1
Gehe/Pflüger	Ethanol 70% pure / denatured	170419	2
Gehe/Pflüger	Ethanol 70% pure / denatured	180928	1
Gehe-Kremer	Ethanol 70% pure / denatured	150209	1
Gehe-Kremer	Ethanol 70% pure / denatured	140307	1
Gutenberg-Apotheke	Ethanol 70% pure / denatured	3412I-03043	1
Gutenberg-Apotheke	Ethanol 70% pure / denatured	130502003	1
Gutenberg-Apotheke	Ethanol 70% pure / denatured	1813M-02320	1
Heck/Wittich	Ethanol 70% pure / denatured	2113N-02320	1
Hirsch	Ethanol 70% pure / denatured	4413I-02320	1
Hirsch	Ethanol 70% pure / denatured	714E-02320	1
HirschApotheke	Ethanol 70% pure / denatured	1015I-02320	1
HirschApotheke	Ethanol 70% pure / denatured	2315I-02320	1
HirschApotheke	Ethanol 70% pure / denatured	4614A-02320	1
Hoffmann & Sommer GmbH ...	Ethanol 70% pure / denatured	580916	1
Hoffmanns/Anzag	Ethanol 70% pure / denatured	520116	1
Hofman und Sommer GmbH ...	Ethanol 70% pure / denatured	580916	1
Hofmann	Ethanol 70% pure / denatured	320713	1
Hofmann&Sommer/Sanacorp	Ethanol 70% pure / denatured	781218	1
Hohe-Wart-Apotheke	Ethanol 70% pure / denatured	23072013/1	1
Hubertus Apotheke	Ethanol 70% pure / denatured	261113	1
Kastner (eigen)	Ethanol 70% pure / denatured	1215E-02320	1
Kastner (eigen)	Ethanol 70% pure / denatured	3114E-03043	1
Kemer Phönix	Ethanol 70% pure / denatured	130628	1
Klenk	Ethanol 70% pure / denatured	150730	1
Kremer	Ethanol 70% pure / denatured	160909	1
Kremer	Ethanol 70% pure / denatured	160711	1
Kremer	Ethanol 70% pure / denatured	170308	1
Kremer	Ethanol 70% pure / denatured	170619	1
Kremer	Ethanol 70% pure / denatured	180404	1
Kremer	Ethanol 70% pure / denatured	180828	2
Kremer	Ethanol 70% pure / denatured	130206	1
Kremer	Ethanol 70% pure / denatured	141027	1
Kremer	Ethanol 70% pure / denatured	160414	1
Kremer	Ethanol 70% pure / denatured	161017	1
Kremer	Ethanol 70% pure / denatured	170208	1
kremer gmbh	Ethanol 70% pure / denatured	23081605	1
Kremer GmbH	Ethanol 70% pure / denatured	160512	1
Kremer GmbH	Ethanol 70% pure / denatured	170906	1
Kremer GmbH	Ethanol 70% pure / denatured	181206	1
Kremer GmbH & Co.KG	Ethanol 70% pure / denatured	140902	2
Kremer GmbH & Co.KG	Ethanol 70% pure / denatured	150602	1
Kremer GmbH & Co. KG	Ethanol 70% pure / denatured	160215	1
Kremer GmbH & Co. KG	Ethanol 70% pure / denatured	170208	1
Kremer GmbH & Co. KG	Ethanol 70% pure / denatured	161017	1
Kremer GmbH & Co. KG	Ethanol 70% pure / denatured	170116	2
Kremer GmbH & Co. KG	Ethanol 70% pure / denatured	170619	4

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Kremer Gmbh / Noweda	Ethanol 70% pure / denatured	141127	2
Kremer Gmbh / Noweda	Ethanol 70% pure / denatured	140627	1
Kremer GmbH Wuppertal/G...	Ethanol 70% pure / denatured	130729	1
Kremer GmbH/Noweda	Ethanol 70% pure / denatured	181115	1
Kremer/Alliance Healthc...	Ethanol 70% pure / denatured	171025	1
Kremer/Gehe	Ethanol 70% pure / denatured	160414	2
Kremer/Gehe	Ethanol 70% pure / denatured	130116	1
Kremer/Gehe	Ethanol 70% pure / denatured	140121	1
Kremer/Noweda	Ethanol 70% pure / denatured	170906	1
Kremer/Noweda	Ethanol 70% pure / denatured	131011	1
Kremer/Phoenix	Ethanol 70% pure / denatured	150730	1
Kremer/Phönix	Ethanol 70% pure / denatured	150327	1
Kremer/Phönix	Ethanol 70% pure / denatured	151123	1
Kremer/Phönix	Ethanol 70% pure / denatured	180404	1
Kremer/Phönix	Ethanol 70% pure / denatured	180928	1
Kremer/Phönix	Ethanol 70% pure / denatured	141127	1
KremerGmbH & Co. KG	Ethanol 70% pure / denatured	140507	1
kruppa	Ethanol 70% pure / denatured	1216H4	1
kruppa	Ethanol 70% pure / denatured	617H4	1
Kruppa	Ethanol 70% pure / denatured	418H2	1
Kruppa	Ethanol 70% pure / denatured	818H2	1
Libellen Apotheke	Ethanol 70% pure / denatured	1515Q-02320	1
Löwen-Apotheke	Ethanol 70% pure / denatured	219Q-03043	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-121214-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-050515-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-110716-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-021116-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	A-311013-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	A-061213-3D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-100114-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-020314-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-080514-1D	1
Martinus-Apotheke	Ethanol 70% pure / denatured	E-180714-1D	1
Met/ Noweda	Ethanol 70% pure / denatured	3815M-03043	1
n.a.	Ethanol 70% pure / denatured	1707918-a	1
Noweda	Ethanol 70% pure / denatured	120420	1
Noweda/KremerGmbH	Ethanol 70% pure / denatured	130821	1
O:Fischar/Phönix	Ethanol 70% pure / denatured	7027032	1
Otto Fischar	Ethanol 70% pure / denatured	7023111	1
Otto Fischar GmbH & Co...	Ethanol 70% pure / denatured	7025031	2
Otto Fischar GmbH & Co...	Ethanol 70% pure / denatured	7024021	1
Otto Fischar GmbH & Co...	Ethanol 70% pure / denatured	7024071	1
Otto Fischar GmbH/ Amzag	Ethanol 70% pure / denatured	7024091	1
Otto Fischer / Noweda	Ethanol 70% pure / denatured	7025031	1
Otto Fischer GmbH&Co.KG...	Ethanol 70% pure / denatured	7028091	1
otto Fischer/Noweda	Ethanol 70% pure / denatured	7024121	1
Pflüger	Ethanol 70% pure / denatured	170906	1
Pflüger	Ethanol 70% pure / denatured	171025	1
Pflüger	Ethanol 70% pure / denatured	180308	1
Pflüger	Ethanol 70% pure / denatured	190430	2
Pflüger	Ethanol 70% pure / denatured	130607	1
Pflüger	Ethanol 70% pure / denatured	131108	2
Pflüger	Ethanol 70% pure / denatured	141027	1
Pflüger GmbH & Co.KG	Ethanol 70% pure / denatured	170116	1
Pflüger GmbH / Gehe	Ethanol 70% pure / denatured	180404	1
Pflüger/Gehe	Ethanol 70% pure / denatured	170619	1
Phönix	Ethanol 70% pure / denatured	351213	1
PHÖNIX	Ethanol 70% pure / denatured	171025	1
PHÖNIX	Ethanol 70% pure / denatured	171211	1
Caelo	Ethanol 70% pure / denatured	7023111	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Euro OTC	Ethanol 70% pure / denatured	170116	1
Phönix/Kremer	Ethanol 70% pure / denatured	160909	1
Phönix/Kremer	Ethanol 70% pure / denatured	180525	1
Plüger/Anzag	Ethanol 70% pure / denatured	32016	1
Post-Apotheke	Ethanol 70% pure / denatured	1414A-02320	1
Post-Apotheke 15.01.2014	Ethanol 70% pure / denatured	15012044	1
Purren Apotheke	Ethanol 70% pure / denatured	17043	1
Rezeptur	Ethanol 70% pure / denatured	4215Q-03043	1
Rezeptur Apotheke	Ethanol 70% pure / denatured	2016Q-03043	1
Römer-Apotheke	Ethanol 70% pure / denatured	4314A-03043	1
Rondell	Ethanol 70% pure / denatured	1715E-07145	1
Rondell Apotheke	Ethanol 70% pure / denatured	26151-07145	1
Rondell Apotheke	Ethanol 70% pure / denatured	4015A-03043	1
Rondell Apotheke	Ethanol 70% pure / denatured	416M-02320	1
Rondell Apotheke	Ethanol 70% pure / denatured	415M-03043	1
Rondell Apotheke	Ethanol 70% pure / denatured	2616M-02320	1
Rondell Apotheke	Ethanol 70% pure / denatured	1814Q-07145	1
Rondell Apotheke	Ethanol 70% pure / denatured	3414M-07145	1
Rondell Apotheke	Ethanol 70% pure / denatured	3414M-02320	1
Rondell Apotheke	Ethanol 70% pure / denatured	615E-02320	1
Rondell Apotheke	Ethanol 70% pure / denatured	615E-07145	1
Rosen Apotheke	Ethanol 70% pure / denatured	1317A-07095	1
Rosenapotheke	Ethanol 70% pure / denatured	2317E-07095	1
Sanacorp	Ethanol 70% pure / denatured	130124	1
sittig	Ethanol 70% pure / denatured	310316	1
Stern-Defektur	Ethanol 70% pure / denatured	130705003	1
Stiftsapotheke	Ethanol 70% pure / denatured	150420005	1
Stiftsapotheke	Ethanol 70% pure / denatured	13052016	1
Wolf Apotheke/Defektur	Ethanol 70% pure / denatured	70627/52Hk	1
Wolf Apotheke/Defektur	Ethanol 70% pure / denatured	71208/50Gie	1
Wolf-Apotheke	Ethanol 70% pure / denatured	40331/52La	1
Wolf-Apotheke / Defektur	Ethanol 70% pure / denatured	51019/51Wlo	1
Wolf-Apotheke / Defektur	Ethanol 70% pure / denatured	Bulk	1
Wolf-Apotheke / Defektur	Ethanol 70% pure / denatured	70404/53Hk	1
Wolf-Apotheke / Defektur	Ethanol 70% pure / denatured	40722/51Hk	1
Wolf-Apotheke / Defektur	Ethanol 70% pure / denatured	41125/52Hk	1
Wolf-Apotheke-Defektur	Ethanol 70% pure / denatured	70818/50Hk	1
Berkel AHK	Ethanol 70% pure / denatured		1
Caelo	Ethanol 70% pure / denatured		1
Defektur	Ethanol 70% pure / denatured		2
eigen	Ethanol 70% pure / denatured		2
Eigenherstellung	Ethanol 70% pure / denatured		1
frischhergestellt	Ethanol 70% pure / denatured		1
	Ethanol 70% pure / denatured		1
Nachprüfung	Ethanol 70% pure / denatured		1
Wolf Apotheke	Ethanol 70% pure / denatured		2

- 5207 spectra from 479 *Apo-Ident* customers from a total of 2446 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Ethanol 70% pure / denatured* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For

this purpose, all relevant spectra of the various substances were compared with *Ethanol 70% pure / denatured* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	120	0	20 341
Type C	0	323	17	5207

The substance/substance group *Ethanol 70% pure / denatured* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7722 %)	95.0000 % (> 94.1176 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Ethanol 70% pure / denatured* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Orange aroma	55.19	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Ethanol 70% pure / denatured* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30779	30779	0.00	101.97
34101	34101	0.00	96.32
31055	31055	0.00	83.64
34274	34274	0.00	82.67

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Excipial® almond oil ointment**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30720-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Excipial® almond oil ointment

Special notes

When selecting the *Excipial® almond oil ointment* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Excipial® almond oil ointment	4	2	27

Second-stage model

For differentiation of the substance/substance group *Excipial[®] almond oil ointment* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Excipial[®] almond oil ointment*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Spirig Pharma	Excipial [®] almond...	M023	30720	40	not required
Spirig Pharma	Excipial [®] almond...	M031	31090	40	not required
Spirig Pharma	Excipial [®] almond...	N012	31278	40	not required
Spirig Pharma	Excipial [®] almond...	R012	31757	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Excipial[®] almond oil ointment*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Excipial[®] almond oil ointment*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Spirig Pharma	Excipial [®] almond oil ointment	S021	33209	40
Spirig Pharma	Excipial [®] almond oil ointment	T052	33210	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 32 spectra from 13 *Apo-Ident* customers from 28 batches from the substance/substance group *Excipial[®] almond oil ointment*.
- Among them are spectra of independent samples from 27 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Excipial [®] almond oil ointment	lotno32	1
Caelo	Excipial [®] almond oil ointment	20170829Ma3	1
Caelo	Excipial [®] almond oil ointment	20170829Ma2	1
Fiebig	Excipial [®] almond oil ointment	S051	1
Galderma	Excipial [®] almond oil ointment	R043	1
Galderma	Excipial [®] almond oil ointment	50498	1
Galderma (Spirig Pharma...	Excipial [®] almond oil ointment	R043	1
Galderma International ...	Excipial [®] almond oil ointment	T031	1
Galderma/Kehr	Excipial [®] almond oil ointment	T051	1
Galderma/Kehr	Excipial [®] almond oil ointment	V031	1
Galderma/Now	Excipial [®] almond oil ointment	LOTS021	1
Galderma/Noweda	Excipial [®] almond oil ointment	S012	1
Galderma/Phönix	Excipial [®] almond oil ointment	S021	1
Galderma-Spirig	Excipial [®] almond oil ointment	V042-20171127Ma12	1
Caelo	Excipial [®] almond oil ointment	LOTN022	2
Spirig	Excipial [®] almond oil ointment	M032	1
Spirig	Excipial [®] almond oil ointment	LOTM023	1
Spirig	Excipial [®] almond oil ointment	N031	1
Spirig	Excipial [®] almond oil ointment	M023	1
Spirig	Excipial [®] almond oil ointment	N032	1
Spirig	Excipial [®] almond oil ointment	R012	1
Spirig	Excipial [®] almond oil ointment	S032	1
Spirig	Excipial [®] almond oil ointment	S011	1
Spirig / Galderma / Anzag	Excipial [®] almond oil ointment	V061	1
Spirig / Gehe	Excipial [®] almond oil ointment	LOTN022	1
Spirig /Noweda	Excipial [®] almond oil ointment	R012	1
Spirig /Noweda	Excipial [®] almond oil ointment	r021	1
Spirig Pharma/Nowed	Excipial [®] almond oil ointment	N022	1
Spirig/AHD	Excipial [®] almond oil ointment	N011	1
Spirig/Noweda	Excipial [®] almond oil ointment	R043	1
Spirig/Sanacorp	Excipial [®] almond oil ointment	LOTN011	1

- 5515 spectra from 490 *Apo-Ident* customers from a total of 2699 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented

within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Excipial[®] almond oil ointment* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Excipial[®] almond oil ointment* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	31	1	5515

The substance/substance group *Excipial[®] almond oil ointment* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7742 %)	96.8750 % (> 87.5000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Excipial[®] almond oil ointment* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Balm Bio Nature	12.01	—
Argan oil	18.10	—
Wax ointment (stabilised)	43.30	—
White paraffin oil	53.41	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Excipial[®] almond oil ointment* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31278	31278	0.00	26.08
30720	30720	0.00	31.22
31757	31757	0.00	23.34
31090	31090	0.00	24.85

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Fat ointments**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30881-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Fat ointments; Asche Basis[®] fat ointment; Cottonwood ointment; Marjoram ointment; Neribas[®] fat ointment; Protegin[®] XN; Unguentum majoranae; Unguentum Populi

Special notes

When selecting the *Fat ointments* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Asche Basis [®] fat ointment	3	0	6
Cottonwood ointment	3	5	1
Marjoram ointment	3	7	78
Neribas [®] fat ointment	3	2	5
Protegin [®] XN	3	1	68

Second-stage model

For differentiation of the substance/substance group *Fat ointments* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Fat ointments*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Chiesi	Asche Basis [®] fat...	23014A	31013	40	not required
Chiesi	Asche Basis [®] fat...	41017A	31858	60	not required
Chiesi	Asche Basis [®] fat...	53021A	33634	40	not required
Caelo	Cottonwood ointm...	161175	32473	40	20160607*
Caelo	Cottonwood ointm...	170572	33130	40	20170307*
Caelo	Cottonwood ointm...	170573	33131	40	20170308*
Caelo	Marjoram ointment	12123001	30881	40	not required
Caelo	Marjoram ointment	14089901	31443	40	not required
Henry Lamotte	Marjoram ointment	5322500	30926	40	not required
Jenapharm	Neribas [®] fat oin...	32032C	31489	40	not required
Jenapharm	Neribas [®] fat oin...	YY00K7C	31872	60	not required
Jenapharm	Neribas [®] fat oin...	YY01TF2	33986	40	not required
Caelo	Protegin [®] XN	13081901	31112	40	not required
Caelo	Protegin [®] XN	13344402	31475	40	not required
Caelo	Protegin [®] XN	17258703	33921	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 640 spectra of 15 reference samples from the substance/substance group *Fat ointments*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 15 different batches.
- 23 325 spectra from a total of 475 batches from further 155 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 720 spectra of 17 reference samples from the substance/substance group *Fat ointments*.
- Among them are spectra of independent samples from 15 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Cottonwood ointment	170534	33162	40
Caelo	Cottonwood ointment	170574	33163	40
Caelo	Cottonwood ointment	180826	34186	40
Caelo	Cottonwood ointment	180828	34187	40
Caelo	Cottonwood ointment	181888	34256	40
Caelo	Marjoram ointment	153533	31990	60
Caelo	Marjoram ointment	153540	31991	60
Caelo	Marjoram ointment	160687	32516	40
Caelo	Marjoram ointment	162575	32872	40
Caelo	Marjoram ointment	162576	32873	40
Caelo	Marjoram ointment	181900	34259	40
Fagron	Marjoram ointment	18L18-T07-062832	34418	40
Jenapharm	Neribas [®] fat ointment	YY011K0	32764	40
Jenapharm	Neribas [®] fat ointment	YY019KR	33290	40
Caelo	Protegin [®] XN	161645	32340	40
Chiesi	Asche Basis [®] fat ointment	53021A	32716	40
Chiesi	Asche Basis [®] fat ointment	53021A	32925	40

- 19741 spectra from a total of 421 batches from further 199 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 459 spectra from 157 *Apo-Ident* customers from 169 batches from the substance/substance group *Fat ointments*.
- Among them are spectra of independent samples from 157 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Asche Basis [®] fat ointment	73025A	2
Chiese	Asche Basis [®] fat ointment	33016A	1
Chiese	Asche Basis [®] fat ointment	63023A	1
Chiesi	Asche Basis [®] fat ointment	51020A	1
Chiesi	Asche Basis [®] fat ointment	63023A	1
Chiesi	Asche Basis [®] fat ointment	82027A	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
CHiesi	Asche Basis [®] fat ointment	41018A	3
Chiesi/Gehe	Asche Basis [®] fat ointment	51020A	1
Chiesi/Gehe	Asche Basis [®] fat ointment	41017A	1
Jenne	Cottonwood ointment	17057404	1
Lamotte/ Noweda	Marjoram ointment	5322500	1
Caelo	Marjoram ointment	10111402	1
Caelo	Marjoram ointment	11274603	2
Caelo	Marjoram ointment	11061201	1
Caelo	Marjoram ointment	11327501	2
Caelo	Marjoram ointment	12081002	5
Caelo	Marjoram ointment	15101205	1
Caelo	Marjoram ointment	12018001	4
Caelo	Marjoram ointment	12018101	3
Caelo	Marjoram ointment	7121203	1
Caelo	Marjoram ointment	20290312-1	1
Caelo	Marjoram ointment	5322500	1
Caelo	Marjoram ointment	8031304	1
Caelo	Marjoram ointment	13051304	1
Caelo	Marjoram ointment	13028401	9
Caelo	Marjoram ointment	2011405	1
Caelo	Marjoram ointment	13382902	1
Caelo	Marjoram ointment	140020101	1
Caelo	Marjoram ointment	14090002	10
Caelo	Marjoram ointment	2021506	1
Caelo	Marjoram ointment	15354001	5
Caelo	Marjoram ointment	27031505	1
Caelo	Marjoram ointment	312115354001	1
Caelo	Marjoram ointment	16068602	2
Caelo	Marjoram ointment	16257602	3
Caelo	Marjoram ointment	16257502	1
Caelo	Marjoram ointment	17071101	4
Caelo	Marjoram ointment	13307102	6
Caelo	Marjoram ointment	13382903	2
Caelo	Marjoram ointment	14332202	1
Caelo	Marjoram ointment	15392402	2
Caelo	Marjoram ointment	15038401	2
Caelo	Marjoram ointment	66(18050902)	1
Caelo	Marjoram ointment	66(18190001)	1
Caelo	Marjoram ointment	18190102	1
Caelo	Marjoram ointment	13028302	3
Caelo	Marjoram ointment	1225402	1
Caelo	Marjoram ointment	15038501	3
Caelo	Marjoram ointment	65(17070901)	1
Caelo	Marjoram ointment	15038303	1
Caelo	Marjoram ointment	13095401	5
Caelo	Marjoram ointment	16068701	2
Caelo	Marjoram ointment	17070901	7
Caelo	Marjoram ointment	13383001	1
Caelo	Marjoram ointment	19033001	2
Caelo	Marjoram ointment	13e10-t04-003550	1
Caelo	Marjoram ointment	17071001	1
Caelo	Marjoram ointment	12295402	6
Caelo	Marjoram ointment	14332101	9
Caelo	Marjoram ointment	16068901	5
Caelo	Marjoram ointment	17302402	1
Caelo	Marjoram ointment	14002101	15
Caelo	Marjoram ointment	16068801	3
Caelo	Marjoram ointment	16K07-T20-038496	1
Caelo	Marjoram ointment	18050901	2
Caelo	Marjoram ointment	18190101	3

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Marjoram ointment	18190001	3
Caelo	Marjoram ointment	17302401	3
Caelo	Marjoram ointment	1513E-02536	1
Caeolo	Marjoram ointment	14090002	1
Caeolo	Marjoram ointment	1539402	1
Cealo	Marjoram ointment	13028401	2
Fagron	Marjoram ointment	12081002	1
Fagron	Marjoram ointment	13A16-To4-000208	1
Fagron	Marjoram ointment	13F27-T03-004962	3
Fagron	Marjoram ointment	13F27-To3-004962	1
Fagron	Marjoram ointment	17B03-T02-041256	1
Fagron	Marjoram ointment	17E22-T09-044517	1
Fagron	Marjoram ointment	15K10-T10-027644	1
Fagron	Marjoram ointment	14090002	1
Fagron	Marjoram ointment	16E02-T02-032846	1
Fagron	Marjoram ointment	16K07-T20-038496	3
Fagron	Marjoram ointment	13A16-T02	1
Fagron	Marjoram ointment	12D24-T01	2
Fagron	Marjoram ointment	13A16-T04-000208	1
Fagron	Marjoram ointment	14A07-T06-009085	3
Fagron	Marjoram ointment	14A07-T05-009082	2
Fagron	Marjoram ointment	14A07-T04-009079	3
Gehe	Marjoram ointment	13307102	1
Gehe	Marjoram ointment	14090002	1
Caelo	Marjoram ointment	12123101	2
Caelo	Marjoram ointment	13028301	2
Caelo	Marjoram ointment	13382901	1
Henry Lamotte	Marjoram ointment	5563400	1
Henry Lamotte GmbH/Hold. ...	Marjoram ointment	5067400	1
Henry Lamotte Oils GmbH	Marjoram ointment	5322500	1
Henry Lamotte Oils GmbH	Marjoram ointment	5563400	1
Henry Lamotte Oils GmbH...	Marjoram ointment	5067400	1
Henry Lamotte Oils GmbH...	Marjoram ointment	5322500	1
Jenne	Marjoram ointment	13028302	2
Kehr	Marjoram ointment	17071101	1
Lamotte / Gehe	Marjoram ointment	5322500	1
Lamotte/Alliance	Marjoram ointment	5563400	3
Lamotte/Sanacorp	Marjoram ointment	5563400	1
Noweda	Marjoram ointment	5322500	1
Caelo	Marjoram ointment	15353303	1
Phoenix	Marjoram ointment	13028401	1
Phönix	Marjoram ointment	12018001	1
Phönix 10.12.12	Marjoram ointment	12D24-T02	1
Sanacorp	Marjoram ointment	12081002	1
Sanacorp	Marjoram ointment	12295402	1
Sanacorp	Marjoram ointment	13095401	1
Sanacorp	Marjoram ointment	16257502	2
Sanacorp, 21.03.17, 5,73EUR	Marjoram ointment	16068602	1
VDL	Marjoram ointment	14090002	1
/ AHD	Neribas [®] fat ointment	YY016LP	2
BAYER/Phönix WE:26.04.1...	Neribas [®] fat ointment	YY011K0	1
Caelo	Neribas [®] fat ointment	yy00k7C	1
GP Grenzach Produktions...	Neribas [®] fat ointment	YY00K7C	1
Jenapharm / Fiebig	Neribas [®] fat ointment	YY01TF2	1
Jenapharm/Ahd	Neribas [®] fat ointment	YYo11Ko	1
Jenapharm/Anzag	Neribas [®] fat ointment	YY0282F	1
Jenapharm/Phönix	Neribas [®] fat ointment	YY00K7C	1
Jenapharm/Phönix	Neribas [®] fat ointment	YY0282F	1
Phoenix	Neribas [®] fat ointment	YY00K7C	1
Phoenix WE 24.04.17 -7,...	Neribas [®] fat ointment	YY019KR	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
PhönixWE:18.01.2017 E...	Neribas [®] fat ointment	YY016LP	1
Caelo	Protegin [®] XN	3091208	1
Caelo	Protegin [®] XN	11196702	2
Caelo	Protegin [®] XN	11022403	1
Caelo	Protegin [®] XN	12229201	5
Caelo	Protegin [®] XN	8031305	1
Caelo	Protegin [®] XN	12229211	5
Caelo	Protegin [®] XN	12229210	1
Caelo	Protegin [®] XN	25061301	1
Caelo	Protegin [®] XN	12229209	1
Caelo	Protegin [®] XN	13081903	1
Caelo	Protegin [®] XN	13081908	1
Caelo	Protegin [®] XN	6012014A	1
Caelo	Protegin [®] XN	20011402	1
Caelo	Protegin [®] XN	13081904	2
Caelo	Protegin [®] XN	13081907	3
Caelo	Protegin [®] XN	14220204	3
Caelo	Protegin [®] XN	26031509	1
Caelo	Protegin [®] XN	14341301	3
Caelo	Protegin [®] XN	14220208	4
Caelo	Protegin [®] XN	14220206	2
Caelo	Protegin [®] XN	15252703	5
Caelo	Protegin [®] XN	15252702	1
Caelo	Protegin [®] XN	16026703	3
Caelo	Protegin [®] XN	16026707	5
Caelo	Protegin [®] XN	16026706	1
Caelo	Protegin [®] XN	16164502	2
Caelo	Protegin [®] XN	16164503	2
Caelo	Protegin [®] XN	17258707	2
Caelo	Protegin [®] XN	18059501	4
Caelo	Protegin [®] XN	18059512	2
Caelo	Protegin [®] XN	19109001	2
Caelo	Protegin [®] XN	19109002	1
Caelo	Protegin [®] XN	11196805	1
Caelo	Protegin [®] XN	16026704	3
Caelo	Protegin [®] XN	13081902	2
Caelo	Protegin [®] XN	14220209	3
Caelo	Protegin [®] XN	16026702	4
Caelo	Protegin [®] XN	13081906	6
Caelo	Protegin [®] XN	14220203	2
Caelo	Protegin [®] XN	16026709	1
Caelo	Protegin [®] XN	16164501	1
Caelo	Protegin [®] XN	16164504	1
Caelo	Protegin [®] XN	14341302	1
Caelo	Protegin [®] XN	11196801	1
Caelo	Protegin [®] XN	13344401	5
Caelo	Protegin [®] XN	16164506	2
Caelo	Protegin [®] XN	17258705	1
Caelo	Protegin [®] XN	17258708	1
Fagron	Protegin [®] XN	18059501	1
Caelo	Protegin [®] XN	14220202	5
Caelo	Protegin [®] XN	16026701	6
Caelo	Protegin [®] XN	1805907	1
Caelo	Protegin [®] XN	18059505	1
Caelo	Protegin [®] XN	19110201	4
Caelo	Protegin [®] XN	18059502	7
Caelo	Protegin [®] XN	18059503	2
Caelo	Protegin [®] XN	19109003	2
Caelo	Protegin [®] XN	19110202	1
Caelo	Protegin [®] XN	18059507	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Protegin [®] XN	13081905	11
Caelo	Protegin [®] XN	14220201	1
Caelo	Protegin [®] XN	1805901	1
Caesar & Loretz GmbH	Protegin [®] XN	18059511	1
Caesar & Loretz GmbH	Protegin [®] XN	19109001	1
Fagron	Protegin [®] XN	18059507	1
Gehe	Protegin [®] XN	12229201	1
Gehe	Protegin [®] XN	12229211	1
Gehe	Protegin [®] XN	16026701	2
GEHE	Protegin [®] XN	18059507	1
Hedinger/Phönix	Protegin [®] XN	18059501	1
Ichthyol-Gesellschaft	Protegin [®] XN	17258703	1
Kehr	Protegin [®] XN	1805607	1
Klenk	Protegin [®] XN	18059502	1
Phönix	Protegin [®] XN	11196706	1
Phönix	Protegin [®] XN	13081901	3
PHÖNIX	Protegin [®] XN	18059501	1
Phönix 12.03.2013	Protegin [®] XN	12229205	1
Phönix, 07.11.13	Protegin [®] XN	12229210	1
Caelo	Protegin [®] XN	14220205	6
Caelo	Marjoram ointment	12123001	7
Caelo	Marjoram ointment	14089901	8
	Protegin [®] XN	2711E-03598	1
Caelo	Protegin [®] XN	13344402	11
Caelo	Protegin [®] XN	13081901	4
Caelo	Protegin [®] XN	17258703	2
Euro OTC	Protegin [®] XN		1

- 5088 spectra from 466 *Apo-Ident* customers from a total of 2549 batches from a further 138 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Fat ointments* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Fat ointments* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	640	0	23 325
Type B	0	720	0	19 701
Type C	0	444	15	5088

The substance/substance group *Fat ointments* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.0625 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 99.1667 %)
Type C	100.0000 % (> 98.7721 %)	96.7320 % (> 96.0784 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Fat ointments* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
White paraffin oil	21.17	—
Wax ointment (stabilised)	28.48	—
Lygal [®] head ointment N 3%	31.77	—
Salicylic white paraffin 10%	59.04	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Fat ointments* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31112	31112	0.00	38.40
31475	31475	0.00	39.69
33921	33921	0.00	38.29
31013	31013	0.00	37.24
31858	31858	0.00	45.80
33634	33634	0.00	42.98
30881	30881	0.00	33.72
30926	30926	0.00	39.92
31443	31443	0.00	36.59
31489	31489	0.00	44.36
31872	31872	0.00	48.49
33986	33986	0.00	43.35
32473	32473	0.00	31.10
33130	33130	0.00	30.81
33131	33131	0.00	32.58

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Fenistil® Gel**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31045-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Fenistil® Gel

Special notes

When selecting the *Fenistil® Gel* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Fenistil® Gel	3	2	0

Second-stage model

For differentiation of the substance/substance group *Fenistil® Gel* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Fenistil® Gel*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Euro OTC	Fenistil® Gel	U02364A	33638	40	not required
Novartis	Fenistil® Gel	N00927A	31045	40	not required
Novartis	Fenistil® Gel	R02021A	31767	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Fenistil® Gel*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Fenistil® Gel*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Euro OTC	Fenistil® Gel	T02415A	32787	40
Euro OTC	Fenistil® Gel	T02416A	32825	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Fenistil® Gel*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Fenistil® Gel* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Fenistil® Gel* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	0	0	5547

The substance/substance group *Fenistil® Gel* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Fenistil® Gel* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Sebexol [®] cream lotion pH 5	15.98	—
Sebexol [®] basic pH 5 formula basis	21.36	—
SyrSpend [®] SF pH4 cherry aroma	22.34	—
Hans Karrer Hydrocream MicroSilver	23.40	—
Aloe vera gel, 10x concentrated	26.32	—
Bepanthen [®] solution	27.34	—
Retterspitz external	27.80	—
SyrSpend [®] SF pH4 aroma free	30.02	—
Water	32.01	—
Wofacutan wash lotion	34.24	—
Aloe Vera gel, 1:1	34.67	—
Excipial [®] U Hydrolotio	35.46	—
Dimeticone ointment 10% SR	37.23	—
Abitima [®] clinic face cream	50.42	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Fenistil® Gel* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31045	31045	0.00	19.16
31767	31767	0.00	21.87
33638	33638	0.00	21.63

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Fennel oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31140-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Fennel oil; Oleum foeniculum vulgare var. dulce

Special notes

When selecting the *Fennel oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Fennel oil	3	2	1

Second-stage model

For differentiation of the substance/substance group *Fennel oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Fennel oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Fennel oil	L16813D-111973BAG90451	31140	40	not required
Taoasis	Fennel oil	L35513DN-119762	31693	60	not required
Taoasis	Fennel oil	1806-125039	32795	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Fennel oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Fennel oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Fennel oil	1806-127213	32952	40
Taoasis	Fennel oil	1861-129086	33991	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 1 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Fennel oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Fennel oil	2307-5296	1

- 5546 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Fennel oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Fennel oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	74	6	20 381
Type C	0	1	0	5546

The substance/substance group *Fennel oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	92.5000 % (> 88.7500 %)
Type C	100.0000 % (> 98.8428 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Fennel oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Anise oil, organic	15.74	—
Thuja oil	82.22	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Fennel oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32795	32795	0.00	20.20
31140	31140	0.00	88.68
31693	31693	0.00	85.85

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Ginger oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30451-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ginger oil; Oleum zingiber officinalis

Special notes

When selecting the *Ginger oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Ginger oil	4	1	1

Second-stage model

For differentiation of the substance/substance group *Ginger oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Ginger oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Ginger oil	00552A27	34407	40	not required
Taoasis	Ginger oil	130114-110686BAG90451	30958	40	not required
Taoasis	Ginger oil	40592A-112718BAG90451	31142	40	not required
Taoasis	Ginger oil	1431020-124656	32270	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 4 reference samples from the substance/substance group *Ginger oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 805 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Ginger oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Bombastus	Ginger oil	300690	32569	40
Bombastus	Ginger oil	300690	33014	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 1 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Ginger oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Ginger oil	6454-92725	1

- 5546 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Ginger oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Ginger oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	0	20 381
Type C	0	1	0	5546

The substance/substance group *Ginger oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.8428 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Ginger oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Cedar wood oil	17.35	—
Citrus oil	17.95	—
Hyssop oil	20.10	—
Vetiver bourbon oil	23.64	—
Marjoram oil	24.88	—
Angelica root oil	25.89	—
Myrtle oil	28.24	—
Lemon grass oil	31.83	—
Immortelle oil	32.06	—
Cypress oil	36.13	—
Carrot seed oil	37.18	—
Spearmint oil	38.11	—
Yarrow oil	40.26	—
Spruce needle oil	41.24	—
Cumin oil	44.92	—
Frankincense oil	46.39	—
Silver fir oil	47.52	—
Patchouli oil	47.53	—
Swiss pine oil	51.89	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Ginger oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31142	31142	0.00	17.35
32270	32270	0.00	29.05
30958	30958	0.00	20.10
34407	34407	0.00	30.33

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances,

thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Grapefruit oil organic / Orange oil / Blood orange oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30960-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Grapefruit oil organic / Orange oil / Blood orange oil; Blood orange oil; Grapefruit oil, organic; Oleum citrus paradisi; Oleum citrus sinensis; Orange oil

Special notes

When selecting the *Grapefruit oil organic / Orange oil / Blood orange oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Blood orange oil	2	3	1
Grapefruit oil, organic	3	3	11
Orange oil	3	6	18

Second-stage model

For differentiation of the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Blood orange oil	00413G25	33761	40	not required
Taoasis	Blood orange oil	494J09	33759	40	not required
Apotheker Bau...	Grapefruit oil, ...	7.99615.16.02	31853	60	not required
Taoasis	Grapefruit oil, ...	31564-119383	31634	120	not required
Taoasis	Grapefruit oil, ...	38755-122181	31781	60	not required
Primavera	Orange oil	00112K25	33805	40	not required
Taoasis	Orange oil	121109-110685BAG90451	30960	40	not required
Taoasis	Orange oil	33732-12088	31679	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 460 spectra of 8 reference samples from the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 8 different batches.
- 23 505 spectra from a total of 482 batches from further 157 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 471 spectra of 12 reference samples from the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil*.
- Among them are spectra of independent samples from 12 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Blood orange oil	00318C26	34175	40
Primavera	Blood orange oil	00111H26	34296	31
Primavera	Blood orange oil	00013A27	34376	40
Apotheker Bauer & Cie	Grapefruit oil, organic	7.68413.17.012018-03	33019	40
Primavera	Grapefruit oil, organic	00553M26	34385	40
Taoasis	Grapefruit oil, organic	44040A-124468	32979	40
Primavera	Orange oil	00149A29	33956	40
Primavera	Orange oil	00058G26	34180	40
Primavera	Orange oil	00729L26	34392	40
Taoasis	Orange oil	43829C-124974	32790	40
Taoasis	Orange oil	44583A-126780	32902	40
Taoasis	Orange oil	011855A-1538	34105	40

- 19990 spectra from a total of 425 batches from further 201 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 31 spectra from 4 *Apo-Ident* customers from 30 batches from the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil*.
- Among them are spectra of independent samples from 30 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Blood orange oil	1AR18M-3519	1
Taoasis	Grapefruit oil, organic	40038-123110	1
Taoasis	Grapefruit oil, organic	31564-120540	1
Taoasis	Grapefruit oil, organic	44040A-124468	1
Taoasis	Grapefruit oil, organic	44040A-127409	1
Taoasis	Grapefruit oil, organic	44040A-124467	1
Taoasis	Grapefruit oil, organic	46701-128853	1
Taoasis	Grapefruit oil, organic	47037-1144	2
Taoasis	Grapefruit oil, organic	47037-958	1
Taoasis	Grapefruit oil, organic	47037-1602	1
Taoasis	Grapefruit oil, organic	AR18-12022-6352	1
Taoasis	Grapefruit oil, organic	48566-1955	1
BerglandSanacorp	Orange oil	K602772	1
Bombastus	Orange oil	298756	1
Bombastus	Orange oil	302428	1
Taoasis	Orange oil	140129-116983	1
Taoasis	Orange oil	140129-118141	1
Taoasis	Orange oil	140129-118420	1
Taoasis	Orange oil	140129-118790	1
Taoasis	Orange oil	42861A-122532	1
Taoasis	Orange oil	42861A-121691	1
Taoasis	Orange oil	122650-123643	1
Taoasis	Orange oil	43829C-124155	1
Taoasis	Orange oil	43829C-125351	1
Taoasis	Orange oil	44583A-128241	1
Taoasis	Orange oil	45451A-1178	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Orange oil	45451A-128935	1
Taoasis	Orange oil	45441A-1035	1
Taoasis	Orange oil	11855A-3824	1
Taoasis	Orange oil	6193	1

- 5516 spectra from 489 *Apo-Ident* customers from a total of 2688 batches from a further 140 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Grapefruit oil organic / Orange oil / Blood orange oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	460	0	23 505
Type B	0	471	0	19 990
Type C	0	31	0	5516

The substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 98.6957 %)
Type B	100.0000 % (> 99.9440 %)	100.0000 % (> 98.7261 %)
Type C	100.0000 % (> 98.7742 %)	100.0000 % (> 80.6452 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Grapefruit oil organic / Orange oil / Blood orange oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citric oil	16.84	—
Mandarin oil, green	43.86	—
Lime oil	57.74	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Grapefruit oil organic* / *Orange oil* / *Blood orange oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33759	33759	0.00	43.75
33761	33761	0.00	43.13
30960	30960	0.00	43.30
31679	31679	0.00	45.29
33805	33805	0.00	44.20
31634	31634	0.00	41.52
31781	31781	0.00	46.03
31853	31853	0.00	36.25

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Hydrophilic ointments
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30634-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Hydrophilic ointments; Abitima[®] clinic body cream; Abitima[®] clinic face cream; Allergika[®] Base cream; Asche Basis[®] cream; Asche Basis[®] lotion; Base cream Taoasis; Dermatest base ointment; Dermatop[®] base cream; DMS[®] base cream classic; DMS[®] base cream high classic; DMS[®] base cream high classic plus; Eucerinum O/W basis; Eucerinum W/O basis; Excipial[®] hydro cream; Excipial[®] lipo cream; Excipial[®] U Lipolotio; Excipial[®] U10 Lipolotio; Fabitop[®] base cream; Hans Karrer Lipocream MicroSilver; Hans Karrer Lipolotion MicroSilver; Linola[®] body milk; Lipoderm[®] lotion; Neribas[®] cream; Neuroderm[®] care lotion; Neuroderm[®] moisturising cream

Special notes

When selecting the *Hydrophilic ointments* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Abitima [®] clinic body cream	4	3	28
Abitima [®] clinic face cream	3	1	21
Allergika [®] Base cream	2	1	0
Asche Basis [®] cream	3	2	196
Asche Basis [®] lotion	3	1	41
Base cream Taoasis	3	1	15
Dermatest base ointment	3	4	6
Dermatop [®] base cream	2	2	4
DMS [®] base cream classic	4	1	8
DMS [®] base cream high classic	3	2	14
DMS [®] base cream high classic plus	2	1	2
Eucerinum O/W basis	2	0	11
Eucerinum W/O basis	3	1	20
Excipial [®] hydro cream	3	1	75
Excipial [®] lipo cream	5	0	50
Excipial [®] U Lipolotio	4	2	129
Excipial [®] U10 Lipolotio	3	2	3
Fabitol [®] base cream	3	2	11
Hans Karrer Lipocream MicroSilver	3	2	0
Hans Karrer Lipolotion MicroSilver	3	2	3
Linola [®] body milk	3	2	0
Lipoderm [®] lotion	3	2	14
Neribas [®] cream	1	2	16
Neuroderm [®] care lotion	3	2	0
Neuroderm [®] moisturising cream	3	1	23

Second-stage model

For differentiation of the substance/substance group *Hydrophilic ointments* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Hydrophilic ointments*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Actavis	Abitima [®] clinic ...	110712	31058	40	not required
Actavis	Abitima [®] clinic ...	051112	31061	40	not required
Actavis	Abitima [®] clinic ...	070915	32997	40	not required
Actavis	Abitima [®] clinic ...	331017	33969	40	not required
Actavis	Abitima [®] clinic ...	46820	30845	40	not required
Actavis	Abitima [®] clinic ...	161464	33793	40	not required
Actavis	Abitima [®] clinic ...	170180	34360	40	not required
Allergika	Allergika [®] Base ...	11/082022	33668	40	not required
Allergika	Allergika [®] Base ...	10/082022	33669	40	not required
Chiesi	Asche Basis [®] cream	03117A	30713	40	not required
Chiesi	Asche Basis [®] cream	22197A	30775	40	not required
Chiesi	Asche Basis [®] cream	24220A	31085	40	not required
Chiesi	Asche Basis [®] lot...	21042A	30828	40	not required
Chiesi	Asche Basis [®] lot...	24049A	31068	40	not required
Chiesi	Asche Basis [®] lot...	64082A	33737	40	not required
Taoasis	Base cream Taoasis	121205-2276	31041	100	not required
Taoasis	Base cream Taoasis	130124-3021	31115	40	not required
Taoasis	Base cream Taoasis	141222-4350	31578	60	not required

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
P&M Cosmetics	Dermatest base o...	251115	31627	60	not required
P&M Cosmetics	Dermatest base o...	180317	31950	60	not required
P&M Cosmetics	Dermatest base o...	121217	33039	40	not required
Sanofi aventis	Dermatop [®] base c...	3F031A	31234	40	not required
Sanofi aventis	Dermatop [®] base c...	5F056A	32177	40	not required
Koko	DMS [®] base cream ...	L026G13	31307	40	not required
Koko	DMS [®] base cream ...	L034H15	31869	60	not required
Koko	DMS [®] base cream ...	L003H16	32916	40	not required
Koko	DMS [®] base cream ...	L009K17	33968	40	not required
Koko	DMS [®] base cream ...	L010K13	31236	70	not required
Koko	DMS [®] base cream ...	L032A14	31308	40	not required
Koko	DMS [®] base cream ...	L041K15	31870	60	not required
Koko	DMS [®] base cream ...	L014L13	31309	40	not required
Koko	DMS [®] base cream ...	L003L15	32178	40	not required
Beiersdorf	Eucerinum O/W ba...	41830108WA	31539	60	not required
Beiersdorf	Eucerinum O/W ba...	64030208WA	33213	40	not required
Beiersdorf	Eucerinum W/O ba...	31230108WA	30993	40	not required
Beiersdorf	Eucerinum W/O ba...	53430208WA	32767	40	not required
Beiersdorf	Eucerinum W/O ba...	83730208WA	34359	40	not required
Spirig Pharma	Excipial [®] hydro ...	I013	30725	40	not required
Spirig Pharma	Excipial [®] hydro ...	N013	31089	40	not required
Spirig Pharma	Excipial [®] hydro ...	T052	33208	40	not required
Galderma Labo...	Excipial [®] lipo c...	V051	33636	40	not required
Spirig Pharma	Excipial [®] lipo c...	I011	30726	40	not required
Spirig Pharma	Excipial [®] lipo c...	N017	31088	40	not required
Spirig Pharma	Excipial [®] lipo c...	R011	31520	60	not required
Spirig Pharma	Excipial [®] lipo c...	T081	33207	40	not required
Galderma Labo...	Excipial [®] U Lipo...	T122	33270	40	not required
Spirig Pharma	Excipial [®] U Lipo...	M042	30732	60	not required
Spirig Pharma	Excipial [®] U Lipo...	N031	31067	40	not required
Spirig Pharma	Excipial [®] U Lipo...	N085	31280	40	not required
Spirig Pharma	Excipial [®] U10 Li...	M021	30733	60	not required
Spirig Pharma	Excipial [®] U10 Li...	N025	31066	40	not required
Spirig Pharma	Excipial [®] U10 Li...	N047	31281	40	not required
Fontapharm	Fabitol [®] base cr...	6RWW2	31082	40	not required
Fontapharm	Fabitol [®] base cr...	GWWL3	31576	60	not required
Fontapharm	Fabitol [®] base cr...	GLWD5	33221	40	not required
Hans Karrer G...	Hans Karrer Lipo...	15003	33194	40	not required
Hans Karrer G...	Hans Karrer Lipo...	15005	33195	40	not required
Hans Karrer G...	Hans Karrer Lipo...	18002	34117	40	not required
Hans Karrer G...	Hans Karrer Lipo...	15003	31730	60	not required
Hans Karrer G...	Hans Karrer Lipo...	15008	31873	60	not required
Hans Karrer G...	Hans Karrer Lipo...	18005	34119	40	not required
Dr. Wolff	Linola [®] body milk	433240	31511	60	not required
Dr. Wolff	Linola [®] body milk	511750	31874	60	not required
Dr. Wolff	Linola [®] body milk	707930	34043	40	not required
Spirig Pharma	Lipoderm [®] lotion	K057	30635	40	not required
Spirig Pharma	Lipoderm [®] lotion	M065	31072	40	not required
Spirig Pharma	Lipoderm [®] lotion	R023	31535	60	not required
Intendis	Neribas [®] cream	21076A	30634	40	not required
Intendis	Neribas [®] cream	21076A	31050	40	not required
Intendis	Neribas [®] cream	21076A	31095	40	not required
Infectopharm	Neuroderm [®] care ...	S041204.1	31070	40	not required
Infectopharm	Neuroderm [®] care ...	S031505.1	31772	60	not required
Infectopharm	Neuroderm [®] care ...	S071706.1	34044	40	not required
Infectopharm	Neuroderm [®] moist...	S041214.1	30722	40	not required
Infectopharm	Neuroderm [®] moist...	S021307.1	31102	40	not required
Infectopharm	Neuroderm [®] moist...	S101428.1	31761	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 3470 spectra of 76 reference samples from the substance/substance group *Hydrophilic ointments*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 73 different batches.
- 20 495 spectra from a total of 419 batches from further 135 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 2220 spectra of 56 reference samples from the substance/substance group *Hydrophilic ointments*.
- Among them are spectra of independent samples from 38 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Actavis	Abitima [®] clinic body cream	072013	30736	40
Actavis	Abitima [®] clinic body cream	040116	32999	40
Actavis	Abitima [®] clinic body cream	150818	34363	40
Actavis	Abitima [®] clinic face cream	158584	32179	40
Allergika	Allergika [®] Base cream	09/072022	33670	40
Chiesi	Asche Basis [®] cream	63351A	32928	40
Chiesi	Asche Basis [®] cream	63354A	33435	40
Chiesi	Asche Basis [®] lotion	53075A	32715	40
Taoasis	Base cream Taoasis	161124-6322	32944	40
P&M Cosmetics	Dermatest base ointment	120911	30737	40
P&M Cosmetics	Dermatest base ointment	070615	31053	20
P&M Cosmetics	Dermatest base ointment	231115	31288	40
P&M Cosmetics	Dermatest base ointment	260820	34032	40
Sanofi aventis	Dermatop [®] base cream	5F057A	32717	40
Sanofi aventis	Dermatop [®] base cream	7F069A	33966	40
Koko	DMS [®] base cream classic	L003E16	32788	40
Koko	DMS [®] base cream high classic	L037K16	33433	40
Koko	DMS [®] base cream high classic...	L018D16	32827	40
Beiersdorf	Eucerinum W/O basis	72630108WA	33629	40
Spirig Pharma	Excipial [®] hydro cream	50235	33982	40
Galderma Laboratorium G...	Excipial [®] U Lipolotio	V011	33298	40
Spirig Pharma	Excipial [®] U Lipolotio	T122	33204	40
Spirig Pharma	Excipial [®] U10 Lipolotio	T072	33205	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Spirig Pharma	Excipial [®] U10 Lipolotio	50393	33980	40
Fontapharm	Fabitop [®] base cream	GRWW1	30835	40
Fontapharm	Fabitop [®] base cream	GLWD4	33869	40
Hans Karrer GmbH	Hans Karrer Lipocream MicroS...	17001	33196	40
Hans Karrer GmbH	Hans Karrer Lipocream MicroS...	16002	33197	40
Hans Karrer GmbH	Hans Karrer Lipolotion Micro...	16005	32753	40
Hans Karrer GmbH	Hans Karrer Lipolotion Micro...	18004	34118	40
Dr. Wolff	Linola [®] body milk	606430	32765	40
Dr. Wolff	Linola [®] body milk	609202	33258	40
Spirig Pharma	Lipoderm [®] lotion	V012	33248	40
Spirig Pharma	Lipoderm [®] lotion	V042	33985	40
Jenapharm	Neribas [®] cream	YY01FX3	33289	40
Jenapharm	Neribas [®] cream	YY01X64	33951	40
Infectopharm	Neuroderm [®] care lotion	S111514.1	32740	40
Infectopharm	Neuroderm [®] care lotion	S081610.1	33286	40
Infectopharm	Neuroderm [®] moisturising cream	S051612.1	32905	40
Actavis	Abitima [®] clinic body cream	040116	33791	40
Actavis	Abitima [®] clinic face cream	158584	32723	40
Actavis	Abitima [®] clinic face cream	158584	32998	40
Chiesi	Asche Basis [®] lotion	53075A	32926	40
Taoasis	Base cream Taoasis	161124-6322	32945	40
Koko	DMS [®] base cream classic	L003E16	32826	40
Koko	DMS [®] base cream high classic	L003H16	32789	40
Koko	DMS [®] base cream high classic	L037K16	33434	40
Beiersdorf	Eucerinum O/W basis	64030208WA	33212	40
Beiersdorf	Eucerinum O/W basis	64030208WA	33850	40
Beiersdorf	Eucerinum W/O basis	72630108WA	33922	40
Spirig Pharma	Excipial [®] hydro cream	I013	30836	40
Spirig Pharma	Excipial [®] hydro cream	N013	31277	40
Galderma Laboratorium G...	Excipial [®] lipo cream	V051	33637	40
Spirig Pharma	Excipial [®] lipo cream	N017	31276	40
Galderma Laboratorium G...	Excipial [®] U Lipolotio	T122	33269	40
Infectopharm	Neuroderm [®] moisturising cream	S051612.1	32906	40

- 18 241 spectra from a total of 392 batches from further 179 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 1521 spectra from 210 *Apo-Ident* customers from 722 batches from the substance/substance group *Hydrophilic ointments*.
- Among them are spectra of independent samples from 650 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
A.H.D.	Abitima [®] clinic body cream	260515	2
Abitima	Abitima [®] clinic body cream	52015/051112	1
actavis	Abitima [®] clinic body cream	20912	2
actavis	Abitima [®] clinic body cream	60513	2
actavis	Abitima [®] clinic body cream	140113	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
actavis	Abitima [®] clinic body cream	70513	1
actavis	Abitima [®] clinic body cream	110517	1
Actavis	Abitima [®] clinic body cream	20912	1
Actavis	Abitima [®] clinic body cream	31114	2
Actavis	Abitima [®] clinic body cream	10915	4
Actavis	Abitima [®] clinic body cream	31015	2
Actavis	Abitima [®] clinic body cream	32018	1
Actavis / Gehe	Abitima [®] clinic body cream	110712	1
Actavis Deutschland GmbH	Abitima [®] clinic body cream	350313	2
Actavis Deutschland GmbH	Abitima [®] clinic body cream	31015	1
Actavis Deutschland GmbH	Abitima [®] clinic body cream	121115	1
Actavis Group PTC	Abitima [®] clinic body cream	260515	1
Actavis/ Gehe	Abitima [®] clinic body cream	60513	1
actavis/ebert	Abitima [®] clinic body cream	110712	1
actavis/Gehe	Abitima [®] clinic body cream	112015	1
actavis/Gehe	Abitima [®] clinic body cream	110712	2
actavis/Gehe	Abitima [®] clinic body cream	60513	1
Actavis/Gehe	Abitima [®] clinic body cream	51112	1
Actavis/Gehe	Abitima [®] clinic body cream	81013	1
Actavis/Noweda	Abitima [®] clinic body cream	21015	1
Actavis/Sanacorp	Abitima [®] clinic body cream	110712	1
APL swift Service/AHD	Abitima [®] clinic body cream	251118	1
APL swift Service/Sanac...	Abitima [®] clinic body cream	90118	1
Astellas Pharma	Abitima [®] clinic body cream	190213	1
Balkanpharma	Abitima [®] clinic body cream	90118	2
Caelo	Abitima [®] clinic body cream	40116	1
GEHE	Abitima [®] clinic body cream	100116	2
GEHE	Abitima [®] clinic body cream	331017	2
Puren Ph./Gehe	Abitima [®] clinic body cream	131118	1
Puren Pharma GmbH	Abitima [®] clinic body cream	131118	2
Puren Pharma GmbH	Abitima [®] clinic body cream	13118	1
Puren Pharma/Noweda	Abitima [®] clinic body cream	90118	1
Roche/AHD	Abitima [®] clinic body cream	142620	1
Sanacorp	Abitima [®] clinic body cream	210612	1
Sanacorp	Abitima [®] clinic body cream	70512	1
Sanacorp	Abitima [®] clinic body cream	51112	1
Sanacorp	Abitima [®] clinic body cream	12015/110/12	1
Sanacorp	Abitima [®] clinic body cream	140113	1
actavis	Abitima [®] clinic face cream	148496	2
actavis	Abitima [®] clinic face cream	148495	1
actavis	Abitima [®] clinic face cream	150202	1
actavis	Abitima [®] clinic face cream	150203	2
Actavis	Abitima [®] clinic face cream	160670	1
Actavis / Anzag	Abitima [®] clinic face cream	148024	1
Actavis / Anzag	Abitima [®] clinic face cream	148503	1
Actavis / Anzag	Abitima [®] clinic face cream	150237	1
Actavis / Gehe	Abitima [®] clinic face cream	161904	3
Actavis / Noweda	Abitima [®] clinic face cream	142371	1
actavis group	Abitima [®] clinic face cream	161468	1
Actavis/Gehe	Abitima [®] clinic face cream	148495	1
Actavis/GEHE	Abitima [®] clinic face cream	148051	1
Actavis/Noweda	Abitima [®] clinic face cream	161423	1
actavis/Phönix	Abitima [®] clinic face cream	164225	1
Actavis/Phönix	Abitima [®] clinic face cream	159274	2
Actavis/Phönix	Abitima [®] clinic face cream	164225	1
Caelo	Abitima [®] clinic face cream	146735	1
Caelo	Abitima [®] clinic face cream	149666	2
Caelo	Abitima [®] clinic face cream	161468	2
Caelo	Abitima [®] clinic face cream	170180	1
Fagron	Abitima [®] clinic face cream	150204	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Noweda	Abitima [®] clinic face cream	146735	1
Persano/Gehe	Abitima [®] clinic face cream	57792	1
Phoenix/actavis	Abitima [®] clinic face cream	148460	1
Puren Pharma	Abitima [®] clinic face cream	169357	1
All.Heal./Chiesi	Asche Basis [®] cream	24218A	1
Alliance Healthcare	Asche Basis [®] cream	33237A	1
Alliance Healthcare	Asche Basis [®] cream	33240A	1
Anzag	Asche Basis [®] cream	23204A	1
Anzag/ Chiesi	Asche Basis [®] cream	42269A	1
Anzag/ Chiesi GmbH	Asche Basis [®] cream	42272A	1
Anzag/ Chiesi GmbH	Asche Basis [®] cream	42273A	1
Caelo	Asche Basis [®] cream	41265B	1
Caelo	Asche Basis [®] cream	52323a	1
Caelo	Asche Basis [®] cream	53331A	1
Caelo	Asche Basis [®] cream	61341A	2
Caelo	Asche Basis [®] cream	71372A	1
Caelo	Asche Basis [®] cream	74398A	1
Caelo	Asche Basis [®] cream	83411A	2
Caelo	Asche Basis [®] cream	82409A	1
Caelo	Asche Basis [®] cream	61340A	1
Caelo	Asche Basis [®] cream	52306A	3
Caelo	Asche Basis [®] cream	61337A	1
Caelo	Asche Basis [®] cream	31226A	1
Caelo	Asche Basis [®] cream	64364A	1
Caelo	Asche Basis [®] cream	20170829Ma4	1
Caelo	Asche Basis [®] cream	52322A	3
Caelo	Asche Basis [®] cream	53330A	1
Caelo	Asche Basis [®] cream	73386A	2
Caelo	Asche Basis [®] cream	31227A	1
Caelo	Asche Basis [®] cream	64363A	1
Caelo	Asche Basis [®] cream	61338A	1
Caelo	Asche Basis [®] cream	74391A	1
Caelo	Asche Basis [®] cream	81402A	3
Chiese	Asche Basis [®] cream	24221A	1
Chiese	Asche Basis [®] cream	41259A	1
Chiese / Gehe	Asche Basis [®] cream	74392A	1
chiesi	Asche Basis [®] cream	71374A	1
chiesi	Asche Basis [®] cream	82407A	1
chiesi	Asche Basis [®] cream	83413A	1
chiesi	Asche Basis [®] cream	84422A	1
chiesi	Asche Basis [®] cream	84423A	1
Chiesi	Asche Basis [®] cream	23204A	1
Chiesi	Asche Basis [®] cream	24214A	2
Chiesi	Asche Basis [®] cream	24219A	1
Chiesi	Asche Basis [®] cream	23206A	1
Chiesi	Asche Basis [®] cream	31227A	2
Chiesi	Asche Basis [®] cream	14178A	1
Chiesi	Asche Basis [®] cream	32236A	1
Chiesi	Asche Basis [®] cream	32235A	1
Chiesi	Asche Basis [®] cream	32233A	4
Chiesi	Asche Basis [®] cream	31232A	1
Chiesi	Asche Basis [®] cream	24217A	1
Chiesi	Asche Basis [®] cream	33237A	1
Chiesi	Asche Basis [®] cream	33240A	1
Chiesi	Asche Basis [®] cream	33243A	1
Chiesi	Asche Basis [®] cream	34249A	1
Chiesi	Asche Basis [®] cream	34251A	3
Chiesi	Asche Basis [®] cream	34250A	1
Chiesi	Asche Basis [®] cream	34248A	1
Chiesi	Asche Basis [®] cream	41258A	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi	Asche Basis [®] cream	33239A	2
Chiesi	Asche Basis [®] cream	41261A	1
Chiesi	Asche Basis [®] cream	41260A	2
Chiesi	Asche Basis [®] cream	42270A	1
Chiesi	Asche Basis [®] cream	42272A	1
Chiesi	Asche Basis [®] cream	30102014A	1
Chiesi	Asche Basis [®] cream	42271A	2
Chiesi	Asche Basis [®] cream	43280A	1
Chiesi	Asche Basis [®] cream	42275A	1
Chiesi	Asche Basis [®] cream	43278A	1
Chiesi	Asche Basis [®] cream	43279A	1
Chiesi	Asche Basis [®] cream	43287A	1
Chiesi	Asche Basis [®] cream	51300A	4
Chiesi	Asche Basis [®] cream	51294A	1
Chiesi	Asche Basis [®] cream	51296A	2
Chiesi	Asche Basis [®] cream	51305A	2
Chiesi	Asche Basis [®] cream	52307A	2
Chiesi	Asche Basis [®] cream	52308A	3
Chiesi	Asche Basis [®] cream	52309A	1
Chiesi	Asche Basis [®] cream	52322A	1
Chiesi	Asche Basis [®] cream	53331A	2
Chiesi	Asche Basis [®] cream	53326A	1
Chiesi	Asche Basis [®] cream	52310A	2
Chiesi	Asche Basis [®] cream	53330A	1
Chiesi	Asche Basis [®] cream	54332A	2
Chiesi	Asche Basis [®] cream	61338A	1
Chiesi	Asche Basis [®] cream	53329A	1
Chiesi	Asche Basis [®] cream	62343A	3
Chiesi	Asche Basis [®] cream	63347A	5
Chiesi	Asche Basis [®] cream	63354A	1
Chiesi	Asche Basis [®] cream	63350A	1
Chiesi	Asche Basis [®] cream	63355A	1
Chiesi	Asche Basis [®] cream	64357A	3
Chiesi	Asche Basis [®] cream	64360A	2
Chiesi	Asche Basis [®] cream	64362A-20170704Ma4	1
Chiesi	Asche Basis [®] cream	71374A	1
Chiesi	Asche Basis [®] cream	71370A	1
Chiesi	Asche Basis [®] cream	72380A	1
Chiesi	Asche Basis [®] cream	72378A	1
Chiesi	Asche Basis [®] cream	72383A	1
Chiesi	Asche Basis [®] cream	73387A	2
Chiesi	Asche Basis [®] cream	74390A	2
Chiesi	Asche Basis [®] cream	74393A	1
Chiesi	Asche Basis [®] cream	74392A	1
Chiesi	Asche Basis [®] cream	74398A	1
Chiesi	Asche Basis [®] cream	81400A	1
Chiesi	Asche Basis [®] cream	1(81404A)	1
Chiesi	Asche Basis [®] cream	81399A	2
Chiesi	Asche Basis [®] cream	81401A	4
Chiesi	Asche Basis [®] cream	81402A	1
Chiesi	Asche Basis [®] cream	83411A	1
Chiesi	Asche Basis [®] cream	84417A	1
Chiesi	Asche Basis [®] cream	84424A	2
Chiesi	Asche Basis [®] cream	83413A	1
CHiesi	Asche Basis [®] cream	41264A	1
chiesi-	Asche Basis [®] cream	71372A20171127Ma13	1
chiesi-	Asche Basis [®] cream	72376A-20180830Ma8	1
Chiesi / Alliance Healt...	Asche Basis [®] cream	82410A	1
Chiesi / Gehe	Asche Basis [®] cream	33244A	1
Chiesi / Gehe	Asche Basis [®] cream	34252A	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi / Gehe	Asche Basis [®] cream	41265A	1
Chiesi / Gehe	Asche Basis [®] cream	43281A	1
Chiesi / Gehe	Asche Basis [®] cream	51292A	1
Chiesi / Gehe	Asche Basis [®] cream	42273A	1
Chiesi / Gehe	Asche Basis [®] cream	52314A	1
chiesi / Noweda	Asche Basis [®] cream	23213A	1
chiesi / Noweda	Asche Basis [®] cream	31222A	1
chiesi / Noweda	Asche Basis [®] cream	31225A	1
chiesi / Noweda	Asche Basis [®] cream	34250A	1
Chiesi / Noweda	Asche Basis [®] cream	33238A	1
Chiesi / Noweda	Asche Basis [®] cream	33246A	1
Chiesi / Phoenix	Asche Basis [®] cream	51300A	1
Chiesi / Phoenix	Asche Basis [®] cream	52323A	2
Chiesi / Phoenix WE: 06...	Asche Basis [®] cream	53325A	1
chiesi /Jenne	Asche Basis [®] cream	31227a	1
chiesi gmbh	Asche Basis [®] cream	72380A	1
chiesi gmbh	Asche Basis [®] cream	82410A	1
Chiesi GmbH	Asche Basis [®] cream	24214A	1
Chiesi GmbH	Asche Basis [®] cream	52319A	1
Chiesi GmbH	Asche Basis [®] cream	61335A	1
Chiesi GmbH	Asche Basis [®] cream	72379A	1
Chiesi GmbH	Asche Basis [®] cream	74394A	1
Chiesi GmbH	Asche Basis [®] cream	81402A	1
Chiesi GmbH	Asche Basis [®] cream	82407A	1
Chiesi GmbH	Asche Basis [®] cream	91426A	1
Chiesi GmbH	Asche Basis [®] cream	84419A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	31222A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	22196A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	31230A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	31229A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	31231A	2
Chiesi GmbH / Anzag	Asche Basis [®] cream	33244A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	34249A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	41260A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	41261A	1
Chiesi GmbH / Anzag	Asche Basis [®] cream	42268A	2
Chiesi GmbH / Anzag	Asche Basis [®] cream	74394A	1
Chiesi GmbH / Sanacorp	Asche Basis [®] cream	34247A	1
Chiesi GmbH/ Alliance H...	Asche Basis [®] cream	83415A	1
Chiesi Sanacorp	Asche Basis [®] cream	81404A	1
Chiesi/	Asche Basis [®] cream	41266A	1
Chiesi/ Fiebig	Asche Basis [®] cream	63356A	1
Chiesi/ Fiebig	Asche Basis [®] cream	64363A	2
Chiesi/ Fiebig	Asche Basis [®] cream	72376A	2
Chiesi/ Fiebig	Asche Basis [®] cream	74392A	1
Chiesi/ Now	Asche Basis [®] cream	33240A	1
Chiesi/ Now	Asche Basis [®] cream	41259A	1
Chiesi/ Now	Asche Basis [®] cream	42273A	1
Chiesi/ Now	Asche Basis [®] cream	43283A	2
Chiesi/ Now	Asche Basis [®] cream	43282A	1
Chiesi/ Noweda	Asche Basis [®] cream	51294a	1
Chiesi/ Noweda	Asche Basis [®] cream	52307A	1
Chiesi/ Noweda	Asche Basis [®] cream	170420AB/63353A	1
Chiesi/ Noweda	Asche Basis [®] cream	170601ABC/64357A	1
Chiesi/ Noweda	Asche Basis [®] cream	170628ABC/64362A	1
Chiesi/ Noweda	Asche Basis [®] cream	170706ABC/64361A	1
Chiesi/ Noweda	Asche Basis [®] cream	170816AB/64364A	1
Chiesi/ Noweda	Asche Basis [®] cream	170927AB/71370A	1
Chiesi/ Noweda	Asche Basis [®] cream	171025AB/71371A	1
Chiesi/ Noweda	Asche Basis [®] cream	71371A	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi/ Noweda	Asche Basis [®] cream	171215ABC/72376A	1
Chiesi/ Noweda	Asche Basis [®] cream	171228ABC/72376A	1
Chiesi/ Noweda	Asche Basis [®] cream	180219AB/72379A	1
Chiesi/ Noweda	Asche Basis [®] cream	73389A	1
Chiesi/ phoenix	Asche Basis [®] cream	33239A	1
Chiesi/ /Phönix	Asche Basis [®] cream	63354A	1
Chiesi/ AHD	Asche Basis [®] cream	31222A	1
Chiesi/ AHD	Asche Basis [®] cream	31223A	1
Chiesi/ AHD	Asche Basis [®] cream	31224A	1
Chiesi/ AHD	Asche Basis [®] cream	31228A	2
Chiesi/ AHD	Asche Basis [®] cream	32234A	1
Chiesi/ AHD	Asche Basis [®] cream	32235A	1
Chiesi/ AHD	Asche Basis [®] cream	33238A	1
Chiesi/ AHD	Asche Basis [®] cream	33242A	1
Chiesi/ AHD	Asche Basis [®] cream	34247A	1
Chiesi/ AHD	Asche Basis [®] cream	81404A	1
Chiesi/ Alliance Healthc...	Asche Basis [®] cream	44290A	4
Chiesi/ Alliance Healthc...	Asche Basis [®] cream	52323A	4
Chiesi/ Alliance Healthc...	Asche Basis [®] cream	53329A	1
Chiesi/ Anzag	Asche Basis [®] cream	24221A	1
Chiesi/ Anzag	Asche Basis [®] cream	53327A	1
Chiesi/ Ebert	Asche Basis [®] cream	31224A	1
Chiesi/ Fiebig	Asche Basis [®] cream	74396A	1
Chiesi/ Fiebig	Asche Basis [®] cream	81400A	2
chiesi/ gehe	Asche Basis [®] cream	31228A	1
chiesi/ gehe	Asche Basis [®] cream	32236A	1
chiesi/ gehe	Asche Basis [®] cream	33246A	2
Chiesi/ Gehe	Asche Basis [®] cream	24221A	4
Chiesi/ Gehe	Asche Basis [®] cream	24218A	1
Chiesi/ Gehe	Asche Basis [®] cream	31224A	1
Chiesi/ Gehe	Asche Basis [®] cream	32233A	1
Chiesi/ Gehe	Asche Basis [®] cream	34248A	1
Chiesi/ Gehe	Asche Basis [®] cream	34253A	1
Chiesi/ Gehe	Asche Basis [®] cream	41262A	1
Chiesi/ Gehe	Asche Basis [®] cream	41260A	1
Chiesi/ Gehe	Asche Basis [®] cream	42271A	1
Chiesi/ Gehe	Asche Basis [®] cream	51301A	1
Chiesi/ Gehe	Asche Basis [®] cream	52307A	1
Chiesi/ Gehe	Asche Basis [®] cream	63350A	1
Chiesi/ Gehe	Asche Basis [®] cream	71371A	1
Chiesi/ Gehe	Asche Basis [®] cream	72379A	1
Chiesi/ Gehe	Asche Basis [®] cream	72381A	2
Chiesi/ Gehe	Asche Basis [®] cream	73388A	1
Chiesi/ Gehe	Asche Basis [®] cream	74390A	1
Chiesi/ Gehe	Asche Basis [®] cream	81400A	1
Chiesi/ Gehe	Asche Basis [®] cream	81401A	1
Chiesi/ Gehe	Asche Basis [®] cream	81402A	1
Chiesi/ Gehe	Asche Basis [®] cream	82408A	2
Chiesi/ Gehe	Asche Basis [®] cream	82409A	2
Chiesi/ Gehe	Asche Basis [®] cream	84420A	1
Chiesi/ Gehe	Asche Basis [®] cream	83413A	1
Chiesi/ Gehe	Asche Basis [®] cream	941426A	1
Chiesi/ Gehe	Asche Basis [®] cream	91426A	2
Chiesi/ Gehe	Asche Basis [®] cream	91429A	1
Chiesi/ Gehe	Asche Basis [®] cream	91430A	2
Chiesi/ Insel	Asche Basis [®] cream	74391A	1
Chiesi/ Noweda	Asche Basis [®] cream	31224A	1
Chiesi/ Noweda	Asche Basis [®] cream	31229A	1
Chiesi/ Noweda	Asche Basis [®] cream	31232A	1
Chiesi/ Noweda	Asche Basis [®] cream	33237A	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi/Noweda	Asche Basis [®] cream	34247A	1
Chiesi/Noweda	Asche Basis [®] cream	41258A	1
Chiesi/Noweda	Asche Basis [®] cream	42275A	1
Chiesi/Noweda	Asche Basis [®] cream	43280A	1
Chiesi/Noweda	Asche Basis [®] cream	44288A	1
Chiesi/Noweda	Asche Basis [®] cream	52318a	1
Chiesi/Noweda	Asche Basis [®] cream	52318A	1
Chiesi/Noweda	Asche Basis [®] cream	53329A	1
Chiesi/Noweda	Asche Basis [®] cream	170421AB/63353A	1
Chiesi/Noweda	Asche Basis [®] cream	171211AB/72376A	1
Chiesi/Noweda	Asche Basis [®] cream	180112ABC/72378A	1
Chiesi/Noweda	Asche Basis [®] cream	180322AB/72382A	1
Chiesi/Noweda	Asche Basis [®] cream	74394A	1
Chiesi/Phoenix	Asche Basis [®] cream	24215A	1
Chiesi/Phoenix	Asche Basis [®] cream	31227A	2
Chiesi/Phoenix	Asche Basis [®] cream	31225A	1
Chiesi/Phoenix	Asche Basis [®] cream	31229A	1
Chiesi/Phoenix	Asche Basis [®] cream	32233A	1
Chiesi/Phoenix	Asche Basis [®] cream	43278A	1
Chiesi/Phoenix	Asche Basis [®] cream	71368A	1
Chiesi/Phoenix	Asche Basis [®] cream	72377A	1
Chiesi/Phoenix	Asche Basis [®] cream	72383A	1
Chiesi/Phoenix	Asche Basis [®] cream	74394A	1
Chiesi/Phönix	Asche Basis [®] cream	53329A	1
Chiesi/Phönix	Asche Basis [®] cream	72385A	1
Chiesi/Phönix	Asche Basis [®] cream	81400A	1
Chiesi/Phönix	Asche Basis [®] cream	81401A	2
Chiesi/Phönix	Asche Basis [®] cream	83416A	1
Chiesi/Phönix	Asche Basis [®] cream	92435A	1
Chiesi/Phönix WE:19.05....	Asche Basis [®] cream	64357A	1
Chiesi/Phönix WE:20.06....	Asche Basis [®] cream	64362A	2
Chiesi/Phönix WE:27.05....	Asche Basis [®] cream	52309A	1
Chiesi/Sanacorp	Asche Basis [®] cream	31227A	1
Chiesi/Sanacorp	Asche Basis [®] cream	51305A	3
Chiesi/Sanacorp	Asche Basis [®] cream	74394A	1
Chiesi/Sanacorp	Asche Basis [®] cream	84418A	1
Chiesi/Sanacorp WE:06.0. . .	Asche Basis [®] cream	52317A	1
Chiesi/V.d.L.	Asche Basis [®] cream	34250A	1
Chiesi-Fa.Gehe	Asche Basis [®] cream	71372A	1
Chiesi-Fa.Gehe	Asche Basis [®] cream	81401A-A20190115Ma11	1
Chiesi-Fa.Gehe 19.6.18	Asche Basis [®] cream	74391A-20180830Ma7	1
Chisi	Asche Basis [®] cream	23203A	1
Chisie/ Jenne	Asche Basis [®] cream	91431A	1
Euro OTC	Asche Basis [®] cream	3229A	1
Euro OTC	Asche Basis [®] cream	61337A	2
Fa.Gehe	Asche Basis [®] cream	20160727Ma4	1
Fagron	Asche Basis [®] cream	63353A	1
Fiebig	Asche Basis [®] cream	83413A	3
Fiebig	Asche Basis [®] cream	84421A	1
Fiebig	Asche Basis [®] cream	84420A	1
Fiebig	Asche Basis [®] cream	91428A	2
Gehe	Asche Basis [®] cream	32236A	1
Gehe	Asche Basis [®] cream	33244A	1
Gehe	Asche Basis [®] cream	64358A	2
Gehe	Asche Basis [®] cream	64360A	1
GEHE	Asche Basis [®] cream	73387A	2
GEHE	Asche Basis [®] cream	81399A	1
GEHE	Asche Basis [®] cream	82410A	1
Gehe/Chesie	Asche Basis [®] cream	52318A	2
Gehe/Chiesi	Asche Basis [®] cream	32233A	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Gehe/Chiesi	Asche Basis [®] cream	51296A	1
Gehe-Chiesi	Asche Basis [®] cream	52308A	1
Hedinger	Asche Basis [®] cream	74398A	1
Ichthyol/Sanacorp	Asche Basis [®] cream	24221A	1
Insel	Asche Basis [®] cream	72378A	1
Kremer	Asche Basis [®] cream	71367A	3
Lamotte / Gehe	Asche Basis [®] cream	34247A	1
noweda/chiesi	Asche Basis [®] cream	52306A	1
Phoenix	Asche Basis [®] cream	53331A	1
Phoenix	Asche Basis [®] cream	54332A	1
Phoenix WE 13.04.17 -7,...	Asche Basis [®] cream	63353A	2
Phoenix WE: 08.11.17 10...	Asche Basis [®] cream	71372A	1
Phoenix WE: 09.10.17 50...	Asche Basis [®] cream	71368A	1
Phoenix/Chiesi	Asche Basis [®] cream	33246A	1
Phoenix/Chiesi	Asche Basis [®] cream	61333A	1
Phoenix/Chiesi	Asche Basis [®] cream	64358A	1
Phönix	Asche Basis [®] cream	32234A	1
PHÖNIX	Asche Basis [®] cream	62343A	1
PHÖNIX	Asche Basis [®] cream	73386A	1
phönix WE: 28.08.17 EK...	Asche Basis [®] cream	64365A	2
PhönixWE:3.02.2017 EK...	Asche Basis [®] cream	63350A	1
Sanacoro W.E:01.03.18 ...	Asche Basis [®] cream	72379A	2
Sanacoro W.E:01.03.18 ...	Asche Basis [®] cream	72378A	1
SANACORP	Asche Basis [®] cream	84417A	2
SANACORP	Asche Basis [®] cream	92435A	1
Sanacorp /100ml	Asche Basis [®] cream	72382A	2
Sanacorp EK:8,07 EUR...	Asche Basis [®] cream	64363A	1
Sanacorp EK:8,07 EUR...	Asche Basis [®] cream	64364A	1
Sanacorp W.E: 02.02.18 ...	Asche Basis [®] cream	72377A	1
Sanacorp WE 20.02.17 -7...	Asche Basis [®] cream	63351A	3
WE Sanacorp	Asche Basis [®] cream	61341A	1
WE: Phoenix 07.10.2016 ...	Asche Basis [®] cream	61340A	1
WE: Phoenix 23.09.2016 ...	Asche Basis [®] cream	61339A	1
WE:Phönix28.07.2016 E...	Asche Basis [®] cream	61336A	1
Wolff/Gehe	Asche Basis [®] cream	64365A-20171106Ma10	1
Wolff/Gehe	Asche Basis [®] cream	71366A	1
Caelo	Asche Basis [®] lotion	33055A	3
Caelo	Asche Basis [®] lotion	32054A	1
Caelo	Asche Basis [®] lotion	53072A	1
Caelo	Asche Basis [®] lotion	53073A	1
Caelo	Asche Basis [®] lotion	73089A	1
Chiese	Asche Basis [®] lotion	41060A	1
chiesi	Asche Basis [®] lotion	84095A	1
Chiesi	Asche Basis [®] lotion	333056A	2
Chiesi	Asche Basis [®] lotion	32054A	1
Chiesi	Asche Basis [®] lotion	41059A	1
Chiesi	Asche Basis [®] lotion	43066A	1
Chiesi	Asche Basis [®] lotion	53072A	1
Chiesi	Asche Basis [®] lotion	53075A	2
Chiesi	Asche Basis [®] lotion	53073A	1
Chiesi	Asche Basis [®] lotion	61077A	1
Chiesi	Asche Basis [®] lotion	75085A	1
Chiesi	Asche Basis [®] lotion	73088A	2
Chiesi	Asche Basis [®] lotion	82094A	1
Chiesi GmbH	Asche Basis [®] lotion	53071A	3
Chiesi GmbH	Asche Basis [®] lotion	53072A	2
Chiesi GmbH	Asche Basis [®] lotion	53074A	1
Chiesi GmbH	Asche Basis [®] lotion	61076A	2
Chiesi GmbH	Asche Basis [®] lotion	63078A	2
Chiesi GmbH	Asche Basis [®] lotion	63079A	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi GmbH	Asche Basis [®] lotion	63980A	1
Chiesi GmbH	Asche Basis [®] lotion	73087A	1
Chiesi GmbH / Phönix	Asche Basis [®] lotion	51067A	1
Chiesi GmbH/Gehe	Asche Basis [®] lotion	53072A	1
Chiesi/ Fiebig	Asche Basis [®] lotion	63980A	1
Chiesi/ Phönix	Asche Basis [®] lotion	43066A	1
Chiesi/AHD	Asche Basis [®] lotion	24049A	1
Chiesi/E+J	Asche Basis [®] lotion	64082A	1
Chiesi/Fa.Gehe	Asche Basis [®] lotion	53075A	1
Chiesi/Fiebig	Asche Basis [®] lotion	53073A	2
Chiesi/Fiebig	Asche Basis [®] lotion	53074A	1
Chiesi/Fiebig	Asche Basis [®] lotion	63980A	1
chiesi/gehe	Asche Basis [®] lotion	33056A	2
chiesi/gehe	Asche Basis [®] lotion	34058A	1
Chiesi/Gehe	Asche Basis [®] lotion	23047A	1
Chiesi/Noweda	Asche Basis [®] lotion	61077A	1
Chiesi/Phoenix	Asche Basis [®] lotion	52070A	1
Chiesi/Phoenix	Asche Basis [®] lotion	53071A	1
Chiesi/Phoenix	Asche Basis [®] lotion	64082A	1
Chiesi/Phönix	Asche Basis [®] lotion	53071A	1
Chiesi/Phönix	Asche Basis [®] lotion	53073A	1
Chiesi/Phönix	Asche Basis [®] lotion	63078A	1
Chiesi/Phönix	Asche Basis [®] lotion	63981A	1
Chiesi/Phönix	Asche Basis [®] lotion	73086A	1
Chiesi/Anzag	Asche Basis [®] lotion	32054A	1
Chiesi-Fa.Gehe	Asche Basis [®] lotion	64082A-20180112Ma3	1
Chiesi-Fa.Gehe	Asche Basis [®] lotion	73086A-20180206Ma8	1
Chiesi-Fa.Gehe	Asche Basis [®] lotion	73087A-20180206Ma9	1
Chiesi-Fa.Gehe	Asche Basis [®] lotion	82093A-A20181115Ma1	1
Chiesi-Fa.Gehe 19.7.18	Asche Basis [®] lotion	74090A-20180830Ma10	1
Fa.Gehe	Asche Basis [®] lotion	20160727Ma5	1
Fiebig	Asche Basis [®] lotion	91097A	1
Caelo	Asche Basis [®] lotion	63078A	1
Fiebig/Chiesi	Asche Basis [®] lotion	71083A	1
Fiebig/Chiesi	Asche Basis [®] lotion	71084A	3
Fiebig/Chiesi	Asche Basis [®] lotion	73087A	2
Fiebig/Chiesi	Asche Basis [®] lotion	84095A	1
Gehe Chiesi	Asche Basis [®] lotion	53075A-20160615Ma5	1
gehe/Chiesi	Asche Basis [®] lotion	43066A	1
Gehe20.10.15	Asche Basis [®] lotion	52070A	1
Noweda	Asche Basis [®] lotion	63980A	1
Phoenix	Asche Basis [®] lotion	52069A	1
PHÖNIX	Asche Basis [®] lotion	91098A	1
/Sanacorp	Base cream Taoasis	180718-7100	4
Bombastus	Base cream Taoasis	180307	1
Caelo	Base cream Taoasis	171127-7290	1
Caelo	Base cream Taoasis	170110-6322	1
Taoasis	Base cream Taoasis	150219-4350	1
Taoasis	Base cream Taoasis	150326-5079	1
Taoasis	Base cream Taoasis	160201-6027	1
Taoasis	Base cream Taoasis	161124-6322	1
Taoasis	Base cream Taoasis	170110-6322	1
Taoasis	Base cream Taoasis	170317-7031	1
Taoasis	Base cream Taoasis	170517-7100	1
Taoasis	Base cream Taoasis	171127-7290	1
Taoasis	Base cream Taoasis	181204-8333	1
Taoasis GmbH/ Taoasis	Base cream Taoasis	190916-9182	1
Taoasis/Sanacorp	Base cream Taoasis	170317-7031	3
Taoasis/Sanacorp	Base cream Taoasis	170517-7100	2
Taoasis/Sanacorp	Base cream Taoasis	1807187100	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis/Sanacorp	Base cream Taoasis	171127-7290	10
Taoasis/Sanacorp	Base cream Taoasis	180924-8114	1
Taoasis/Sanacorp	Base cream Taoasis	180515-8030	1
Caelo	Dermatest base ointment	121217	1
Leyh GmbH	Dermatest base ointment	121217	1
P&M	Dermatest base ointment	241115	1
P&M Cosmetics	Dermatest base ointment	210915	1
P&M Cosmetics/Alliance ...	Dermatest base ointment	152241	1
P&M Cosmetics/Anzag	Dermatest base ointment	122631	1
p&m cosmetics/gehe	Dermatest base ointment	200419	1
Sanacorp	Dermatest base ointment	70615	1
Klindwort Apotheke Rath. ...	Dermatop [®] base cream	8F075A	1
Sanofi	Dermatop [®] base cream	4F046A	1
Sanofi / Gehe	Dermatop [®] base cream	4F046A	1
Sanofi Aventis	Dermatop [®] base cream	4F046A	1
Sanofi/Anzag	Dermatop [®] base cream	5F051A	1
Sanofi/Anzag	Dermatop [®] base cream	5F056A	1
Sanofi/Gehe	Dermatop [®] base cream	4F050A	1
Sanofi/Noweda	Dermatop [®] base cream	5F056A	1
Sanofi/Phönix	Dermatop [®] base cream	5F051A	1
KOKO GmbH	DMS [®] base cream classic	L005A14	1
KOKO GmbH	DMS [®] base cream classic	L003E16	1
KOKO GmbH & Co KG	DMS [®] base cream classic	L062H18	6
KOKO GmbH & Co KG	DMS [®] base cream classic	L036I18	2
KOKO GmbH & Co KG	DMS [®] base cream classic	L036118	2
KOKO GmbH & Co KG	DMS [®] base cream classic	L036118	1
koko GmbH EK: EUR 38,30 /...	DMS [®] base cream classic	L008F17	1
Koko GmbH&Co KG	DMS [®] base cream classic	L038J16	1
Caelo	DMS [®] base cream high classic	L010J15	1
Caelo	DMS [®] base cream high classic	L047117	4
KOKO	DMS [®] base cream high classic	L031A14	1
Koko GmbH	DMS [®] base cream high classic	L019H17	1
Koko GmbH	DMS [®] base cream high classic	L033J17	3
Koko GmbH	DMS [®] base cream high classic	L031D18	1
Koko GmbH	DMS [®] base cream high classic	L031A14	1
KOKO GmbH	DMS [®] base cream high classic	L010E17	10
KOKO GmbH	DMS [®] base cream high classic	L019H17	5
KOKO GmbH	DMS [®] base cream high classic	L008K17	5
KOKO GmbH	DMS [®] base cream high classic	L028c18	5
KOKO GmbH	DMS [®] base cream high classic	L042E18	5
KOKO GmbH	DMS [®] base cream high classic	L053f18	3
KOKO GmbH	DMS [®] base cream high classic	L050I18	5
KOKO GmbH	DMS [®] base cream high classic	L030L16	3
KOKO GmbH & Co. KG	DMS [®] base cream high classic	L054B16	1
Koko GmbH	DMS [®] base cream high classic...	L035F17	1
KOKO GmbH & Co. KG	DMS [®] base cream high classic...	L018D16	1
Beiersdorf	Eucerinum O/W basis	24830308WA	1
Beiersdorf	Eucerinum O/W basis	319030108WA	1
Beiersdorf AG	Eucerinum O/W basis	2483030308WA	1
Beiersdorf AG	Eucerinum O/W basis	24830308WA	1
Beiersdorf AG / Allianc...	Eucerinum O/W basis	64030208WA	1
Beiersdorf AG/Noweda	Eucerinum O/W basis	53430208WA	1
Beiersdorf/AHD	Eucerinum O/W basis	51630108WA	1
Beiersdorf/AHD	Eucerinum O/W basis	64030208WA	1
Beiersdorf/Gehe	Eucerinum O/W basis	31930108WA	1
Beiersdorf/Gehe	Eucerinum O/W basis	80230108WA	1
Beiersdorf/Gehe	Eucerinum O/W basis	84030208WA	1
Beiersdorf/kehr	Eucerinum O/W basis	72630108WA	1
Beiersdorf/Kehr	Eucerinum O/W basis	53430208WA	3
Beiersdorf/Kehr	Eucerinum O/W basis	61130108WA	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Beiersdorf/VDL	Eucerinum O/W basis	64030208WA	1
Caelo	Eucerinum O/W basis	31930108WA	1
Caelo	Eucerinum O/W basis	64030208WA	1
Caelo	Eucerinum O/W basis	13730308WA	1
Allianz Healthcare	Eucerinum W/O basis	64030108wa	1
Caelo	Eucerinum W/O basis	53430208WA	4
Baiersdorf	Eucerinum W/O basis	24830208WA	1
Baiersdorf	Eucerinum W/O basis	41839108WA	1
Baiersdorf	Eucerinum W/O basis	43430208WA	1
BDF	Eucerinum W/O basis	31230108WA	1
BDF	Eucerinum W/O basis	41830108WA	1
BDF / Noweda	Eucerinum W/O basis	43430208WA	1
BDF / Sanacorp	Eucerinum W/O basis	21430108WA	1
Beiersdor	Eucerinum W/O basis	541830108WA	1
beiersdorf	Eucerinum W/O basis	31230108WA	1
beiersdorf	Eucerinum W/O basis	24830208WA	1
Beiersdorf	Eucerinum W/O basis	21430108WA	2
Beiersdorf	Eucerinum W/O basis	24830208WA	1
Beiersdorf	Eucerinum W/O basis	32930208WA	4
Beiersdorf	Eucerinum W/O basis	31230108wa	1
Beiersdorf	Eucerinum W/O basis	34930308WA	5
Beiersdorf	Eucerinum W/O basis	51630108WA	8
Beiersdorf	Eucerinum W/O basis	24072015A	1
Beiersdorf	Eucerinum W/O basis	516301328wa	1
Beiersdorf	Eucerinum W/O basis	64030108WA	2
Beiersdorf	Eucerinum W/O basis	72630108WA	6
Beiersdorf	Eucerinum W/O basis	80330108WA	1
Beiersdorf / Alliance h...	Eucerinum W/O basis	72630108WA	1
Beiersdorf / Phoenix	Eucerinum W/O basis	80330108WA	1
Beiersdorf / Phönix	Eucerinum W/O basis	53430208WA	1
Beiersdorf /AHC	Eucerinum W/O basis	83730208WA	1
Beiersdorf AG	Eucerinum W/O basis	32930208WA	3
Beiersdorf AG	Eucerinum W/O basis	34930308WA	1
Beiersdorf AG	Eucerinum W/O basis	41830108WA	1
Beiersdorf AG	Eucerinum W/O basis	51630108WA	3
Beiersdorf AG	Eucerinum W/O basis	80330108WA	1
Beiersdorf AG	Eucerinum W/O basis	3730208WA	1
Beiersdorf AG/Noweda	Eucerinum W/O basis	31230108WA	1
Beiersdorf/ Phoenix	Eucerinum W/O basis	64030108WA	1
Beiersdorf/ Sanacorp	Eucerinum W/O basis	418301087WA	1
Beiersdorf/ Vedono	Eucerinum W/O basis	34930308WA	1
Beiersdorf/Alliance	Eucerinum W/O basis	72630108WA	1
Beiersdorf/Alliance Hea...	Eucerinum W/O basis	72630108WA	1
Beiersdorf/Anzag	Eucerinum W/O basis	31230108WA	1
Beiersdorf/Gehe	Eucerinum W/O basis	43430208WA	1
Beiersdorf/Gehe	Eucerinum W/O basis	83730308WA	1
Beiersdorf/Kehr	Eucerinum W/O basis	64030108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	34930308WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	41830108Wa	1
Beiersdorf/Noweda	Eucerinum W/O basis	41830108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	51630108WA	4
Beiersdorf/Noweda	Eucerinum W/O basis	51630108wa	1
Beiersdorf/Noweda	Eucerinum W/O basis	53430208WA	5
Beiersdorf/Noweda	Eucerinum W/O basis	64030108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	72630108VVA	1
Beiersdorf/Noweda	Eucerinum W/O basis	72630108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	726300108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	80330108WA	1
Beiersdorf/Noweda	Eucerinum W/O basis	83730208WA	1
Beiersdorf/Phoenix	Eucerinum W/O basis	34930308WA	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Beiersdorf/Phönix	Eucerinum W/O basis	53430208WA	1
Beiersdorf/Phönix	Eucerinum W/O basis	80330108WA	2
Beiersdorf/Sanacorp	Eucerinum W/O basis	31230108WA	1
BeiersdorfPhoenix	Eucerinum W/O basis	31230108WA	1
Caelo	Eucerinum W/O basis	51630108wa	1
Caelo	Eucerinum W/O basis	41830108WA	3
Caelo	Eucerinum W/O basis	21430108WA	1
Caelo	Eucerinum W/O basis	72630108Wa	1
Caelo	Eucerinum W/O basis	51630108WA	1
Caelo	Eucerinum W/O basis	51630108	1
eucerinum	Eucerinum W/O basis	41830108WA	1
Gehe	Eucerinum W/O basis	32930208WA	1
Gehe/Beiersdorf	Eucerinum W/O basis	51630108WA	1
Caelo	Eucerinum W/O basis	64030108WA	2
Ichthyol-Gesellschaft	Eucerinum W/O basis	80330108WA	1
Noweda	Eucerinum W/O basis	72630108WA	4
Noweda/BDF	Eucerinum W/O basis	51630108WA	1
Ph.Eur.8.0	Eucerinum W/O basis	41830108WA	1
Rondell Apotheke	Eucerinum W/O basis	51630108WA	1
Sanacorp/Beiersdorf	Eucerinum W/O basis	80330108WA	1
AHD	Excipial [®] hydro cream	R011	1
Alliance/Spirig	Excipial [®] hydro cream	N043	1
Caelo	Excipial [®] hydro cream	V071	2
Caelo	Excipial [®] hydro cream	R045	1
Chiesi/Phoenix	Excipial [®] hydro cream	LOTV071	1
Fa.Gehe	Excipial [®] hydro cream	20160727Ma3	1
Galderma	Excipial [®] hydro cream	S054	1
Galderma	Excipial [®] hydro cream	T052	1
Galderma	Excipial [®] hydro cream	LOTV051	1
Galderma	Excipial [®] hydro cream	V051	2
Galderma	Excipial [®] hydro cream	LOTV071	1
Galderma	Excipial [®] hydro cream	LOTV072	1
Galderma	Excipial [®] hydro cream	50782	2
Galderma	Excipial [®] hydro cream	50634	2
Galderma	Excipial [®] hydro cream	50564	1
Galderma /Phönix	Excipial [®] hydro cream	LOTT052	2
Galderma/ Gehe	Excipial [®] hydro cream	V051	1
Galderma/ Sana	Excipial [®] hydro cream	S025	1
Galderma/ Sana	Excipial [®] hydro cream	S024	1
Galderma/Alliance Healt...	Excipial [®] hydro cream	S025	1
Galderma/Ebert	Excipial [®] hydro cream	V041	1
Galderma/Galderma	Excipial [®] hydro cream	S024	2
Galderma/Galderma	Excipial [®] hydro cream	so25	1
Galderma/Galderma	Excipial [®] hydro cream	S054	1
Galderma/Galderma	Excipial [®] hydro cream	V051	1
Galderma/Galderma	Excipial [®] hydro cream	V042	1
Galderma/Gehe	Excipial [®] hydro cream	R031	1
Galderma/Gehe	Excipial [®] hydro cream	V042	1
Galderma/Gehe	Excipial [®] hydro cream	V071	1
Galderma/Gehe	Excipial [®] hydro cream	V072	2
Galderma/Gehe	Excipial [®] hydro cream	8767001	1
Galderma/Gehe	Excipial [®] hydro cream	9767001	1
Galderma/Noweda	Excipial [®] hydro cream	S054	2
Galderma/Noweda	Excipial [®] hydro cream	170420EH/LOTT012	1
Galderma/Noweda	Excipial [®] hydro cream	170706EH/LOTT091	1
Galderma/Noweda	Excipial [®] hydro cream	V042	1
Galderma/Noweda	Excipial [®] hydro cream	180319EH/LOTV051	1
Galderma/Phoenix	Excipial [®] hydro cream	V031	1
Galderma/Phönic	Excipial [®] hydro cream	V061	1
Galderma/Phönix	Excipial [®] hydro cream	S045	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Galderma/Phönix	Excipial [®] hydro cream	V011	2
Galderma/Phönix	Excipial [®] hydro cream	50235	1
Galderma/Phönix	Excipial [®] hydro cream	50782	2
Galderma-Spirig	Excipial [®] hydro cream	To52-20171127Ma11	1
Galderma-Spirig	Excipial [®] hydro cream	V041-20180619Ma8	1
Galderma-Spirig	Excipial [®] hydro cream	50235-E20190115Ma10	1
Galderma-Spirig,Gehe 14...	Excipial [®] hydro cream	V061-20180830Ma11	1
Gehe, Galderma Spirig	Excipial [®] hydro cream	R031-20160615Ma7	1
Gladerma/Ebert	Excipial [®] hydro cream	V072	1
Jenne	Excipial [®] hydro cream	S041	1
Noweda	Excipial [®] hydro cream	1120114	1
Noweda	Excipial [®] hydro cream	V051	1
Noweda/Galderma	Excipial [®] hydro cream	T091	2
Phoenix/Galderma	Excipial [®] hydro cream	T012	1
Phoenix/Spirig	Excipial [®] hydro cream	M015	1
Phoenix/Spirig	Excipial [®] hydro cream	N044	1
Phönix/Spirig	Excipial [®] hydro cream	N034	1
Sanacorp	Excipial [®] hydro cream	LOTN011	1
Sanacorp	Excipial [®] hydro cream	N011	1
Spirig Pharma AG/ Anzag	Excipial [®] hydro cream	LOTN034	1
Spirig Pharma AG/ Anzag	Excipial [®] hydro cream	LOTN013	1
Spirig/Gehe	Excipial [®] hydro cream	R014	1
spirig	Excipial [®] hydro cream	M014	2
spirig	Excipial [®] hydro cream	M034	1
spirig	Excipial [®] hydro cream	M041	6
spirig	Excipial [®] hydro cream	813993/10	1
spirig	Excipial [®] hydro cream	N034	2
spirig	Excipial [®] hydro cream	N014	1
spirig	Excipial [®] hydro cream	N043	2
spirig	Excipial [®] hydro cream	R013	2
spirig	Excipial [®] hydro cream	N045	2
spirig	Excipial [®] hydro cream	R014	2
spirig	Excipial [®] hydro cream	s025	1
Spirig	Excipial [®] hydro cream	K013	1
Spirig	Excipial [®] hydro cream	N035	1
Spirig	Excipial [®] hydro cream	N043	1
Spirig	Excipial [®] hydro cream	R013	1
Spirig	Excipial [®] hydro cream	S025	6
Spirig (Galderma)	Excipial [®] hydro cream	T012	2
Spirig (Galderma)	Excipial [®] hydro cream	T011	1
Spirig (Galderma)	Excipial [®] hydro cream	V011	2
Spirig / Anzag	Excipial [®] hydro cream	813993/09	1
Spirig / Anzag	Excipial [®] hydro cream	813993/10	1
Spirig / Anzag	Excipial [®] hydro cream	N034	1
Spirig / Anzag	Excipial [®] hydro cream	LOTN043	1
Spirig / Gehe	Excipial [®] hydro cream	N011	1
Spirig / Noweda	Excipial [®] hydro cream	N035	1
Spirig /Gehe	Excipial [®] hydro cream	LOTN044	1
Spirig Pharma	Excipial [®] hydro cream	N013	1
Spirig Pharma	Excipial [®] hydro cream	813993/10	1
Spirig Pharma	Excipial [®] hydro cream	N011	1
Spirig Pharma	Excipial [®] hydro cream	LON014	1
Spirig Pharma	Excipial [®] hydro cream	N044	1
Spirig Pharma AG	Excipial [®] hydro cream	813993/12	1
Spirig Pharma AG/GEHE	Excipial [®] hydro cream	R011	1
Spirig Pharma/ G	Excipial [®] hydro cream	S053	1
Spirig/Anzag	Excipial [®] hydro cream	LOTM041	1
Spirig/Anzag	Excipial [®] hydro cream	N035	1
Spirig/Fiebig	Excipial [®] hydro cream	N013	1
Spirig/Gehe	Excipial [®] hydro cream	M012	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Spirig/Gehe	Excipial [®] hydro cream	LOTR031	2
Spirig/Noweda	Excipial [®] hydro cream	N043	1
Alliance Healthcare	Excipial [®] lipo cream	M045	1
Anzag/ Chiesi	Excipial [®] lipo cream	LOTR012	2
Caelo	Excipial [®] lipo cream	V112	3
Caelo	Excipial [®] lipo cream	V051	1
Caelo	Excipial [®] lipo cream	9031	1
Caelo	Excipial [®] lipo cream	7121	1
galderma	Excipial [®] lipo cream	LOT50627	1
Galderma	Excipial [®] lipo cream	N061	2
Galderma	Excipial [®] lipo cream	R012	1
Galderma	Excipial [®] lipo cream	R026	2
Galderma	Excipial [®] lipo cream	R042	1
Galderma	Excipial [®] lipo cream	R035	2
Galderma	Excipial [®] lipo cream	L0TS032	1
Galderma	Excipial [®] lipo cream	T021	2
Galderma	Excipial [®] lipo cream	T061	2
Galderma	Excipial [®] lipo cream	v042	1
Galderma	Excipial [®] lipo cream	LOTV041	1
Galderma	Excipial [®] lipo cream	V091	1
Galderma /AHD	Excipial [®] lipo cream	50567	3
Galderma /AHD	Excipial [®] lipo cream	8769004	1
Galderma/ Noweda	Excipial [®] lipo cream	s023	6
Galderma/ Noweda	Excipial [®] lipo cream	S031	9
Galderma/ Noweda	Excipial [®] lipo cream	t022	5
Galderma/ Noweda	Excipial [®] lipo cream	T022	4
Galderma/ Noweda	Excipial [®] lipo cream	T021	5
Galderma/Anzag	Excipial [®] lipo cream	S011	1
Galderma/Galderma	Excipial [®] lipo cream	R026	1
Galderma/Galderma	Excipial [®] lipo cream	ro26	1
Galderma/Galderma	Excipial [®] lipo cream	R042	9
Galderma/Galderma	Excipial [®] lipo cream	S023	8
Galderma/Galderma	Excipial [®] lipo cream	T021	8
Galderma/Galderma	Excipial [®] lipo cream	V121	1
Galderma/Galderma	Excipial [®] lipo cream	50567	1
Galderma/Galderma	Excipial [®] lipo cream	8769004	1
Galderma/Gehe	Excipial [®] lipo cream	R042	2
Galderma/Gehe	Excipial [®] lipo cream	V091	1
Galderma/Noweda	Excipial [®] lipo cream	170420EL/L0TT021	1
Galderma/Noweda	Excipial [®] lipo cream	T021	1
Galderma/Noweda	Excipial [®] lipo cream	171819E/L0TT021	1
Galderma/Noweda	Excipial [®] lipo cream	V051	1
Galderma/Noweda	Excipial [®] lipo cream	180208L/L0TV091	1
Galderma/Noweda	Excipial [®] lipo cream	50567	1
Galderma/Phönix	Excipial [®] lipo cream	R042	1
Galderma/Phönix	Excipial [®] lipo cream	R026	2
Galderma/Phönix	Excipial [®] lipo cream	R012	1
Galderma/Phönix	Excipial [®] lipo cream	S031	1
Galderma/Phönix	Excipial [®] lipo cream	S023	1
Galderma/Phönix	Excipial [®] lipo cream	T021	1
Galderma/Phönix WE: 03...	Excipial [®] lipo cream	L0TV012	1
Galmeda Noweda	Excipial [®] lipo cream	180504EL/L0TV112	1
Gehe	Excipial [®] lipo cream	N061	1
Gehe/Galderma	Excipial [®] lipo cream	L0TS031	1
Noweda/ Galderma	Excipial [®] lipo cream	V112180607EL	1
Caelo	Excipial [®] lipo cream	L0TS023	1
Phönix/Galderma	Excipial [®] lipo cream	S023	1
Sanacorp	Excipial [®] lipo cream	M027	1
Sanacorp	Excipial [®] lipo cream	L0TN016	1
spirig	Excipial [®] lipo cream	M017	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
spirig	Excipial [®] lipo cream	M016	4
spirig	Excipial [®] lipo cream	813994/09	1
spirig	Excipial [®] lipo cream	M042	2
spirig	Excipial [®] lipo cream	N018	4
spirig	Excipial [®] lipo cream	N021	5
spirig	Excipial [®] lipo cream	R012	3
spirig	Excipial [®] lipo cream	N061	3
spirig	Excipial [®] lipo cream	r042	1
Spirig	Excipial [®] lipo cream	K021	1
Spirig	Excipial [®] lipo cream	N021	1
Spirig	Excipial [®] lipo cream	R012	4
Spirig (Galderma)	Excipial [®] lipo cream	T061	1
Spirig / Anzag	Excipial [®] lipo cream	M017	1
Spirig / Anzag	Excipial [®] lipo cream	813994/09	1
Spirig / Anzag	Excipial [®] lipo cream	M042	3
Spirig / Anzag	Excipial [®] lipo cream	N018	3
Spirig / Anzag	Excipial [®] lipo cream	N018	1
Spirig / Anzag	Excipial [®] lipo cream	LOTN021	2
Spirig / Gehe	Excipial [®] lipo cream	LOTN021	2
Spirig / Gehe	Excipial [®] lipo cream	LOTR012	1
Spirig / Gehe	Excipial [®] lipo cream	R012	1
Spirig Pharma	Excipial [®] lipo cream	813994/09	2
Spirig Pharma	Excipial [®] lipo cream	T021	1
Spirig Pharma AG	Excipial [®] lipo cream	M042	1
Spirig Pharma AG/Allian...	Excipial [®] lipo cream	N018	1
Spirig Pharma AG/GEHE	Excipial [®] lipo cream	R012	1
Spirig Pharma Europe GmbH	Excipial [®] lipo cream	R026	1
Spirig/AHD	Excipial [®] lipo cream	M017	1
Spirig/AHD	Excipial [®] lipo cream	N018	2
Spirig/Anzag	Excipial [®] lipo cream	S023	1
Spirig/Anzag	Excipial [®] lipo cream	S031	1
Spirig/Anzag	Excipial [®] lipo cream	R011	1
Spirig/Gehe	Excipial [®] lipo cream	R012	1
Spirig/Phoenix	Excipial [®] lipo cream	M041	2
Spirig/Phoenix	Excipial [®] lipo cream	M042	2
Spirig/Phönix	Excipial [®] lipo cream	4622	1
Spirig/Phönix	Excipial [®] lipo cream	R042	1
Wolff	Excipial [®] lipo cream	S031	1
Caelo	Excipial [®] U Lipolotio	R186	1
Caelo	Excipial [®] U Lipolotio	V101	1
Caelo	Excipial [®] U Lipolotio	V143	1
Caelo	Excipial [®] U Lipolotio	S206	1
Caelo	Excipial [®] U Lipolotio	LotV137	1
Caelo	Excipial [®] U Lipolotio	LoTV143	1
Euro/ Phönix	Excipial [®] U Lipolotio	4417A-03749	1
Fagron	Excipial [®] U Lipolotio	N168	2
Fagron	Excipial [®] U Lipolotio	V081	1
Fiebig/DR. Wolf	Excipial [®] U Lipolotio	V028	1
Fischar	Excipial [®] U Lipolotio	LOTN085	1
Galaderma	Excipial [®] U Lipolotio	R072	1
Galderma	Excipial [®] U Lipolotio	R111	1
Galderma	Excipial [®] U Lipolotio	R167	2
Galderma	Excipial [®] U Lipolotio	R168	1
Galderma	Excipial [®] U Lipolotio	S064	1
Galderma	Excipial [®] U Lipolotio	S091	1
Galderma	Excipial [®] U Lipolotio	R171	1
Galderma	Excipial [®] U Lipolotio	R172	1
Galderma	Excipial [®] U Lipolotio	S137	1
Galderma	Excipial [®] U Lipolotio	S147	1
Galderma	Excipial [®] U Lipolotio	T056	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Galderma	Excipial [®] U Lipolotio	T125	1
Galderma	Excipial [®] U Lipolotio	L0TV121	1
Galderma	Excipial [®] U Lipolotio	V153	2
Galderma	Excipial [®] U Lipolotio	V159	1
Galderma	Excipial [®] U Lipolotio	V053	1
Galderma	Excipial [®] U Lipolotio	50346	1
Galderma	Excipial [®] U Lipolotio	50852	1
Galderma	Excipial [®] U Lipolotio	270918A	1
Galderma	Excipial [®] U Lipolotio	169005	1
Galderma (Spirig Pharma...	Excipial [®] U Lipolotio	R061	1
Galderma (Spirig Pharma...	Excipial [®] U Lipolotio	T057	1
Galderma / Galderma	Excipial [®] U Lipolotio	R086	1
Galderma / Kehr	Excipial [®] U Lipolotio	R167	1
Galderma / Kehr	Excipial [®] U Lipolotio	R171	1
Galderma / Kehr	Excipial [®] U Lipolotio	T029	2
Galderma / Kehr	Excipial [®] U Lipolotio	T156	2
Galderma / Noweda	Excipial [®] U Lipolotio	T073/170522EUL	1
Galderma /AHD	Excipial [®] U Lipolotio	169853	1
Galderma /Fiebig	Excipial [®] U Lipolotio	170615	2
Galderma, Sanacorp	Excipial [®] U Lipolotio	L0TS042	1
Galderma/ Alliance	Excipial [®] U Lipolotio	T115	1
Galderma/ Noweda	Excipial [®] U Lipolotio	L0T50450	1
Galderma/ NOWEDA	Excipial [®] U Lipolotio	V082	1
Galderma/Alliance Healt...	Excipial [®] U Lipolotio	T121	1
Galderma/Anzag	Excipial [®] U Lipolotio	S206	1
galderma/G	Excipial [®] U Lipolotio	L0TS202	1
Galderma/Galderma	Excipial [®] U Lipolotio	s017	1
Galderma/Galderma	Excipial [®] U Lipolotio	S017	1
Galderma/Galderma	Excipial [®] U Lipolotio	S142	1
Galderma/Galderma	Excipial [®] U Lipolotio	50852	1
Galderma/Gehe	Excipial [®] U Lipolotio	R189	1
Galderma/Gehe	Excipial [®] U Lipolotio	T061	1
Galderma/Gehe	Excipial [®] U Lipolotio	T066	1
Galderma/Gehe	Excipial [®] U Lipolotio	S139	1
Galderma/Gehe	Excipial [®] U Lipolotio	T156	2
Galderma/Gehe	Excipial [®] U Lipolotio	V108	1
Galderma/Gehe	Excipial [®] U Lipolotio	L0T50450	1
Galderma/Gehe	Excipial [®] U Lipolotio	50450	1
Galderma/Gehe	Excipial [®] U Lipolotio	50691	1
Galderma/Gehe	Excipial [®] U Lipolotio	50842	1
Galderma/Gehe	Excipial [®] U Lipolotio	171710	1
Galderma/Gehe	Excipial [®] U Lipolotio	169831	1
Galderma/Gehe	Excipial [®] U Lipolotio	312417	1
Galderma/Kehr	Excipial [®] U Lipolotio	S071	1
Galderma/Kehr	Excipial [®] U Lipolotio	S203	1
Galderma/Noweda	Excipial [®] U Lipolotio	170420EUL/L0TS204	1
Galderma/Noweda	Excipial [®] U Lipolotio	170518EUL/L0TT073	1
Galderma/Noweda	Excipial [®] U Lipolotio	170316EL/L0TT073	1
Galderma/Noweda	Excipial [®] U Lipolotio	V011	1
Galderma/Noweda	Excipial [®] U Lipolotio	V041	1
Galderma/Noweda	Excipial [®] U Lipolotio	170906EL/T072	1
Galderma/Phoenix	Excipial [®] U Lipolotio	L0TT085	1
Galderma/Phoenix	Excipial [®] U Lipolotio	3717E-03749	1
Galderma/Phoenix	Excipial [®] U Lipolotio	V041	1
Galderma/Phoenix	Excipial [®] U Lipolotio	V061	1
Galderma/Phoenix	Excipial [®] U Lipolotio	V011	1
Galderma/Phoenix	Excipial [®] U Lipolotio	50450	1
Galderma/Phönix	Excipial [®] U Lipolotio	50876	1
Galderma/Phönix	Excipial [®] U Lipolotio	170615	4
Galderma/Phönix	Excipial [®] U Lipolotio	173469	4

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Galderma/Sanacorp	Excipial [®] U Lipolotio	V151	1
Galderma/Spirig Pharma AG	Excipial [®] U Lipolotio	L0TR187	1
Gehe	Excipial [®] U Lipolotio	S132	1
Gehe	Excipial [®] U Lipolotio	S143	1
Gehe	Excipial [®] U Lipolotio	V121	1
GEHE	Excipial [®] U Lipolotio	50459	1
GEHE	Excipial [®] U Lipolotio	50688	1
GEHE	Excipial [®] U Lipolotio	50890	2
GEHE	Excipial [®] U Lipolotio	174996	1
GEHE	Excipial [®] U Lipolotio	174966	1
GEHE	Excipial [®] U Lipolotio	309197	2
GEHE	Excipial [®] U Lipolotio	312811	1
Caelo	Excipial [®] U Lipolotio	L0TS081	1
Gehe/Galderma	Excipial [®] U Lipolotio	LotV011	1
GEHE/GALDERMA 25_11:16	Excipial [®] U Lipolotio	S147	1
Gehe-Spring	Excipial [®] U Lipolotio	L0TR167	1
Kehr/Galderma	Excipial [®] U Lipolotio	T029	1
Nestle Skin Health	Excipial [®] U Lipolotio	174756	1
Nestle Skin Health/Gehe	Excipial [®] U Lipolotio	174756	1
Nestle Skin Health/Phönix	Excipial [®] U Lipolotio	303485	1
Nestle Skin Health/Phönix	Excipial [®] U Lipolotio	311839	1
Noweda	Excipial [®] U Lipolotio	R261	1
Phoenix	Excipial [®] U Lipolotio	N105	1
Phoenix	Excipial [®] U Lipolotio	S091	1
Phoenix	Excipial [®] U Lipolotio	S138	2
Phoenix	Excipial [®] U Lipolotio	S148	1
Phoenix WE 16.01.17 EK...	Excipial [®] U Lipolotio	L0TS122	2
Phoenix/Spirig	Excipial [®] U Lipolotio	N041	1
PHÖNIX	Excipial [®] U Lipolotio	T063	1
PHÖNIX	Excipial [®] U Lipolotio	V039	1
PHÖNIX	Excipial [®] U Lipolotio	V105	1
Spirig	Excipial [®] U Lipolotio	N086	1
spirig	Excipial [®] U Lipolotio	M142	1
spirig	Excipial [®] U Lipolotio	N013	1
spirig	Excipial [®] U Lipolotio	N058	3
spirig	Excipial [®] U Lipolotio	N086	1
spirig	Excipial [®] U Lipolotio	R037	1
Spirig	Excipial [®] U Lipolotio	M091	1
Spirig	Excipial [®] U Lipolotio	N123	1
Spirig	Excipial [®] U Lipolotio	R047	1
Spirig	Excipial [®] U Lipolotio	L0TT057	1
Spirig	Excipial [®] U Lipolotio	50450	1
Spirig	Excipial [®] U Lipolotio	169838	1
Spirig / Anzag	Excipial [®] U Lipolotio	M182	1
Spirig / Anzag	Excipial [®] U Lipolotio	N032	1
Spirig / Anzag	Excipial [®] U Lipolotio	N041	1
Spirig / Galderma / Anzag	Excipial [®] U Lipolotio	170615	1
Spirig / Galderma / Anzag	Excipial [®] U Lipolotio	169010	1
Spirig / Sanacorp	Excipial [®] U Lipolotio	R041	1
Spirig Pharma	Excipial [®] U Lipolotio	L0TK131	1
Spirig Pharma	Excipial [®] U Lipolotio	L0TN013	1
Spirig Pharma	Excipial [®] U Lipolotio	M134	1
Spirig Pharma	Excipial [®] U Lipolotio	S122	1
Spirig Pharma	Excipial [®] U Lipolotio	V082	1
Spirig Pharma	Excipial [®] U Lipolotio	V053	1
Spirig Pharma	Excipial [®] U Lipolotio	V141	2
Spirig/AHD	Excipial [®] U Lipolotio	M085	1
Spirig/AHD	Excipial [®] U Lipolotio	N058	1
Spirig/AHD	Excipial [®] U Lipolotio	lotno86	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Spirig/Fiebig	Excipial [®] U Lipolotio	S143	1
Spirig/Galderma	Excipial [®] U Lipolotio	R156	2
Spirig/Galderma	Excipial [®] U Lipolotio	R146	1
Spirig/Gehe	Excipial [®] U Lipolotio	M102	2
Spirig/Gehe	Excipial [®] U Lipolotio	M146	1
Spirig/Gehe	Excipial [®] U Lipolotio	M182	1
Spirig/Gehe	Excipial [®] U Lipolotio	R262	1
Spirig/Kehr	Excipial [®] U Lipolotio	V038	1
Spirig/Noweda	Excipial [®] U Lipolotio	N061	1
Sprig (Galderma)/ G	Excipial [®] U Lipolotio	S123	1
Galderma	Excipial [®] U10 Lipolotio	LOT50679	1
Galderma/Galderma	Excipial [®] U10 Lipolotio	308310	1
Spirig/AHD	Excipial [®] U10 Lipolotio	M025	1
Artesan	Fabitop [®] base cream	GLWW5	1
Artesan	Fabitop [®] base cream	GLWD4	1
Caelo	Fabitop [®] base cream	glwd2	1
Fontapharm	Fabitop [®] base cream	GLWW4	1
Fontapharm	Fabitop [®] base cream	GLWD2	9
Fontapharm	Fabitop [®] base cream	GLWD2x2	1
Fontapharm	Fabitop [®] base cream	GLWD3	2
Fontapharm	Fabitop [®] base cream	101601	1
Fontapharm/Gehe	Fabitop [®] base cream	GLWD4	1
Fontapharm/Phönix	Fabitop [®] base cream	101601	2
Spangropharm	Fabitop [®] base cream	1016022	1
Gehe	Fabitop [®] base cream	GRWW2	6
Jenne	Fabitop [®] base cream	GWWL1	1
jenne artisan	Fabitop [®] base cream	GLWWW5	1
Caelo	Fabitop [®] base cream	GWWL1	1
Phoenix/Artesan	Fabitop [®] base cream	GLWD5	3
Phönix/Fontapharm	Fabitop [®] base cream	GRWW2	1
THC/Noweda	Fabitop [®] base cream	1016022	1
Hans Karrer / Anzag	Hans Karrer Lipolotion Micro...	16004	1
Hans Karrer/Gehe	Hans Karrer Lipolotion Micro...	17002	20
KARRER/ E	Hans Karrer Lipolotion Micro...	LOT17002	1
Galderma	Lipoderm [®] lotion	R044	2
Galderma	Lipoderm [®] lotion	S021	1
Galderma	Lipoderm [®] lotion	T011	1
Galderma	Lipoderm [®] lotion	169310	1
Galderma/AllianceHC	Lipoderm [®] lotion	T011	2
Galderma/Kehr	Lipoderm [®] lotion	S021	2
Galderma/Phoenix	Lipoderm [®] lotion	S041	1
Ichthyol/Phönix	Lipoderm [®] lotion	LOTT043	1
Jenne	Lipoderm [®] lotion	T011	1
Spirig	Lipoderm [®] lotion	R011	2
Spirig	Lipoderm [®] lotion	LOTR011	1
Spirig	Lipoderm [®] lotion	R023	2
Spirig	Lipoderm [®] lotion	S041	2
Spirig Pharma	Lipoderm [®] lotion	V012	1
Spirig Pharma AG	Lipoderm [®] lotion	N041	1
Spirig Pharma AG/Allian...	Lipoderm [®] lotion	N041	1
Spirig Pharma AG/Allian...	Lipoderm [®] lotion	N041	1
Spirig Pharma AG/Allian...	Lipoderm [®] lotion	R011	4
Spirig Pharma AG/Allian...	Lipoderm [®] lotion	R023	8
Spirig Pharma AG/Allian...	Lipoderm [®] lotion	R044	3
Spirig Pharma/Phoenix	Lipoderm [®] lotion	T043	2
Spirig/AHD	Lipoderm [®] lotion	N041	1
Spirig/AHD	Lipoderm [®] lotion	LOTN041	1
Spirig/AllianceHC	Lipoderm [®] lotion	S021	3
Spirig/Phoenix	Lipoderm [®] lotion	M065	4
SpirigPharm/Noweda	Lipoderm [®] lotion	LOT50932	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Bayer/ Sanacorp	Neribas [®] cream	YY002L6	1
Caelo	Neribas [®] cream	yyo18ff	1
Caelo	Neribas [®] cream	YY01X64	1
Chiesi / Gehe	Neribas [®] cream	32097A	1
GPGrenzach Produktion/P...	Neribas [®] cream	YY01673	1
Intendis / Gehe	Neribas [®] cream	21076A	1
Intendis / Sanacorp	Neribas [®] cream	24105A	1
Intendis GmbH	Neribas [®] cream	24089A	1
Jenapharm	Neribas [®] cream	33100C	1
Jenapharm / Gehe	Neribas [®] cream	34104C	1
Jenapharm / Gehe	Neribas [®] cream	YY02L84	1
Jenapharm/ G	Neribas [®] cream	YY01KK7	1
Jenapharm/Alliance	Neribas [®] cream	YY000C3	1
Jenapharm/Alliance	Neribas [®] cream	YY001HS	1
Jenapharm/Gehe	Neribas [®] cream	YY005HT	1
Jenapharm/Gehe	Neribas [®] cream	YY006KY	1
Phönix / Jenapharm	Neribas [®] cream	YY01FX3	1
Caelo	Neuroderm [®] moisturising cream	6051801	1
Infectopharm/Gehe	Neuroderm [®] moisturising cream	S0315081	1
Allergika Pharma GmbH	Allergika [®] Base cream		1
Chiesi	Asche Basis [®] cream	24220A	2
Chiesi GmbH/Gehe	Asche Basis [®] cream		2
Chiesi,Fa.Gehe	Asche Basis [®] cream		1
Chiesi,Gehe	Asche Basis [®] cream		1
Dr. Wolff	Asche Basis [®] cream		1
Chiesi	Asche Basis [®] lotion	64082A	1
Beiersdorf	Eucerinum O/W basis	53430208WA	2
Beiersdorf	Eucerinum W/O basis	31230108WA	1
Beiersdorf	Eucerinum W/O basis	41830108WA	2
Beiersdorf	Eucerinum W/O basis	83730208WA	1
Spirig Pharma/Gehe	Excipial [®] hydro cream		1
Spirig/Gehe	Excipial [®] hydro cream		3
Alliance Healthcare	Excipial [®] lipo cream		1
spirig	Excipial [®] lipo cream		1
Fontapharm	Fabitol [®] base cream	GLWD5	1
Caelo	Neuroderm [®] moisturising cream		4
infectopharm	Neuroderm [®] moisturising cream		1
Infectopharm	Neuroderm [®] moisturising cream		6
InfectoPharm	Neuroderm [®] moisturising cream		5
Infectopharm/Fiebig	Neuroderm [®] moisturising cream		1
Infectopharm/Kehr	Neuroderm [®] moisturising cream		1
Infectopharm/Phönix	Neuroderm [®] moisturising cream		4
Noweda	Neuroderm [®] moisturising cream		1
Bombastus	Neuroderm [®] moisturising cream		1
PHÖNIX	Neuroderm [®] moisturising cream		1
Sanacorp	Neuroderm [®] moisturising cream		1

- 4026 spectra from 469 *Apo-Ident* customers from a total of 2013 batches from a further 121 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Hydrophilic ointments* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose,

all relevant spectra of the various substances were compared with *Hydrophilic ointments* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	3470	0	20 495
Type B	0	2108	112	17 550
Type C	0	1415	106	4001

The substance/substance group *Hydrophilic ointments* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9596 %)	100.0000 % (> 99.8271 %)
Type B	100.0000 % (> 99.9429 %)	94.9550 % (> 94.8198 %)
Type C	100.0000 % (> 98.7795 %)	93.0309 % (> 92.8337 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Hydrophilic ointments* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Dimeticone ointment 10% SR	12.74	—
Optiderm [®] lotion	15.09	—
Dexeryl [®]	15.53	—
Neuroderm [®] moisturising cream lipo	15.64	—
Lipolotio urea 5% F body lotion	17.75	—
La Roche-Posay Toleriane	18.63	—
Amciderm [®] Base cream	27.90	—
Linola [®] Sept	33.98	—
Dermifant [®] kids cream	35.02	—
Dermatop [®] base ointment	35.02	—
Allergika evening primrose oil cream 20%	36.66	—
Nourivan [™] Antiox	41.02	—
Linola [®] H fat N	59.21	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Hydrophilic ointments* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30713	30713	0.00	44.83
30775	30775	0.00	54.22
31085	31085	0.00	54.31
33194	33194	0.00	32.31
33195	33195	0.00	33.67
34117	34117	0.00	32.83
31873	31873	0.00	25.95
30726	30726	0.00	35.86
34044	34044	0.00	21.35
31067	31067	0.00	39.08
31307	31307	0.00	15.41
33270	33270	0.00	39.73
33221	33221	0.00	38.44
31309	31309	0.00	44.34
32178	32178	0.00	40.23
31070	31070	0.00	18.97
31772	31772	0.00	19.59
30722	30722	0.00	35.73
31102	31102	0.00	44.37
31761	31761	0.00	42.02
31234	31234	0.00	33.64
32177	32177	0.00	32.22
31058	31058	0.00	40.61
31061	31061	0.00	42.26
30993	30993	0.00	43.66
32997	32997	0.00	40.62
32767	32767	0.00	40.70
33969	33969	0.00	41.45
34359	34359	0.00	40.27
31627	31627	0.00	18.74
31950	31950	0.00	19.24
30732	30732	0.00	39.14
33039	33039	0.00	19.27
31280	31280	0.00	44.85
30725	30725	0.00	49.41
31730	31730	0.00	26.68
31236	31236	0.00	34.99
34119	34119	0.00	23.35
31308	31308	0.00	45.61
31870	31870	0.00	40.85
31539	31539	0.00	21.51
30845	30845	0.00	16.05
33213	33213	0.00	26.25
31082	31082	0.00	56.65
30634	30634	0.00	38.41
31089	31089	0.00	45.14

continued on the next page

continued from previous page

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31050	31050	0.00	42.92
32916	32916	0.00	40.92
33208	33208	0.00	44.11
31095	31095	0.00	44.95
31072	31072	0.00	38.73
33968	33968	0.00	40.67
31535	31535	0.00	34.59
30828	30828	0.00	21.38
31041	31041	0.00	19.98
31068	31068	0.00	26.94
31576	31576	0.00	55.81
30733	30733	0.00	32.27
33737	33737	0.00	23.98
31066	31066	0.00	29.72
31281	31281	0.00	29.12
33668	33668	0.00	44.43
31511	31511	0.00	48.63
33669	33669	0.00	42.73
31874	31874	0.00	49.87
34043	34043	0.00	48.33
33793	33793	0.00	16.41
34360	34360	0.00	16.32
31869	31869	0.00	15.09
31088	31088	0.00	47.06
31115	31115	0.00	34.41
31520	31520	0.00	49.45
31578	31578	0.00	31.31
30635	30635	0.00	35.12
33207	33207	0.00	45.50
33636	33636	0.00	44.88

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Immortelle oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30450-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Immortelle oil; Oleum helichrysum italicum

Special notes

When selecting the *Immortelle oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Immortelle oil	4	2	4

Second-stage model

For differentiation of the substance/substance group *Immortelle oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Immortelle oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Immortelle oil	00324A27	34383	40	not required
Taoasis	Immortelle oil	L24113D-113148BAG90451	31138	40	not required
Taoasis	Immortelle oil	L24415DN-122092BAG90451	32069	60	not required
Taoasis	Immortelle oil	114717DNJ-137	33727	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Immortelle oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Immortelle oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Immortelle oil	L17716DN-126770	32975	40
Taoasis	Immortelle oil	L17716DN-124955	33021	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 5 spectra from 2 *Apo-Ident* customers from 4 batches from the substance/substance group *Immortelle oil*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Immortelle oil	L03111DN	1
Taoasis	Immortelle oil	L38914DN-118878	2
Taoasis	Immortelle oil	L14717DNJ-132	1
Taoasis	Immortelle oil	L14717DNJ-3017	1

- 5542 spectra from 490 *Apo-Ident* customers from a total of 2714 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Immortelle oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Immortelle oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	5	0	5542

The substance/substance group *Immortelle oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7861 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Immortelle oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Melissa oil	15.14	—
Ginger oil	15.73	—
Vetiver bourbon oil	21.99	—
Lemon grass oil	25.25	—
Citrus oil	29.20	—
Myrtle oil	30.73	—
Cedar wood oil	33.62	—
Chamomile (essential oil)	34.68	—
Spearmint oil	40.78	—
Swiss pine oil	40.95	—
Patchouli oil	45.80	—
Marjoram oil	46.22	—
Cypress oil	46.77	—
Carrot seed oil	47.26	—
Hyssop oil	50.21	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Immortelle oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31138	31138	0.00	25.17
32069	32069	0.00	20.26
33727	33727	0.00	29.50
34383	34383	0.00	28.40

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Juniper oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31559-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Juniper oil; Oleum juniperi e baccaræ

Special notes

When selecting the *Juniper oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Juniper oil	3	3	2

Second-stage model

For differentiation of the substance/substance group *Juniper oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Juniper oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Juniper oil	4155-116757	31559	60	not required
Taoasis	Juniper oil	4155-120900	31687	60	not required
Taoasis	Juniper oil	02JB0B-126047	32809	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Juniper oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Juniper oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Juniper oil	00497L26	34398	40
Taoasis	Juniper oil	02JB0B-127283	32932	40
Taoasis	Juniper oil	1713-128196	33651	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 2 *Apo-Ident* customers from 2 batches from the substance/substance group *Juniper oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Juniper oil	16160706	1
Taoasis	Juniper oil	155-118896	1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Juniper oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Juniper oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	76	44	20 341
Type C	0	2	0	5545

The substance/substance group *Juniper oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	63.3333 % (> 60.8333 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Juniper oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Dwarf pine oil	21.44	—
Spearmint oil	22.70	—
Frankincense oil	26.73	—
Spruce needle oil	28.24	—
Angelica root oil	29.49	—
Swiss pine oil	35.65	—
Pine silvestris oil	36.67	—
Silver fir oil	43.23	—
Citrus oil	45.61	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Juniper oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32809	32809	0.00	21.88
31559	31559	0.00	24.17
31687	31687	0.00	25.82

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	La Roche-Posay Cold Cream Naturel
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30829-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

La Roche-Posay Cold Cream Naturel

Special notes

When selecting the *La Roche-Posay Cold Cream Naturel* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
La Roche-Posay Cold Cream Naturel	3	2	4

Second-stage model

For differentiation of the substance/substance group *La Roche-Posay Cold Cream Naturel* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *La Roche-Posay Cold Cream Naturel*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
La Roche-Posay	La Roche-Posay C...	54J01P	30829	40	not required
La Roche-Posay	La Roche-Posay C...	54K31P	31074	40	not required
La Roche-Posay	La Roche-Posay C...	54LN1P	31765	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *La Roche-Posay Cold Cream Naturel*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *La Roche-Posay Cold Cream Naturel*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
La Roche-Posay	La Roche-Posay Cold Cream Na...	54M51P	33262	40
La Roche-Posay	La Roche-Posay Cold Cream Na...	54P61P	33984	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 4 spectra from 2 *Apo-Ident* customers from 4 batches from the substance/substance group *La Roche-Posay Cold Cream Naturel*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
La Roche-Posay	La Roche-Posay Cold Cream Na...	54M11P	1
La Roche-Posay	La Roche-Posay Cold Cream Na...	54M91P	1
La Roche-Posay	La Roche-Posay Cold Cream Na...	54M01P	1
Mea-SanacorpWE10.02.201...	La Roche-Posay Cold Cream Na...	LOT54M91P	1

- 5543 spectra from 490 *Apo-Ident* customers from a total of 2714 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *La Roche-Posay Cold Cream Naturel* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *La Roche-Posay Cold Cream Naturel* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	4	0	5543

The substance/substance group *La Roche-Posay Cold Cream Naturel* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7897 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *La Roche-Posay Cold Cream Naturel* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Stomahesive [®] adhesive paste	50.64	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *La Roche-Posay Cold Cream Naturel* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30829	30829	0.00	80.61
31074	31074	0.00	84.09
31765	31765	0.00	83.29

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	La Roche-Posay Toleriane
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30827-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

La Roche-Posay Toleriane

Special notes

When selecting the *La Roche-Posay Toleriane* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
La Roche-Posay Toleriane	3	2	4

Second-stage model

For differentiation of the substance/substance group *La Roche-Posay Toleriane* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *La Roche-Posay Toleriane*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
La Roche-Posay	La Roche-Posay T...	54J901	30827	40	not required
La Roche-Posay	La Roche-Posay T...	54K500	31094	40	not required
La Roche-Posay	La Roche-Posay T...	54N201	32563	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *La Roche-Posay Toleriane*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 845 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *La Roche-Posay Toleriane*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
La Roche-Posay	La Roche-Posay Toleriane	54N600	32759	40
La Roche-Posay	La Roche-Posay Toleriane	54P401	33983	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 7 spectra from 2 *Apo-Ident* customers from 4 batches from the substance/substance group *La Roche-Posay Toleriane*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	La Roche-Posay Toleriane	54J500	1
Gehe	La Roche-Posay Toleriane	54P802	4
Roche Posay/Gehe	La Roche-Posay Toleriane	54R1011	1
Roche/AHD	La Roche-Posay Toleriane	54J800	1

- 5540 spectra from 490 *Apo-Ident* customers from a total of 2714 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *La Roche-Posay Toleriane* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *La Roche-Posay Toleriane* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	80	0	20 381
Type C	0	7	0	5540

The substance/substance group *La Roche-Posay Toleriane* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7821 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *La Roche-Posay Toleriane* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Eucerinum W/O basis	17.44	—
Neuroderm [®] moisturising cream	21.45	—
Excipial [®] U10 Lipolotio	22.61	—
DMS [®] base cream high classic	23.94	—
DMS [®] base cream classic	27.17	—
Base cream Taoasis	27.21	—
Hans Karrer Lipocream MicroSilver	27.30	—
Asche Basis [®] lotion	28.73	—
Abitima [®] clinic body cream	28.76	—
Excipial [®] U Lipolotio	29.36	—
Lipoderm [®] lotion	29.78	—
Dimeticone ointment 10% SR	34.64	—
Asche Basis [®] cream	35.16	—
Neribas [®] cream	39.54	—
Hans Karrer Lipolotion MicroSilver	41.37	—
Linola [®] body milk	42.02	—
Neuroderm [®] care lotion	42.23	—
DMS [®] base cream high classic plus	42.81	—
Excipial [®] hydro cream	50.18	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *La Roche-Posay Toleriane* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30827	30827	0.00	31.16
31094	31094	0.00	24.84
32563	32563	0.00	30.00

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all

substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Lemon grass oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30661-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Lemon grass oil; Cymbopogonis aetheroleum

Special notes

When selecting the *Lemon grass oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Lemon grass oil	4	3	14

Second-stage model

For differentiation of the substance/substance group *Lemon grass oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Lemon grass oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Bombastus	Lemon grass oil	263571	30661	40	not required
Bombastus	Lemon grass oil	278923	31185	40	not required
Bombastus	Lemon grass oil	278526	31187	40	not required
Taoasis	Lemon grass oil	130930-116754	31549	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Lemon grass oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Lemon grass oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Bombastus	Lemon grass oil	294338	33012	40
Primavera	Lemon grass oil	00536M26	34370	40
Taoasis	Lemon grass oil	1448-127048	32977	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 14 spectra from 6 *Apo-Ident* customers from 14 batches from the substance/substance group *Lemon grass oil*.
- Among them are spectra of independent samples from 14 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Lemon grass oil	270423	1
Primavera	Lemon grass oil	11401144	1
Taoasis	Lemon grass oil	532897-111140	1
Taoasis	Lemon grass oil	13131-112982	1
Taoasis	Lemon grass oil	130930-115336	1
Taoasis	Lemon grass oil	8911011-121890	1
Taoasis	Lemon grass oil	FFL457-123568	1
Taoasis	Lemon grass oil	1663-125423	1
Taoasis	Lemon grass oil	1448-126624	1
Taoasis	Lemon grass oil	18988-125876	1
Taoasis	Lemon grass oil	1448-128742	1
Taoasis	Lemon grass oil	1777-2776	1
Taoasis	Lemon grass oil	1448-507	1
Taoasis	Lemon grass oil	6093-6119	1

- 5533 spectra from 490 *Apo-Ident* customers from a total of 2704 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Lemon grass oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Lemon grass oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	119	1	20 341
Type C	0	14	0	5533

The substance/substance group *Lemon grass oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9441 %)	99.1667 % (> 96.6667 %)
Type C	100.0000 % (> 98.7770 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Lemon grass oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Carrot seed oil	30.47	—
Patchouli oil	31.81	—
Cypress oil	32.74	—
Immortelle oil	33.94	—
Marjoram oil	35.70	—
Tea tree oil	40.54	—
Myrtle oil	40.80	—
Ginger oil	42.33	—
Melissa oil	47.30	—
Vetiver bourbon oil	49.26	—
Citrus oil	53.52	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Lemon grass oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31185	31185	0.00	34.45
31549	31549	0.00	39.63
30661	30661	0.00	41.65
31187	31187	0.00	31.81

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at

least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Liniment ointments**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30731-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Liniment ointments; Amciderm[®] Base cream; Excipial[®] U Hydrolotio; Linola[®] O/W cream; Linola[®] Sept; Nourivan[™] Antiox

Special notes

When selecting the *Liniment ointments* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Amciderm [®] Base cream	2	2	0
Excipial [®] U Hydrolotio	4	2	13
Linola [®] O/W cream	3	2	70
Linola [®] Sept	3	1	0
Nourivan [™] Antiox	3	0	1

Second-stage model

For differentiation of the substance/substance group *Liniment ointments* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Liniment ointments*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Almirall	Amciderm [®] Base c...	313311	31509	60	not required
Almirall	Amciderm [®] Base c...	313311	31628	75	not required
Almirall	Amciderm [®] Base c...	650341	33502	40	not required
Spirig Pharma	Excipial [®] U Hydr...	M016	30731	40	not required
Spirig Pharma	Excipial [®] U Hydr...	M063	31073	40	not required
Spirig Pharma	Excipial [®] U Hydr...	N013	31279	40	not required
Spirig Pharma	Excipial [®] U Hydr...	R014	31536	60	not required
Dr. Wolff	Linola [®] O/W cream	238482	30834	40	not required
Dr. Wolff	Linola [®] O/W cream	334010	31133	40	not required
Dr. Wolff	Linola [®] O/W cream	432480	31312	40	not required
Dr. Wolff	Linola [®] Sept	334080	31079	40	not required
Dr. Wolff	Linola [®] Sept	509361	31856	60	not required
Dr. Wolff	Linola [®] Sept	707990	34126	40	not required
Fagron	Nourivan TM Antiox	14C11-T09-010959	31495	60	not required
Fagron	Nourivan TM Antiox	1503258	31958	45	not required
Fagron	Nourivan TM Antiox	1703842	33789	30	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 750 spectra of 16 reference samples from the substance/substance group *Liniment ointments*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 15 different batches.
- 23 215 spectra from a total of 476 batches from further 155 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra

in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 425 spectra of 12 reference samples from the substance/substance group *Liniment ointments*.
- Among them are spectra of independent samples from 7 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Almirall	Amciderm [®] Base cream	538331	32758	40
Almirall	Amciderm [®] Base cream	822351	34365	40
Spirig Pharma	Excipial [®] U Hydrolotio	S061	33206	40
Spirig Pharma	Excipial [®] U Hydrolotio	V052	33981	40
Dr. Wolff	Linola [®] O/W cream	610960	33259	40
Dr. Wolff	Linola [®] O/W cream	801520	34129	40
Dr. Wolff	Linola [®] Sept	603190	32760	40
Dr. Wolff	Linola [®] Sept	603190	33257	40
Fagron	Nourivan TM Antiox	1503258	31958 [†]	15
Fagron	Nourivan TM Antiox	1503258	32778	40
Fagron	Nourivan TM Antiox	1503258	32822	40
Fagron	Nourivan TM Antiox	1703842	33789 [†]	10

- 20036 spectra from a total of 428 batches from further 199 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 146 spectra from 50 *Apo-Ident* customers from 89 batches from the substance/substance group *Liniment ointments*.
- Among them are spectra of independent samples from 84 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Excipial [®] U Hydrolotio	L0TR092	1
Galderma	Excipial [®] U Hydrolotio	L0TR054	1
Galderma	Excipial [®] U Hydrolotio	T011	1
Galderma	Excipial [®] U Hydrolotio	50857	1
Galderma	Excipial [®] U Hydrolotio	1107483	1
Galderma/Gehe	Excipial [®] U Hydrolotio	50723	1
Galderma/Noweda	Excipial [®] U Hydrolotio	R054	1
Noweda	Excipial [®] U Hydrolotio	S061	1
Phoenix/Spirig	Excipial [®] U Hydrolotio	M016	1
PHÖNIX	Excipial [®] U Hydrolotio	V051	1
PHÖNIX	Excipial [®] U Hydrolotio	50593	1

continued on the next page

[†]These spectra were recorded from material of the same package as the corresponding calibration spectra (*Type A*). Hence, these spectra are not independent and are not of *Type B*.

continued from previous page

Supplier	Substance	Batch	Spectra
SANACORP	Excipial [®] U Hydrolotio	172141	1
Spirig	Excipial [®] U Hydrolotio	N013	1
Spirig	Excipial [®] U Hydrolotio	N013	1
Spirig Pharma AG/ NOWEDA	Excipial [®] U Hydrolotio	L0TN022	1
Spirig Pharma AG/Noweda	Excipial [®] U Hydrolotio	R054	1
AHD	Linola [®] O/W cream	437110	1
Caelo	Linola [®] O/W cream	1111111111	1
Caelo	Linola [®] O/W cream	704260	1
Caelo	Linola [®] O/W cream	239181	1
Caelo	Linola [®] O/W cream	238520	2
Caelo	Linola [®] O/W cream	238484	1
Caelo	Linola [®] O/W cream	330760	1
Caelo	Linola [®] O/W cream	801630	2
Caelo	Linola [®] O/W cream	438350	1
Caelo	Linola [®] O/W cream	236281	1
Caelo	Linola [®] O/W cream	238530	2
chiesi / Noweda	Linola [®] O/W cream	331460	1
Dr. A.Wolff GmbH/Noweda	Linola [®] O/W cream	707510	1
Dr. August Wolff GmbH &...	Linola [®] O/W cream	170522LC/701090	1
Dr. Wolf/GEHE	Linola [®] O/W cream	437110	1
Dr. Wolff	Linola [®] O/W cream	236290	1
Dr. Wolff	Linola [®] O/W cream	238520	2
Dr. Wolff	Linola [®] O/W cream	238484	1
Dr. Wolff	Linola [®] O/W cream	233200	1
Dr. Wolff	Linola [®] O/W cream	238530	2
Dr. Wolff	Linola [®] O/W cream	435080	1
Dr. Wolff	Linola [®] O/W cream	431200	3
Dr. Wolff	Linola [®] O/W cream	435530	1
Dr. Wolff	Linola [®] O/W cream	434430	3
Dr. Wolff	Linola [®] O/W cream	437120	1
Dr. Wolff	Linola [®] O/W cream	438200	2
Dr. Wolff	Linola [®] O/W cream	504100	1
Dr. Wolff	Linola [®] O/W cream	508280	1
Dr. Wolff	Linola [®] O/W cream	505200	4
Dr. Wolff	Linola [®] O/W cream	512330	1
Dr. Wolff	Linola [®] O/W cream	602300	1
Dr. Wolff	Linola [®] O/W cream	510792	1
Dr. Wolff	Linola [®] O/W cream	602190	3
Dr. Wolff	Linola [®] O/W cream	510430	2
Dr. Wolff	Linola [®] O/W cream	605419	1
Dr. Wolff	Linola [®] O/W cream	606121	1
Dr. Wolff	Linola [®] O/W cream	605410	2
Dr. Wolff	Linola [®] O/W cream	610020	1
Dr. Wolff	Linola [®] O/W cream	701090	1
Dr. Wolff	Linola [®] O/W cream	610960	1
Dr. Wolff	Linola [®] O/W cream	704260	2
Dr. Wolff	Linola [®] O/W cream	701330	1
Dr. Wolff	Linola [®] O/W cream	705810	1
Dr. Wolff	Linola [®] O/W cream	707520	2
DR. WOLFF	Linola [®] O/W cream	234192	1
Dr. Wolff / Sanacorp	Linola [®] O/W cream	338990	3
Dr. Wolff GmbH / Phoenix	Linola [®] O/W cream	606100	1
Dr. Wolff/Gehe	Linola [®] O/W cream	434320	2
Dr. Wolff/Gehe	Linola [®] O/W cream	138350	1
Dr. Wolff/Malteser	Linola [®] O/W cream	330751	1
Dr. Wolff/Malteser	Linola [®] O/W cream	333880	1
Dr. Wolff/Malteser	Linola [®] O/W cream	338990	1
Dr. August Wolff	Linola [®] O/W cream	233140	1
Dr. August Wolff	Linola [®] O/W cream	607140	1
Dr. August Wolff	Linola [®] O/W cream	505560	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Dr. August Wolff	Linola [®] O/W cream	605560	1
Dr. August Wolff	Linola [®] O/W cream	608900	1
Dr. August Wolff/Ebert	Linola [®] O/W cream	333640	2
Dr. August Wolff/Ebert	Linola [®] O/W cream	431250	1
Dr. August Wolff/Ebert	Linola [®] O/W cream	432970	1
Dr. Wolff	Linola [®] O/W cream	238482	1
Dr. Wolff	Linola [®] O/W cream	238530	1
Dr. Wolff	Linola [®] O/W cream	334003	1
Dr. Wolff	Linola [®] O/W cream	333640	1
Dr. Wolff	Linola [®] O/W cream	432490	1
Dr. Wolff	Linola [®] O/W cream	438200	1
Dr. Wolff	Linola [®] O/W cream	438360	1
Dr. Wolff	Linola [®] O/W cream	903600	1
Dr. Wolff/ Anzag	Linola [®] O/W cream	234193	1
Dr. Wolff/ Noweda	Linola [®] O/W cream	707330	1
Dr. Wolff/ Anzag	Linola [®] O/W cream	238520	2
Dr. Wolff/ Fiebig	Linola [®] O/W cream	510430	1
Dr. Wolff/ Fiebig	Linola [®] O/W cream	606120	1
Dr. Wolff/ Fiebig	Linola [®] O/W cream	704270	1
Dr. Wolff/ Gehe	Linola [®] O/W cream	238520	1
Dr. Wolff/ Gehe	Linola [®] O/W cream	432490	2
Dr. Wolff/ Gehe	Linola [®] O/W cream	438360	1
Dr. Wolff/ Gehe	Linola [®] O/W cream	606100	1
Dr. Wolff/ Noweda	Linola [®] O/W cream	233200	1
Dr. Wolff/ Noweda	Linola [®] O/W cream	701090	1
Dr. Wolff/ Sanacorp	Linola [®] O/W cream	701100	1
Dr. Wolff/ Sanacorp	Linola [®] O/W cream	704270	1
Euro OTC	Linola [®] O/W cream	333730	1
Galderma/ Noweda	Linola [®] O/W cream	704270	1
Krieger	Linola [®] O/W cream	705810	1
Noweda/ Dr. Wolff	Linola [®] O/W cream	610020	2
Phoenix/ Wolff	Linola [®] O/W cream	333640	1
wolff	Linola [®] O/W cream	434320	1
wolff	Linola [®] O/W cream	711110	1
Wolff	Linola [®] O/W cream	709750	1
Wolff / Fiebig	Linola [®] O/W cream	710650	1
Wolff / Gehe	Linola [®] O/W cream	431130	3
Wolff / Noweda	Linola [®] O/W cream	431120	4
Wolff/ Sanacorp	Linola [®] O/W cream	333630	2
Fagron	Nourivan TM Antiox	150325	1
Dr. Wolff	Linola [®] O/W cream	432480	1
Fagron	Nourivan TM Antiox	1503258	2

- 5401 spectra from 490 *Apo-Ident* customers from a total of 2636 batches from a further 140 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Liniment ointments* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Liniment ointments* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	750	0	23 215
Type B	0	383	42	19 904
Type C	0	142	4	5400

The substance/substance group *Liniment ointments* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.2000 %)
Type B	100.0000 % (> 99.9435 %)	90.1176 % (> 89.4118 %)
Type C	100.0000 % (> 98.7948 %)	97.2603 % (> 95.2055 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Liniment ointments* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Hans Karrer Hydrocream MicroSilver	10.82	—
Sebexol [®] basic pH 5 formula basis	11.34	—
Sebexol [®] cream lotion pH 5	15.94	—
Dimeticone ointment 10% SR	17.57	—
Wofacutan wash lotion	19.51	—
Abitima [®] clinic face cream	21.09	—
Base cream Taoasis	23.42	—
Optiderm [®] lotion	30.52	—
Hans Karrer Lipolotion MicroSilver	30.79	—
Neuroderm [®] moisturising cream	32.87	—
Asche Basis [®] lotion	35.69	—
Eucerinum W/O basis	37.93	—
Excipial [®] U10 Lipolotio	41.43	—
Fabitop [®] base cream	42.04	—
Fenistil [®] Gel	43.18	—
DMS [®] base cream classic	48.84	—
DMS [®] base cream high classic	53.16	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Liniment ointments* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested

reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30834	30834	0.00	30.42
31495	31495	0.00	21.08
31079	31079	0.00	30.57
33789	33789	0.00	20.67
34126	34126	0.00	32.24
31509	31509	0.00	30.65
31628	31628	0.00	30.47
33502	33502	0.00	32.61
31856	31856	0.00	30.19
31958	31958	0.00	22.05
31133	31133	0.00	30.89
31312	31312	0.00	27.22
30731	30731	0.00	10.79
31073	31073	0.00	10.51
31279	31279	0.00	10.42
31536	31536	0.00	10.69

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30724-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair; Alfason[®] Repair; Linola[®] fat cream; Linola[®] H fat N

Special notes

When selecting the *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Alfason [®] Repair	4	1	11
Linola [®] fat cream	4	3	22
Linola [®] H fat N	3	1	1

Second-stage model

For differentiation of the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Astellas Pharma	Alfason [®] Repair	12F18/77	30724	55	not required
Astellas Pharma	Alfason [®] Repair	13E16/76	31069	40	not required
Astellas Pharma	Alfason [®] Repair	16G60/75	32993	40	not required
LEO Pharma GmbH	Alfason [®] Repair	17E20/75	33790	40	not required
Dr. Wolff	Linola [®] fat cream	235260	30771	40	not required
Dr. Wolff	Linola [®] fat cream	337280	31096	40	not required
Dr. Wolff	Linola [®] fat cream	611011	33243	40	not required
Dr. Wolff	Linola [®] fat cream	612211	33260	40	not required
Dr. Wolff	Linola [®] H fat N	333080	31092	40	not required
Dr. Wolff	Linola [®] H fat N	611060	33211	40	not required
Dr. Wolff	Linola [®] H fat N	801410	34128	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 455 spectra of 11 reference samples from the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 11 different batches.
- 23 510 spectra from a total of 479 batches from further 157 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 240 spectra of 6 reference samples from the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair*.

- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Astellas Pharma	Alfason [®] Repair	15K07/77	32562	40
Dr. Wolff	Linola [®] fat cream	603820	32561	40
Dr. Wolff	Linola [®] fat cream	607250	34125	40
Dr. Wolff	Linola [®] fat cream	802990	34253	40
Dr. Wolff	Linola [®] H fat N	603230	32560	40
Dr. Wolff	Linola [®] H fat N	611060	33038	40

- 20 221 spectra from a total of 431 batches from further 201 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 39 spectra from 20 *Apo-Ident* customers from 34 batches from the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair*.
- Among them are spectra of independent samples from 34 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Astellas	Alfason [®] Repair	13H02/76	1
GEHE	Alfason [®] Repair	17J11/79	1
GEHE	Alfason [®] Repair	17J13/76	1
GEHE	Alfason [®] Repair	18EB5/75	1
GEHE	Alfason [®] Repair	17K83/75	1
GEHE	Alfason [®] Repair	18I90/75	1
Phoenix	Alfason [®] Repair	15/03/75	1
Phönix	Alfason [®] Repair	15J09/75	1
PHÖNIX	Alfason [®] Repair	17E81/75	2
PHÖNIX	Alfason [®] Repair	17E77/75	2
PHÖNIX	Alfason [®] Repair	17F72/75	1
Caelo	Linola [®] fat cream	435161	1
Caelo	Linola [®] fat cream	238540	1
Caelo	Linola [®] fat cream	438070	1
Dr. Wolff	Linola [®] fat cream	237920	1
Dr. Wolff	Linola [®] fat cream	333650	1
Dr. Wolff	Linola [®] fat cream	432591	1
Dr. Wolff	Linola [®] fat cream	437270	1
Dr. Wolff	Linola [®] fat cream	610320	1
Dr. Wolff	Linola [®] fat cream	101808	1
Dr. Wolff / Alliance He...	Linola [®] fat cream	709800	1
Dr. Wolff / Gehe	Linola [®] fat cream	337860	1
Dr. Wolff / Anzag	Linola [®] fat cream	237710	1
Dr. Wolff/Phönix	Linola [®] fat cream	700310	1
Dr. Wolff/Phönix	Linola [®] fat cream	810170	1
dr.wolff	Linola [®] fat cream	337760	1
dr.wolff	Linola [®] fat cream	337770	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Dr. Wolff	Linola [®] fat cream	431160	1
Dr. Wolff	Linola [®] fat cream	810170	1
Dr. Wolff/NOW	Linola [®] fat cream	435160	1
Dr. Wolff/Sanacorp	Linola [®] fat cream	700320	1
Dr. Wolff/Sanacorp	Linola [®] fat cream	704020	1
Löwen City-Apotheke Bar...	Linola [®] fat cream	231060	1
Phönix	Linola [®] fat cream	238540	1
Wolff / Wolff	Linola [®] fat cream	431190	1
Wolff/Phönix	Linola [®] fat cream	337770	1
Engel-Apotheke	Linola [®] H fat N	2319Q-07101	1

- 5508 spectra from 490 *Apo-Ident* customers from a total of 2684 batches from a further 140 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	455	0	23 510
Type B	0	238	2	20 204
Type C	0	35	4	5508

The substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 98.6813 %)
Type B	100.0000 % (> 99.9444 %)	99.1667 % (> 97.9167 %)
Type C	100.0000 % (> 98.7738 %)	89.7436 % (> 82.0513 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Alfason Basis Cresa [®]	10.33	—
Dermatop [®] base ointment	14.29	—
Excipial [®] lipo cream	30.27	—
Lipolotio urea 5% F body lotion	55.43	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33243	33243	0.00	22.61
33260	33260	0.00	21.77
30771	30771	0.00	16.51
31096	31096	0.00	19.13
32993	32993	0.00	15.61
33790	33790	0.00	16.92
31092	31092	0.00	17.68
33211	33211	0.00	22.02
34128	34128	0.00	24.67
30724	30724	0.00	20.25
31069	31069	0.00	8.98

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Lipolotio urea 5% F body lotion**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30973-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Lipolotio urea 5% F body lotion

Special notes

When selecting the *Lipolotio urea 5% F body lotion* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Lipolotio urea 5% F body lotion	3	1	0

Second-stage model

For differentiation of the substance/substance group *Lipolotio urea 5% F body lotion* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Lipolotio urea 5% F body lotion*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Allergika	Lipolotio urea 5...	1205050	30973	80	not required
Allergika	Lipolotio urea 5...	13112021	31766	60	not required
Allergika	Lipolotio urea 5...	1801022	34362	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 3 reference samples from the substance/substance group *Lipolotio urea 5% F body lotion*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 785 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Lipolotio urea 5% F body lotion*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Allergika	Lipolotio urea 5% F body lot...	1502011	32766	40
Allergika	Lipolotio urea 5% F body lot...	1502011	33482	40

- 20381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Lipolotio urea 5% F body lotion*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Lipolotio urea 5% F body lotion* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Lipolotio urea 5% F body lotion* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	0	0	5547

The substance/substance group *Lipolotio urea 5% F body lotion* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Lipolotio urea 5% F body lotion* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Neuroderm [®] moisturising cream lipo	16.19	—
Dermatest base ointment	24.36	—
Allergika evening primrose oil cream 20%	35.48	—
Excipial [®] U Lipolotio	39.83	—
Dermifant [®] kids cream	49.73	—
DMS [®] base cream high classic	65.65	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Lipolotio urea 5% F body lotion* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30973	30973	0.00	30.18
34362	34362	0.00	37.85
31766	31766	0.00	39.95

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Lygal® head ointment N 3%**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31049-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Lygal® head ointment N 3%

Special notes

When selecting the *Lygal® head ointment N 3%* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Lygal® head ointment N 3%	2	2	3

Second-stage model

For differentiation of the substance/substance group *Lygal[®] head ointment N 3%* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Lygal[®] head ointment N 3%*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taurus	Lygal [®] head oint...	124311	31049	40	not required
Taurus	Lygal [®] head oint...	143710	31763	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 100 spectra of 2 reference samples from the substance/substance group *Lygal[®] head ointment N 3%*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 865 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Lygal[®] head ointment N 3%*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taurus	Lygal [®] head ointment N 3%	160732	32763	40
Taurus	Lygal [®] head ointment N 3%	181802	34127	40
Taurus	Lygal [®] head ointment N 3%	160732	33261	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 3 spectra from 3 *Apo-Ident* customers from 3 batches from the substance/substance group *Lygal® head ointment N 3%*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Almirall	Lygal® head ointment N 3%	181908	1
Almirall	Lygal® head ointment N 3%	174928	1
Taurus Pharma	Lygal® head ointment N 3%	134507	1

- 5544 spectra from 490 *Apo-Ident* customers from a total of 2715 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Lygal® head ointment N 3%* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Lygal® head ointment N 3%* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	100	0	23 865
Type B	0	120	0	20 341
Type C	0	3	0	5544

The substance/substance group *Lygal® head ointment N 3%* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 94.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7956 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Lygal[®] head ointment N 3%* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Lygal [®] ointment base	38.98	—
Stomahesive [®] adhesive paste	55.74	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Lygal[®] head ointment N 3%* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31049	31049	0.00	38.98
31763	31763	0.00	39.04

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Lygal® ointment base**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31014-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Lygal® ointment base

Special notes

When selecting the *Lygal® ointment base* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Lygal® ointment base	3	2	19

Second-stage model

For differentiation of the substance/substance group *Lygal[®] ointment base* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Lygal[®] ointment base*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taurus	Lygal [®] ointment ...	121302P	31014	40	not required
Taurus	Lygal [®] ointment ...	154841	32749	40	not required
Taurus	Lygal [®] ointment ...	164201	32772	40	not required
Taurus	Lygal [®] ointment ...	164201	33244	40	not required
Taurus	Lygal [®] ointment ...	164201	33297	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 5 reference samples from the substance/substance group *Lygal[®] ointment base*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 765 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 100 spectra of 2 reference samples from the substance/substance group *Lygal[®] ointment base*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Almirall	Lygal [®] ointment base	174104	33988	40
Taurus	Lygal [®] ointment base	124904P	31704	60

- 20361 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 45 spectra from 19 *Apo-Ident* customers from 20 batches from the substance/substance group *Lygal[®] ointment base*.
- Among them are spectra of independent samples from 18 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Almiral / Gehe	Lygal [®] ointment base	175007	4
Almiral / Gehe	Lygal [®] ointment base	182905	2
Almiral/ Phönix	Lygal [®] ointment base	174106	1
Almirall	Lygal [®] ointment base	175007	1
Almirall	Lygal [®] ointment base	174106	2
Almirall	Lygal [®] ointment base	175008	1
Almirall	Lygal [®] ointment base	182002	1
Almirall/ Gehe	Lygal [®] ointment base	175008	2
almirall/gehe	Lygal [®] ointment base	174106	1
Almirall/Noweda	Lygal [®] ointment base	175008	1
Almirall/Noweda	Lygal [®] ointment base	182903	1
Caelo	Lygal [®] ointment base	174106	1
Caelo	Lygal [®] ointment base	141601P	1
Caelo	Lygal [®] ointment base	182903	1
Finteler Apotheke	Lygal [®] ointment base	1704011	1
Phoenix WE: 08.11.17 20...	Lygal [®] ointment base	172803_2	1
TAUROS PHARMA	Lygal [®] ointment base	124803	1
TAUROS PHARMA	Lygal [®] ointment base	141601P	1
Taurus	Lygal [®] ointment base	124803	2
Taurus	Lygal [®] ointment base	133401T	2
Taurus	Lygal [®] ointment base	133402	1
Taurus	Lygal [®] ointment base	141601T	1
Taurus	Lygal [®] ointment base	141603	2
Taurus	Lygal [®] ointment base	18121705	1
Taurus / Gehe	Lygal [®] ointment base	1704011	1
Taurus Pharma	Lygal [®] ointment base	133401P	1
Taurus Pharma	Lygal [®] ointment base	133401T	2
TAURUS PHARMA	Lygal [®] ointment base	141602T	1
TAURUS PHARMA	Lygal [®] ointment base	154841	1
Taurus Pharma / Gehe	Lygal [®] ointment base	133401T	1
Taurus Pharma GmbH	Lygal [®] ointment base	164803	1
Taurus Pharma GmbH	Lygal [®] ointment base	172803_2	1
Taurus/ Phönix	Lygal [®] ointment base	133401T	1
Taurus/Phönix	Lygal [®] ointment base	154841	1
TAUROS PHARMA	Lygal [®] ointment base		1

- 5502 spectra from 490 *Apo-Ident* customers from a total of 2698 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Lygal[®] ointment base* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Lygal[®] ointment base* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	100	0	20 361
Type C	0	43	2	5502

The substance/substance group *Lygal[®] ointment base* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9442 %)	100.0000 % (> 94.0000 %)
Type C	100.0000 % (> 98.7735 %)	95.5556 % (> 88.8889 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Lygal[®] ointment base* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Lygal [®] head ointment N 3%	20.12	—
Stomahesive [®] adhesive paste	38.96	—
Asche Basis [®] fat ointment	103.35	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Lygal[®] ointment base* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33244	33244	0.00	27.85
32749	32749	0.00	26.08
31014	31014	0.00	21.75
32772	32772	0.00	31.42
33297	33297	0.00	23.66

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Mandarin oil, green**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33798-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Mandarin oil, green

Special notes

When selecting the *Mandarin oil, green* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Mandarin oil, green	2	2	1

Second-stage model

For differentiation of the substance/substance group *Mandarin oil, green* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Mandarin oil, green*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Mandarin oil, gr...	00431E25	33798	40	not required
Primavera	Mandarin oil, gr...	00381H25	33806	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Mandarin oil, green*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Mandarin oil, green*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Mandarin oil, green	00425M25	33960	40
Primavera	Mandarin oil, green	00350J26	34397	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 1 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Mandarin oil, green*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Mandarin oil, green	110776-2806	1

- 5546 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Mandarin oil, green* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Mandarin oil, green* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	80	0	20 381
Type C	0	1	0	5546

The substance/substance group *Mandarin oil, green* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.8428 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Mandarin oil, green* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citric oil	25.45	—
Lime oil	29.18	—
Grapefruit oil, organic	37.29	—
Orange oil	50.27	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Mandarin oil, green* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33798	33798	0.00	24.88
33806	33806	0.00	25.28

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Manuka oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31545-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Manuka oil; Oleum leptospermum scoparium

Special notes

When selecting the *Manuka oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Manuka oil	3	2	10

Second-stage model

For differentiation of the substance/substance group *Manuka oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Manuka oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Manuka oil	1235-116650	31545	60	not required
Taoasis	Manuka oil	14286-119821	31655	60	not required
Taoasis	Manuka oil	83579-2408	33994	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Manuka oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Manuka oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Manuka oil	00476A27	34390	40
Taoasis	Manuka oil	42798-125299	32799	40
Taoasis	Manuka oil	42798-125299	33198	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 19 spectra from 2 *Apo-Ident* customers from 11 batches from the substance/substance group *Manuka oil*.
- Among them are spectra of independent samples from 10 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Manuka oil	36968-121509	1
Taoasis	Manuka oil	23694-122415	1
Taoasis	Manuka oil	23694-123569	1
Taoasis	Manuka oil	42798-125299	3
Taoasis	Manuka oil	65261-127051	1
Taoasis	Manuka oil	42798-126332	2
Taoasis	Manuka oil	83579-2220	4
Taoasis	Manuka oil	96134-2927	3
Taoasis	Manuka oil	2501-3536	1
Taoasis	Manuka oil	96134-2223	1
Canea Pharma GmbH	Manuka oil		1

- 5528 spectra from 490 *Apo-Ident* customers from a total of 2707 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Manuka oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Manuka oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	120	0	20 341
Type C	0	19	0	5528

The substance/substance group *Manuka oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7757 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Manuka oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Vetiver bourbon oil	25.64	–
Citrus oil	39.68	–
Immortelle oil	43.30	–
Cardamom oil	45.22	–
Hyssop oil	48.47	–
Cumin oil	49.00	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Manuka oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31545	31545	0.00	34.71
31655	31655	0.00	33.96
33994	33994	0.00	25.34

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Marjoram oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30454-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Marjoram oil; Majoranae aetheroleum

Special notes

When selecting the *Marjoram oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Marjoram oil	5	1	19

Second-stage model

For differentiation of the substance/substance group *Marjoram oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Marjoram oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Marjoram oil	16170005	32819	40	not required
Caelo	Marjoram oil	190992	34436	40	20190410*
Taoasis	Marjoram oil	130312-111991BAG90451	31137	40	not required
Taoasis	Marjoram oil	3701004-121123	32067	60	not required
Taoasis	Marjoram oil	1700187-3444	34275	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 220 spectra of 5 reference samples from the substance/substance group *Marjoram oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 5 different batches.
- 23 745 spectra from a total of 485 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Marjoram oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Marjoram oil	1838-125624	32478	40
Caelo	Marjoram oil	16170005	32919	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 32 spectra from 8 *Apo-Ident* customers from 19 batches from the substance/substance group *Marjoram oil*.
- Among them are spectra of independent samples from 19 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Marjoram oil	278279	1
Caelo	Marjoram oil	13121301	1
Caelo	Marjoram oil	12041602	7
Caelo	Marjoram oil	15051505	1
Caelo	Marjoram oil	13041603	2
Caelo	Marjoram oil	13041606	1
Caelo	Marjoram oil	14198304	1
Caelo	Marjoram oil	13041601	1
Taoasis	Marjoram oil	29293-98717	1
Taoasis	Marjoram oil	130312-111347	1
Taoasis	Marjoram oil	130312-111870	1
Taoasis	Marjoram oil	130910-116960	1
Taoasis	Marjoram oil	130910-117430	1
Taoasis	Marjoram oil	3701004-119994	2
Taoasis	Marjoram oil	1631-122347	1
Taoasis	Marjoram oil	1631-124621	1
Taoasis	Marjoram oil	1838-127470	3
Taoasis	Marjoram oil	1987-1387	3
Taoasis	Marjoram oil	1987-767	1
Taoasis/Gehe	Marjoram oil	29293-98717	1

- 5515 spectra from 490 *Apo-Ident* customers from a total of 2699 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Marjoram oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Marjoram oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following

table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	220	0	23 745
Type B	0	80	0	20 381
Type C	0	31	1	5515

The substance/substance group *Marjoram oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.2727 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7742 %)	96.8750 % (> 87.5000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Marjoram oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Carrot seed oil	22.62	–
Tea tree oil	26.48	–
Cypress oil	63.37	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Marjoram oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31137	31137	0.00	66.50
32067	32067	0.00	41.58
34275	34275	0.00	69.29

continued on the next page

continued from previous page

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32819	32819	0.00	52.42
34436	34436	0.00	45.27

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Matricaria oil, morrocan**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30844-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Matricaria oil, morrocan; Oleum ormenis multicaulis

Special notes

When selecting the *Matricaria oil, morrocan* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Matricaria oil, morrocan	3	3	2

Second-stage model

For differentiation of the substance/substance group *Matricaria oil, morrocan* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Matricaria oil, morrocan*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Matricaria oil, ...	140124-116959	31579	60	not required
Taoasis	Matricaria oil, ...	6121017-122184	31841	60	not required
Taoasis	Matricaria oil, ...	1629-124596	32269	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Matricaria oil, morrocan*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Matricaria oil, morrocan*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Matricaria oil, morrocan	6982-1074109BAC90451	30844	40
Taoasis	Matricaria oil, morrocan	1629-125295	32480	40
Taoasis	Matricaria oil, morrocan	1814-126707	33020	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 1 *Apo-Ident* customers from 2 batches from the substance/substance group *Matricaria oil, morrocan*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Matricaria oil, morrocan	6631-104465	1
Taoasis	Matricaria oil, morrocan	6159-93239	1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Matricaria oil, morrocan* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Matricaria oil, morrocan* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	112	8	20 341
Type C	0	1	1	5545

The substance/substance group *Matricaria oil, morrocan* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	93.3333 % (> 90.8333 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Matricaria oil, morrocan* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Thyme oil, white	28.87	—
Citrus oil	40.54	—
Marjoram oil	42.99	—
Angelica root oil	45.07	—
Carrot seed oil	52.23	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Matricaria oil, morrocan* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31579	31579	0.00	37.97
31841	31841	0.00	40.04
32269	32269	0.00	49.83

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Matricaria oil, roman**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31254-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Matricaria oil, roman; Oleum anthemis nobilis

Special notes

When selecting the *Matricaria oil, roman* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Matricaria oil, roman	3	1	9

Second-stage model

For differentiation of the substance/substance group *Matricaria oil, roman* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Matricaria oil, roman*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Matricaria oil, ...	34561-112874	31254	40	not required
Taoasis	Matricaria oil, ...	1850119-119823	31686	60	not required
Taoasis	Matricaria oil, ...	2033-843	33989	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Matricaria oil, roman*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Matricaria oil, roman*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Matricaria oil, roman	8941-125875	32796	40
Taoasis	Matricaria oil, roman	8941-125875	32978	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 19 spectra from 1 *Apo-Ident* customers from 9 batches from the substance/substance group *Matricaria oil, roman*.
- Among them are spectra of independent samples from 9 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Matricaria oil, roman	1850119-116753	1
Taoasis	Matricaria oil, roman	1511-122183	1
Taoasis	Matricaria oil, roman	1850119-118138	1
Taoasis	Matricaria oil, roman	1850119-121467	1
Taoasis	Matricaria oil, roman	1850119-119451	1
Taoasis	Matricaria oil, roman	1638-123706	1
Taoasis	Matricaria oil, roman	8941-125875	1
Taoasis	Matricaria oil, roman	1930-126600	7
Taoasis	Matricaria oil, roman	2033-3091	5

- 5528 spectra from 490 *Apo-Ident* customers from a total of 2709 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Matricaria oil, roman* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Matricaria oil, roman* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	70	10	20 381
Type C	0	19	0	5528

The substance/substance group *Matricaria oil, roman* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	87.5000 % (> 83.7500 %)
Type C	100.0000 % (> 98.7757 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Matricaria oil, roman* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Hyssop oil	33.84	—
Sage oil	36.19	—
Rosemary camphor oil	49.29	—
Citrus oil	53.71	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Matricaria oil, roman* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31254	31254	0.00	36.15
31686	31686	0.00	37.23
33989	33989	0.00	33.84

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Melissa oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33800-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Melissa oil

Special notes

When selecting the *Melissa oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Melissa oil	4	1	0

Second-stage model

For differentiation of the substance/substance group *Melissa oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Melissa oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Melissa oil	00720H25	33800	40	not required
Primavera	Melissa oil	00010J26	34298	30	not required
Primavera	Melissa oil	00026A27	34404	40	not required
Taoasis	Melissa oil	640	33831	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 150 spectra of 4 reference samples from the substance/substance group *Melissa oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 815 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Melissa oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Melissa oil	00065E26	34166	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Melissa oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Melissa oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Melissa oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	150	0	23 815
Type B	0	0	40	20 421
Type C	0	0	0	5547

The substance/substance group *Melissa oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.0000 %)
Type B	100.0000 % (> 99.9446 %)	0.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Melissa oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Immortelle oil	15.47	—
Ginger oil	22.91	—
Lemon grass oil	32.99	—
Cedar wood oil	33.32	—
Spearmint oil	36.37	—
Swiss pine oil	36.42	—
Citrus oil	36.75	—
Cypress oil	40.08	—
Myrtle oil	40.33	—
Citronella oil	44.55	—
Vetiver bourbon oil	48.31	—
Marjoram oil	48.32	—
Lime oil	50.24	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Melissa oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33800	33800	0.00	20.58
34298	34298	0.00	17.85
34404	34404	0.00	17.21
33831	33831	0.00	20.43

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Melissa oil 30%**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33812-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Melissa oil 30%; Melissa 30% (essential oil)

Special notes

When selecting the *Melissa oil 30%* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Melissa oil 30%	2	1	0

Second-stage model

For differentiation of the substance/substance group *Melissa oil 30%* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Melissa oil 30%*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Melissa oil 30%	01029J25	33812	40	not required
Primavera	Melissa oil 30%	00344A26	33962	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Melissa oil 30%*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 30 spectra of 1 reference samples from the substance/substance group *Melissa oil 30%*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Melissa oil 30%	00362G26	34297	30

- 20 431 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Melissa oil 30%*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Melissa oil 30%* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Melissa oil 30%* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	30	0	20 431
Type C	0	0	0	5547

The substance/substance group *Melissa oil 30%* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9449 %)	100.0000 % (> 80.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Melissa oil 30%* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Petitgrain oil	27.25	—
Neroli oil	31.82	—
Thyme oil, white	38.19	—
Lavender oil	41.80	—
Coriander oil	44.30	—
Spearmint oil	46.45	—
Juniper oil	47.92	—
Matricaria oil, morrocan	50.08	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Melissa oil 30%* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33812	33812	0.00	27.25
33962	33962	0.00	29.88

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Myrrh oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30748-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Myrrh oil; Oleum myrrha

Special notes

When selecting the *Myrrh oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Myrrh oil	3	2	4

Second-stage model

For differentiation of the substance/substance group *Myrrh oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Myrrh oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Myrrh oil	30007-120958	31692	60	not required
Taoasis	Myrrh oil	41197-124418BAG90451	32271	40	not required
Taoasis	Myrrh oil	2206-2428	33992	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Myrrh oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Myrrh oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Myrrh oil	22920-105398BAG90451	30748	40
Taoasis	Myrrh oil	41197-126694	33050	40
Taoasis	Myrrh oil	41197-126694	33051	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 5 spectra from 2 *Apo-Ident* customers from 4 batches from the substance/substance group *Myrrh oil*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Myrrh oil	2067-107953	1
Taoasis	Myrrh oil	2206-1873	2
Taoasis	Myrrh oil	17F02206-4099	1
Taoasis	Myrrh oil	2379-6234	1

- 5542 spectra from 490 *Apo-Ident* customers from a total of 2714 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Myrrh oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Myrrh oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	79	41	20 341
Type C	0	4	1	5542

The substance/substance group *Myrrh oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9441 %)	65.8333 % (> 63.3333 %)
Type C	100.0000 % (> 98.7861 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Myrrh oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Orange oil	49.69	–
Grapefruit oil, organic	52.86	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Myrrh oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32271	32271	0.00	156.53
33992	33992	0.00	44.68
31692	31692	0.00	112.85

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Neroli oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31260-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Neroli oil; Oleum neroli

Special notes

When selecting the *Neroli oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Neroli oil	4	2	0

Second-stage model

For differentiation of the substance/substance group *Neroli oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Neroli oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Neroli oil	00237B27	34406	40	not required
Taoasis	Neroli oil	91029-115714	31260	40	not required
Taoasis	Neroli oil	6142-120057BAG90451	31695	60	not required
Taoasis	Neroli oil	0717/4-3018	34283	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Neroli oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Neroli oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Neroli oil	125052-124958	32805	40
Taoasis	Neroli oil	071704-1966	33993	40
Taoasis	Neroli oil	125052-124958	33042	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Neroli oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Neroli oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Neroli oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	40	80	20 341
Type C	0	0	0	5547

The substance/substance group *Neroli oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9441 %)	33.3333 % (> 30.8333 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Neroli oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Coriander oil	32.19	—
Thyme oil, white	38.38	—
Lavender oil	43.70	—
Matricaria oil, morrocan	47.08	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Neroli oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31695	31695	0.00	50.43
31260	31260	0.00	46.78
34283	34283	0.00	53.39
34406	34406	0.00	43.70

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Neuroderm® moisturising cream lipo**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30721-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Neuroderm® moisturising cream lipo

Special notes

When selecting the *Neuroderm® moisturising cream lipo* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Neuroderm® moisturising cream lipo	3	2	1

Second-stage model

For differentiation of the substance/substance group *Neuroderm[®] moisturising cream lipo* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Neuroderm[®] moisturising cream lipo*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Infectopharm	Neuroderm [®] moist...	S031202.1	30721	40	not required
Infectopharm	Neuroderm [®] moist...	S031506.1	31672	60	not required
Infectopharm	Neuroderm [®] moist...	S051723.1	34045	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Neuroderm[®] moisturising cream lipo*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Neuroderm[®] moisturising cream lipo*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Infectopharm	Neuroderm [®] moisturising crea...	S071617.2	32739	40
Infectopharm	Neuroderm [®] moisturising crea...	S021706.1	33287	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 2 *Apo-Ident* customers from 2 batches from the substance/substance group *Neuroderm® moisturising cream lipo*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Infectopharm	Neuroderm® moisturising crea...		1
Infectopharm/AHD	Neuroderm® moisturising crea...		1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Neuroderm® moisturising cream lipo* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Neuroderm® moisturising cream lipo* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	2	0	5545

The substance/substance group *Neuroderm® moisturising cream lipo* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Neuroderm® moisturising cream lipo* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Lipolotio urea 5% F body lotion	24.65	—
Dermatest base ointment	25.08	—
Allergika evening primrose oil cream 20%	52.68	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Neuroderm® moisturising cream lipo* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30721	30721	0.00	30.94
31672	31672	0.00	24.50
34045	34045	0.00	30.47

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Nicotine**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31019-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Nicotine

Special notes

When selecting the *Nicotine* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Nicotine	3	1	0

Second-stage model

For differentiation of the substance/substance group *Nicotine* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Nicotine*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Roth	Nicotine	152183017	31019	20	1402687
Roth	Nicotine	194210173	31508	60	1410523
Roth	Nicotine	194210173	31518	60	not required
Roth	Nicotine	116210173	31948	45	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 185 spectra of 4 reference samples from the substance/substance group *Nicotine*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 780 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Nicotine*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Roth	Nicotine	137210173	33291	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Nicotine*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Nicotine* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Nicotine* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	185	0	23 780
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Nicotine* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.7568 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Nicotine* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Dichloroacetic acid	153.15	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Nicotine* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31019	31019	0.00	169.96
31508	31508	0.00	168.62
31518	31518	0.00	168.94
31948	31948	0.00	169.55

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Ointment ash basis / Neribas [®]
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30774-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Ointment ash basis / Neribas[®]; Asche Basis[®] ointment; Neribas[®] ointment

Special notes

When selecting the *Ointment ash basis / Neribas[®]* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Asche Basis [®] ointment	1	2	42
Neribas [®] ointment	2	2	49

Second-stage model

For differentiation of the substance/substance group *Ointment ash basis* / *Neribas*[®] the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Ointment ash basis* / *Neribas*[®]:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Chiesi	Asche Basis [®] oin. ...	21038A	30774	40	not required
Chiesi	Asche Basis [®] oin. ...	21038A	30833	40	not required
Chiesi	Asche Basis [®] oin. ...	21038A	31080	40	not required
Bayer	Neribas [®] ointment	21053B	30969	40	not required
Bayer	Neribas [®] ointment	21053B	30994	40	not required
Jenapharm	Neribas [®] ointment	31064C	31093	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 240 spectra of 6 reference samples from the substance/substance group *Ointment ash basis* / *Neribas*[®]. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 725 spectra from a total of 487 batches from further 158 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 240 spectra of 6 reference samples from the substance/substance group *Ointment ash basis* / *Neribas*[®].
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Chiesi	Asche Basis [®] ointment	61067A	32590	40
Chiesi	Asche Basis [®] ointment	17072A	33840	40
Jenapharm	Neribas [®] ointment	YY00TJ0	32564	40
Jenapharm	Neribas [®] ointment	YY016EC	33288	40
Chiesi	Asche Basis [®] ointment	61067A	32924	40
Chiesi	Asche Basis [®] ointment	61067A	32927	40

- 20 221 spectra from a total of 433 batches from further 202 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 178 spectra from 43 *Apo-Ident* customers from 91 batches from the substance/substance group *Ointment ash basis / Neribas[®]*.
- Among them are spectra of independent samples from 90 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Anzag/Ichtyol-Gesellsch...	Asche Basis [®] ointment	23043A	1
Caelo	Asche Basis [®] ointment	31047A	1
Caelo	Asche Basis [®] ointment	81708A	1
Caelo	Asche Basis [®] ointment	83079A	2
Chiese	Asche Basis [®] ointment	63069A	1
Chiese	Asche Basis [®] ointment	63070A	1
Chiese	Asche Basis [®] ointment	71073A	2
Chiese/Sanacorp WE:07.0...	Asche Basis [®] ointment	52062A	1
chiesi	Asche Basis [®] ointment	42055A	1
chiesi	Asche Basis [®] ointment	44057A	1
Chiesi	Asche Basis [®] ointment	32048A	1
Chiesi	Asche Basis [®] ointment	33049A	1
Chiesi	Asche Basis [®] ointment	34051A	1
Chiesi	Asche Basis [®] ointment	41052A	1
Chiesi	Asche Basis [®] ointment	41054A	3
Chiesi	Asche Basis [®] ointment	510604	1
Chiesi	Asche Basis [®] ointment	51060A	1
Chiesi	Asche Basis [®] ointment	52062A	3
Chiesi	Asche Basis [®] ointment	52063A	2
Chiesi	Asche Basis [®] ointment	53065A	1
Chiesi	Asche Basis [®] ointment	63068A	1
Chiesi	Asche Basis [®] ointment	83079A	1
Chiesi / Gehe	Asche Basis [®] ointment	33049A	1
Chiesi / Gehe	Asche Basis [®] ointment	33050A	1
chiesi / Gehe	Asche Basis [®] ointment	73075A	1
Chiesi GmbH	Asche Basis [®] ointment	21039A	1
Chiesi GmbH	Asche Basis [®] ointment	52062A	1
Chiesi GmbH	Asche Basis [®] ointment	52064A	3
Chiesi GmbH	Asche Basis [®] ointment	52063A	3
Chiesi GmbH	Asche Basis [®] ointment	53065A	4
Chiesi GmbH	Asche Basis [®] ointment	61066A	2
Chiesi GmbH	Asche Basis [®] ointment	63069A	3

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Chiesi GmbH	Asche Basis [®] ointment	63070A	2
Chiesi GmbH	Asche Basis [®] ointment	71071A	1
Chiesi GmbH	Asche Basis [®] ointment	71073A	1
Chiesi GmbH	Asche Basis [®] ointment	71072A	1
Chiesi GmbH	Asche Basis [®] ointment	72074A	1
Chiesi/ Anzag	Asche Basis [®] ointment	83079A	1
CHIESI/ NOWEDA	Asche Basis [®] ointment	51060A	2
Chiesi/AHD	Asche Basis [®] ointment	31047A	1
Chiesi/AHD	Asche Basis [®] ointment	33049A	1
Chiesi/Anzag	Asche Basis [®] ointment	1(92084A)	1
chiesi/gehe	Asche Basis [®] ointment	71072A	1
Chiesi/Gehe	Asche Basis [®] ointment	42056A	1
Chiesi/Gehe	Asche Basis [®] ointment	83079A	1
Chiesi/Jenne	Asche Basis [®] ointment	73076A	1
Chiesi/Jenne	Asche Basis [®] ointment	74077A	2
Chiesi/Noweda	Asche Basis [®] ointment	71072A	1
Chiesi/Phoenix	Asche Basis [®] ointment	31045A	4
Chiesi/Phoenix	Asche Basis [®] ointment	23042A	1
Chiesi/Phoenix	Asche Basis [®] ointment	73076A	1
Chiesi/Phoenix	Asche Basis [®] ointment	73075A	1
Chiesi/Phönix	Asche Basis [®] ointment	51059A	1
Chiesi/Phönix	Asche Basis [®] ointment	72074A	2
Chiesi/Phönix	Asche Basis [®] ointment	81078A	1
Chiesi/Phönix	Asche Basis [®] ointment	84081A	2
Chiesi/Sanacorp	Asche Basis [®] ointment	41053A	1
Chiesi/Sanacorp	Asche Basis [®] ointment	71072A	1
Chiesi/Sanacorp	Asche Basis [®] ointment	83080A	1
Gehe	Asche Basis [®] ointment	17I21-B01	1
Caelo	Asche Basis [®] ointment	63068A	3
Caelo	Asche Basis [®] ointment	61067A	1
Noweda	Asche Basis [®] ointment	71072A	1
Phönix	Asche Basis [®] ointment	31047A	1
PPL	Asche Basis [®] ointment	61067A	1
PPL	Asche Basis [®] ointment	71072A	2
PPL	Asche Basis [®] ointment	73075A	1
Sanacorp WE 29.04.17 -8...	Asche Basis [®] ointment	63070A	1
Sanacorp/Chiesi WE:31.0...	Asche Basis [®] ointment	41054A	1
SanacorpWE:9.12.2016 ...	Asche Basis [®] ointment	63068A	1
WE:27.02.2016 Sanacor...	Asche Basis [®] ointment	52063A	1
WE:Sanacorp19.01.2016 ...	Asche Basis [®] ointment	52064A	2
WE14.12.16 Chiesi/Sanac...	Asche Basis [®] ointment	61067A	2
Wolff/AHD	Asche Basis [®] ointment	32048A	2
Bayer/ Sanacorp	Neribas [®] ointment	YY006JT	3
Caelo	Neribas [®] ointment	YY016EC	1
Caelo	Neribas [®] ointment	YY00TJ0	1
Caelo	Neribas [®] ointment	YY00XEH	1
Caelo	Neribas [®] ointment	YY016LN	1
Caelo	Neribas [®] ointment	YY00CC8	1
Gehe	Neribas [®] ointment	YY023JE	1
Jenaparm	Neribas [®] ointment	12091812	1
Jenapharm	Neribas [®] ointment	YY006JT	1
Jenapharm	Neribas [®] ointment	YY00XEH	1
Jenapharm	Neribas [®] ointment	YY016LN	2
Jenapharm	Neribas [®] ointment	YY00TJ0	1
Jenapharm	Neribas [®] ointment	YY017LF	1
Jenapharm	Neribas [®] ointment	YY01FX4	3
Jenapharm	Neribas [®] ointment	YY01KHH	1
Jenapharm	Neribas [®] ointment	YY01TF3	1
Jenapharm	Neribas [®] ointment	5121811	1
Jenapharm / Anzag	Neribas [®] ointment	YY00THL	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Jenapharm / Anzag	Neribas [®] ointment	75 (YY02825)	1
Jenapharm / Anzag	Neribas [®] ointment	76 (YY02825)	1
Jenapharm / Anzag	Neribas [®] ointment	80 (YY02L27)	1
Jenapharm / Anzag	Neribas [®] ointment	84 (YY02L88)	1
Jenapharm Anzag	Neribas [®] ointment	70 (YY01YEX)	1
Jenapharm Anzag	Neribas [®] ointment	71 (YY023J1)	1
Jenapharm Anzag	Neribas [®] ointment	72 (YY02835)	1
Jenapharm Anzag	Neribas [®] ointment	81 (YY02L27)	1
Jenapharm Anzag	Neribas [®] ointment	82 (YY02L88)	1
Jenapharm Anzag	Neribas [®] ointment	83 (YY02L88)	1
Jenapharm GmbH	Neribas [®] ointment	YY019PE	1
Jenapharm/ Anzag	Neribas [®] ointment	YY00K7E	2
Jenapharm/ Anzag	Neribas [®] ointment	77 (YY02825)	1
Jenapharm/ Anzag	Neribas [®] ointment	78 (YY02L27)	1
Jenapharm/ Anzag	Neribas [®] ointment	79 (YY02L27)	1
Jenapharm/ Gehe	Neribas [®] ointment	YY023J1	1
Jenapharm/ Gehe	Neribas [®] ointment	YY02825	2
Jenapharm/ Gehe	Neribas [®] ointment	YY02L27	1
Jenapharm/ Gehe	Neribas [®] ointment	YY02L88	1
Jenapharm/ Sanacorp	Neribas [®] ointment	YY00THL	1
Jenapharm/ Sanacorp	Neribas [®] ointment	YY01TF3	2
Jenapharm/AHD	Neribas [®] ointment	58 (YY0180C)	1
Jenapharm/AHD	Neribas [®] ointment	59 (YY01KHH)	1
Jenapharm/AHD	Neribas [®] ointment	58 (YY01FX4)	1
Jenapharm/AHD	Neribas [®] ointment	60 (YY01KHH)	2
Jenapharm/AHD	Neribas [®] ointment	61 (YY01KHH)	1
Jenapharm/AHD	Neribas [®] ointment	62 (YY01KHH)	1
Jenapharm/AHD	Neribas [®] ointment	65 (YY019PE)	1
Jenapharm/AHD	Neribas [®] ointment	66 (YY01TF3)	1
Jenapharm/AHD	Neribas [®] ointment	67 (YY01TF3)	1
Jenapharm/AHD	Neribas [®] ointment	68 (YY01YEX)	1
Jenapharm/Anzag	Neribas [®] ointment	YY00XEH	2
Jenapharm/Anzag	Neribas [®] ointment	69 (YY01YEX)	1
Jenapharm/Gehe	Neribas [®] ointment	YY01FX4	1
Jenapharm/Gehe	Neribas [®] ointment	YY01YEX	1
Jenapharm/Gehe	Neribas [®] ointment	YY023JE	1
Jenapharm/Jenne	Neribas [®] ointment	61 (YY019PE)	1
Jenapharm/Jenne	Neribas [®] ointment	YY01TF3	1
Jenapharm/Noweda	Neribas [®] ointment	YY00THL	1
Jenapharm/Phoenix	Neribas [®] ointment	YY023JE	1
Jenapharm/Phönix	Neribas [®] ointment	YY01KHH	1
Jenapharm/Sanacorp	Neribas [®] ointment	YY0180C	1
Wolf Apotheke	Neribas [®] ointment	73 (YY02825)	1
Wolf Apotheke	Neribas [®] ointment	74 (YY02825)	1
Chiesi/Jenne	Asche Basis [®] ointment		1

- 5369 spectra from 489 *Apo-Ident* customers from a total of 2627 batches from a further 141 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Ointment ash basis / Neribas[®]* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Ointment ash basis /*

Neribas[®] and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	240	0	23 725
Type B	0	240	0	20 181
Type C	0	166	12	5369

The substance/substance group *Ointment ash basis / Neribas*[®] can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9444 %)	100.0000 % (> 97.5000 %)
Type C	100.0000 % (> 98.7724 %)	93.2584 % (> 91.5730 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Ointment ash basis / Neribas*[®] in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Bepanthen [®] Wund- und Heilsalbe	23.74	—
Alfason Basis Cresa [®]	26.48	—
Linola [®] fat cream	57.22	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Ointment ash basis / Neribas*[®] is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30969	30969	0.00	37.50
30994	30994	0.00	34.18

continued on the next page

continued from previous page

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31093	31093	0.00	30.03
30774	30774	0.00	33.60
30833	30833	0.00	35.58
31080	31080	0.00	32.96

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Orange aroma**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31190-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Orange aroma; Orange flavour

Special notes

When selecting the *Orange aroma* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Orange aroma	4	6	41

Second-stage model

For differentiation of the substance/substance group *Orange aroma* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Orange aroma*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Orange aroma	13123307	31190	40	not required
Caelo	Orange aroma	13406108	31402	40	not required
Caelo	Orange aroma	163470	33100	40	20161221*
Fagron	Orange aroma	13H23-B41-295530	31510	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Orange aroma*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 785 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 240 spectra of 6 reference samples from the substance/substance group *Orange aroma*.
- Among them are spectra of independent samples from 6 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Orange aroma	162063	32331	40
Caelo	Orange aroma	173005	33881	40
Caelo	Orange aroma	180831	34076	40
Caelo	Orange aroma	182057	34224	40
Caelo	Orange aroma	183261	34323	40
Caelo	Orange aroma	190933	34629	40

- 20 221 spectra from a total of 431 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 99 spectra from 54 *Apo-Ident* customers from 43 batches from the substance/substance group *Orange aroma*.
- Among them are spectra of independent samples from 41 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Allergika/Kehr	Orange aroma	16056107	1
Audor Pharma	Orange aroma	15215409	1
Caelo	Orange aroma	23051201	1
Caelo	Orange aroma	12216712	2
Caelo	Orange aroma	25031304	1
Caelo	Orange aroma	12356503	2
Caelo	Orange aroma	13330206	1
Caelo	Orange aroma	13406104	1
Caelo	Orange aroma	14150707	3
Caelo	Orange aroma	15215402	3
Caelo	Orange aroma	15215403	2
Caelo	Orange aroma	15215410	1
Caelo	Orange aroma	16056107	4
Caelo	Orange aroma	16206301	1
Caelo	Orange aroma	16056108	1
Caelo	Orange aroma	16347005	8
Caelo	Orange aroma	17055104	1
Caelo	Orange aroma	17055103	1
Caelo	Orange aroma	17055110	1
Caelo	Orange aroma	17300509	4
Caelo	Orange aroma	18205701	4
Caelo	Orange aroma	14150706	4
Caelo	Orange aroma	16056105	7
Caelo	Orange aroma	18326103	5
Caelo	Orange aroma	17300507	5
Caelo	Orange aroma	18083103	4
Caelo	Orange aroma	14150714	1
Caelo	Orange aroma	19093301	1
Caelo	Orange aroma	14352903	1
Caelo	Orange aroma	15215401	1
Caelo	Orange aroma	17300501	3
Caelo	Orange aroma	12356502	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Orange aroma	13123305	2
Caelo	Orange aroma	13406101	2
Caelo	Orange aroma	14352904	3
Caelo	Orange aroma	15215408	2
Caelo	Orange aroma	160566107	1
Euro OTC	Orange aroma	17055103	1
Fagron	Orange aroma	17A30-B02-335197	1
Fagron	Orange aroma	17300507	1
Caelo	Orange aroma	14352906	1
Caelo	Orange aroma	13123309	1
Caelo	Orange aroma	13330207	1
Caelo	Orange aroma	14150703	1
Sanacorp	Orange aroma	12356503	1
Fagron	Orange aroma	14352904	1
Caelo	Orange aroma	13406108	2
Caelo	Orange aroma		1

- 5448 spectra from 485 *Apo-Ident* customers from a total of 2675 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Orange aroma* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Orange aroma* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	240	0	20 221
Type C	0	97	2	5448

The substance/substance group *Orange aroma* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9440 %)	100.0000 % (> 97.5000 %)
Type C	100.0000 % (> 98.7727 %)	97.9798 % (> 94.9495 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Orange aroma* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Ethanol 70% pure / denatured	35.79	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Orange aroma* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31190	31190	0.00	59.52
31402	31402	0.00	59.76
33100	33100	0.00	62.00
31510	31510	0.00	108.20

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Oregano oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31554-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Oregano oil; Oleum origani cretici

Special notes

When selecting the *Oregano oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Oregano oil	5	1	0

Second-stage model

For differentiation of the substance/substance group *Oregano oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Oregano oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Oregano oil	00256M26	34368	40	not required
Taoasis	Oregano oil	0131022-117999	31554	60	not required
Taoasis	Oregano oil	7921018-119483	31779	60	not required
Taoasis	Oregano oil	43878A-125814	32769	40	not required
Taoasis	Oregano oil	44314A-129096	33649	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 240 spectra of 5 reference samples from the substance/substance group *Oregano oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 5 different batches.
- 23 725 spectra from a total of 485 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Oregano oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Oregano oil	43878A-123201	32939	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Oregano oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Oregano oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Oregano oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	240	0	23 725
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Oregano oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Oregano oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Thyme oil, red	33.15	—
Savory herb	65.69	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Oregano oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31779	31779	0.00	140.17
31554	31554	0.00	96.78
32769	32769	0.00	48.95
34368	34368	0.00	68.72
33649	33649	0.00	51.82

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Palmarosa oil, organic**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30597-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Palmarosa oil, organic; Oleum palmarosae

Special notes

When selecting the *Palmarosa oil, organic* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Palmarosa oil, organic	3	3	3

Second-stage model

For differentiation of the substance/substance group *Palmarosa oil, organic* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Palmarosa oil, organic*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Palmarosa oil, o. . .	2461021-121891	31828	60	not required
Taoasis	Palmarosa oil, o. . .	4941003-126708	33043	40	not required
Taoasis	Palmarosa oil, o. . .	2141-3447	34289	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Palmarosa oil, organic*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 200 spectra of 5 reference samples from the substance/substance group *Palmarosa oil, organic*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Palmarosa oil, organic	00500L26	34366	40
Taoasis	Palmarosa oil, organic	17524-105015BAG90451	30597	40
Taoasis	Palmarosa oil, organic	104704-129227	33856	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Palmarosa oil, organic	17524-105015BAG90451	30671	40
Taoasis	Palmarosa oil, organic	4941003-126708	33044	40

- 20 261 spectra from a total of 433 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 5 spectra from 4 *Apo-Ident* customers from 3 batches from the substance/substance group *Palmarosa oil, organic*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Palmarosa oil, organic	121018-111094	1
Taoasis	Palmarosa oil, organic	121018-111872	2
Taoasis GmbH/ Taoasis	Palmarosa oil, organic	2587-7434	1
Taoasis/Taoasis	Palmarosa oil, organic	121018-111872	1

- 5542 spectra from 490 *Apo-Ident* customers from a total of 2715 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Palmarosa oil, organic* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Palmarosa oil, organic* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	200	0	20 261
Type C	0	5	0	5542

The substance/substance group *Palmarosa oil, organic* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 97.0000 %)
Type C	100.0000 % (> 98.7861 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Palmarosa oil, organic* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Marjoram oil	96.26	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Palmarosa oil, organic* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31828	31828	0.00	123.76
34289	34289	0.00	116.31
33043	33043	0.00	108.42

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Panthenol ointment Lichtenstein**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30727-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Panthenol ointment Lichtenstein

Special notes

When selecting the *Panthenol ointment Lichtenstein* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Panthenol ointment Lichtenstein	3	2	0

Second-stage model

For differentiation of the substance/substance group *Panthenol ointment Lichtenstein* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Panthenol ointment Lichtenstein*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Winthrop	Panthenol ointme...	2290680H	30727	40	not required
Winthrop	Panthenol ointme...	2290718H	31091	40	not required
Zentiva Pharm...	Panthenol ointme...	EH4594	31764	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Panthenol ointment Lichtenstein*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Panthenol ointment Lichtenstein*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Zentiva Pharma GmbH	Panthenol ointment Lichtenst...	GC5567	33284	40
Zentiva Pharma GmbH	Panthenol ointment Lichtenst...	GD5661	33425	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Panthenol ointment Lichtenstein*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Panthenol ointment Lichtenstein* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Panthenol ointment Lichtenstein* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	0	0	5547

The substance/substance group *Panthenol ointment Lichtenstein* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Panthenol ointment Lichtenstein* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
La Roche-Posay Cold Cream Naturel	101.10	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Panthenol ointment Lichtenstein* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31764	31764	0.00	158.75
30727	30727	0.00	191.37
31091	31091	0.00	188.29

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Patchouli oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31547-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Patchouli oil; Oleum pogostemon cablin

Special notes

When selecting the *Patchouli oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Patchouli oil	3	3	2

Second-stage model

For differentiation of the substance/substance group *Patchouli oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Patchouli oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Patchouli oil	14167204	31619	60	not required
Taoasis	Patchouli oil	130930-112789	31547	60	not required
Taoasis	Patchouli oil	FFL735-123003	32172	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Patchouli oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Patchouli oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Patchouli oil	00475B27	34389	40
Taoasis	Patchouli oil	1633-126207	33031	40
Taoasis	Patchouli oil	P29-1186	34113	40
Taoasis	Patchouli oil	1633-126207	33032	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 1 *Apo-Ident* customers from 2 batches from the substance/substance group *Patchouli oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Patchouli oil	130930-116684	1
Taoasis	Patchouli oil	33474-119161	1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Patchouli oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Patchouli oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	74	86	20 301
Type C	0	1	1	5545

The substance/substance group *Patchouli oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	46.2500 % (> 44.3750 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Patchouli oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Lemon grass oil	23.47	—
Marjoram oil	25.71	—
Carrot seed oil	29.35	—
Tea tree oil	29.59	—
Cedar wood oil	33.17	—
Immortelle oil	44.08	—
Melissa oil	49.57	—
Cypress oil	51.03	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Patchouli oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31619	31619	0.00	35.10
31547	31547	0.00	23.47
32172	32172	0.00	37.14

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Peppermint oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30930-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Peppermint oil; Oleum menthae piperitae dopp. rectific.

Special notes

When selecting the *Peppermint oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Peppermint oil	4	5	35

Second-stage model

For differentiation of the substance/substance group *Peppermint oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Peppermint oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Peppermint oil	00098J25	33809	40	not required
Taoasis	Peppermint oil	443428-83579	30930	40	not required
Taoasis	Peppermint oil	525728-109217B	30965	40	not required
Taoasis	Peppermint oil	2016104277-125426	32481	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 4 reference samples from the substance/substance group *Peppermint oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 805 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 200 spectra of 5 reference samples from the substance/substance group *Peppermint oil*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Peppermint oil	00374B26	33958	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Peppermint oil	00221G26	34168	40
Primavera	Peppermint oil	00465A27	34371	40
Taoasis	Peppermint oil	2016104277-126375	32804	40
Taoasis	Peppermint oil	104277-126684	33030	40

- 20 261 spectra from a total of 432 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 47 spectra from 23 *Apo-Ident* customers from 36 batches from the substance/substance group *Peppermint oil*.
- Among them are spectra of independent samples from 35 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Peppermint oil	18003695	1
Bombastus	Peppermint oil	307854	1
Bombastus	Peppermint oil	286204	1
Caelo	Peppermint oil	12114225	1
Caelo	Peppermint oil	16114611	1
Caelo	Peppermint oil	1703032-01	1
Caelo	Peppermint oil	18003695	1
Caelo	Peppermint oil	18208412	1
Caelo	Peppermint oil	18221701	1
Caelo	Peppermint oil	18208401	1
Caelo	Peppermint oil	9135901	1
Caelo	Peppermint oil	17188609	1
Caelo	Peppermint oil	18221716	1
Caelo	Peppermint oil	18221702	1
Euro OTC	Peppermint oil	16114611	1
Fagron	Peppermint oil	19F01-803	1
Fagron	Peppermint oil	15B11-B08-304117	1
Kögl	Peppermint oil	421211154615	1
Melsan	Peppermint oil	1705811	1
Phoenix 28.12..18	Peppermint oil	18221702	1
Taoasis	Peppermint oil	24699-117643	1
Taoasis	Peppermint oil	40076-120885	1
Taoasis	Peppermint oil	41798-121607	1
Taoasis	Peppermint oil	63561-126008	2
Taoasis	Peppermint oil	63561-125729	1
Taoasis	Peppermint oil	63561-125104	1
Taoasis	Peppermint oil	52216-123564	1
Taoasis	Peppermint oil	75404-127882	1
Taoasis	Peppermint oil	79725-126853	1
Taoasis	Peppermint oil	79725-12653	1
Taoasis	Peppermint oil	79725-128653	2
Taoasis	Peppermint oil	78725-128653	1
Taoasis	Peppermint oil	88914-2568	1
Taoasis	Peppermint oil	93360-3339	4

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Peppermint oil	1800141-3963	1
Taoasis	Peppermint oil	111455-6397	3
Taoasis/ Kehr	Peppermint oil	41798-120746H08	1
Taoasis/Kehr	Peppermint oil	127711	1
Toasis/Noweda	Peppermint oil		2

- 5500 spectra from 488 *Apo-Ident* customers from a total of 2683 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Peppermint oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Peppermint oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	190	10	20 261
Type C	0	47	0	5500

The substance/substance group *Peppermint oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	95.0000 % (> 93.5000 %)
Type C	100.0000 % (> 98.7735 %)	100.0000 % (> 87.2340 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Peppermint oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Carrot seed oil	67.50	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Peppermint oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32481	32481	0.00	70.98
33809	33809	0.00	67.40
30930	30930	0.00	85.64
30965	30965	0.00	93.82

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Perfume oil vanilla**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30665-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Perfume oil vanilla; Oleum vanillae planifoliae

Special notes

When selecting the *Perfume oil vanilla* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Perfume oil vanilla	3	1	2

Second-stage model

For differentiation of the substance/substance group *Perfume oil vanilla* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Perfume oil vanilla*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Perfume oil vani...	10293212	30665	40	not required
Caelo	Perfume oil vani...	13393501	31191	40	1403100
Caelo	Perfume oil vani...	13393501	31400	40	not required
Caelo	Perfume oil vani...	14284107	31786	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 180 spectra of 4 reference samples from the substance/substance group *Perfume oil vanilla*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 785 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Perfume oil vanilla*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Perfume oil vanilla	15316308	33439	40
Caelo	Perfume oil vanilla	15316308	33440	40

- 20381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 14 spectra from 6 *Apo-Ident* customers from 2 batches from the substance/substance group *Perfume oil vanilla*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Perfume oil vanilla	15316308	12
Caelo	Perfume oil vanilla	17054404	2

- 5533 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Perfume oil vanilla* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Perfume oil vanilla* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	180	0	23 785
Type B	0	80	0	20 381
Type C	0	14	0	5533

The substance/substance group *Perfume oil vanilla* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7770 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Perfume oil vanilla* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Salmon oil	97.52	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Perfume oil vanilla* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30665	30665	0.00	124.41
31191	31191	0.00	121.47
31400	31400	0.00	122.13
31786	31786	0.00	130.61

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Raspberry aroma**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30562-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Raspberry aroma; Raspberry flavour

Special notes

When selecting the *Raspberry aroma* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Raspberry aroma	3	4	47

Second-stage model

For differentiation of the substance/substance group *Raspberry aroma* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Raspberry aroma*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Raspberry aroma	12246612	31171	40	1402588
Caelo	Raspberry aroma	14115902	31396	40	not required
Caelo	Raspberry aroma	16126605	33222	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *Raspberry aroma*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 845 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Raspberry aroma*.
- Among them are spectra of independent samples from 4 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Raspberry aroma	12054307	30611	40
Caelo	Raspberry aroma	15438503	33054	40
Caelo	Raspberry aroma	172581	33697	40
Caelo	Raspberry aroma	192776	34746	40

- 20 301 spectra from a total of 433 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 130 spectra from 71 *Apo-Ident* customers from 50 batches from the substance/substance group *Raspberry aroma*.
- Among them are spectra of independent samples from 47 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Raspberry aroma	12054311	1
Bombastus	Raspberry aroma	12246608	1
Caelo	Raspberry aroma	11303813	1
Caelo	Raspberry aroma	12054310	1
Caelo	Raspberry aroma	12246608	2
Caelo	Raspberry aroma	12054302	1
Caelo	Raspberry aroma	12246604	1
Caelo	Raspberry aroma	13255502	2
Caelo	Raspberry aroma	13255510	1
Caelo	Raspberry aroma	14376103	2
Caelo	Raspberry aroma	14376115	4
Caelo	Raspberry aroma	15219102	3
Caelo	Raspberry aroma	15438503	8
Caelo	Raspberry aroma	16126602	3
Caelo	Raspberry aroma	16126606	2
Caelo	Raspberry aroma	17187202	4
Caelo	Raspberry aroma	17187205	5
Caelo	Raspberry aroma	17187209	1
Caelo	Raspberry aroma	17258103	1
Caelo	Raspberry aroma	17258101	4
Caelo	Raspberry aroma	17258106	2
Caelo	Raspberry aroma	18074302	4
Caelo	Raspberry aroma	18249905	1
Caelo	Raspberry aroma	18249907	2
Caelo	Raspberry aroma	18074307	4
Caelo	Raspberry aroma	17187201	1
Caelo	Raspberry aroma	15438501	7
Caelo	Raspberry aroma	12246616	2
Caelo	Raspberry aroma	16126609	3
Caelo	Raspberry aroma	13255507	2
Caelo	Raspberry aroma	19160002	1
Caelo	Raspberry aroma	13255514	2
Caelo	Raspberry aroma	17258102	4
Caelo	Raspberry aroma	17258107	3
Caelo	Raspberry aroma	16126611	1
Caelo	Raspberry aroma	17187213	1
Caelo	Raspberry aroma	14115909	1
Caelo	Raspberry aroma	17187212	8
Caelo	Raspberry aroma	18074305	1
Caelo	Raspberry aroma	171872002	1
Caelo	Raspberry aroma	12246617	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Raspberry aroma	14115913	2
Caelo	Raspberry aroma	14115912	1
Caelo	Raspberry aroma	14376109	4
Caeolo	Raspberry aroma	14376103	1
Caesar & Loretz GmbH	Raspberry aroma	18249907	1
Caesar & Loretz GmbH	Raspberry aroma	18249910	1
Caesar & Loretz GmbH	Raspberry aroma	18249911	1
Caesar & Loretz GmbH	Raspberry aroma	19160002	1
Caesar & Loretz GmbH / ...	Raspberry aroma	18249907	1
Caesar & Loretz GmbH/ AHD	Raspberry aroma	19160002	1
Caesar/Noweda	Raspberry aroma	212m-07020	1
Fagron	Raspberry aroma	18074307	1
Kehr	Raspberry aroma	16126609	1
Kehr	Raspberry aroma	17187209	1
Noweda	Raspberry aroma	14115909	1
Phoenix	Raspberry aroma	17258106	1
Phönix	Raspberry aroma	15438506	1
Phönix Gotha	Raspberry aroma	12246612	1
Rondell Apotheke	Raspberry aroma	15438501	1
Caelo	Raspberry aroma	12246612	1
Caelo	Raspberry aroma	16126605	5
Caelo	Raspberry aroma	14115902	1

- 5417 spectra from 478 *Apo-Ident* customers from a total of 2668 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Raspberry aroma* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Raspberry aroma* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	157	3	20 301
Type C	0	125	5	5417

The substance/substance group *Raspberry aroma* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	98.1250 % (> 96.2500 %)
Type C	100.0000 % (> 98.7725 %)	96.1538 % (> 93.8462 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Raspberry aroma* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Contramarum aroma	59.67	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Raspberry aroma* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31171	31171	0.00	64.47
31396	31396	0.00	68.64
33222	33222	0.00	76.25

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Ravensara oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30386-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ravensara oil; Ravensara (essentiell oil)

Special notes

When selecting the *Ravensara oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Ravensara oil	2	3	14

Second-stage model

For differentiation of the substance/substance group *Ravensara oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Ravensara oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Ravensara oil	231012-118739	31635	60	not required
Taoasis	Ravensara oil	1687-966	33854	40	not required
Taoasis	Ravensara oil	1687-966	33872	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Ravensara oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 825 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Ravensara oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Ravensara oil	00065B27	34403	40
Taoasis	Ravensara oil	1687-125316	32803	40
Taoasis	Ravensara oil	1994-3103	34285	40
Taoasis	Ravensara oil	1687-125316	33029	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 20 spectra from 1 *Apo-Ident* customers from 15 batches from the substance/substance group *Ravensara oil*.
- Among them are spectra of independent samples from 14 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Ravensara oil	2101005-116830	3
Taoasis	Ravensara oil	231012-118738	1
Taoasis	Ravensara oil	231012-119831	1
Taoasis	Ravensara oil	231012-118892	1
Taoasis	Ravensara oil	9331006-121650	3
Taoasis	Ravensara oil	231012-120291	1
Taoasis	Ravensara oil	1687-125316	1
Taoasis	Ravensara oil	1687-127661	1
Taoasis	Ravensara oil	1687-126824	1
Taoasis	Ravensara oil	59/144/17	1
Taoasis	Ravensara oil	1944-1733	1
Taoasis	Ravensara oil	1994-3103	1
Taoasis	Ravensara oil	2427-5280	1
Taoasis	Ravensara oil	1944-1388	1
Taoasis	Ravensara oil	231012-118739	2

- 5527 spectra from 490 *Apo-Ident* customers from a total of 2703 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Ravensara oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Ravensara oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	160	0	20 301
Type C	0	20	0	5527

The substance/substance group *Ravensara oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 96.2500 %)
Type C	100.0000 % (> 98.7755 %)	100.0000 % (> 70.0000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Ravensara oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Hyssop oil	23.16	—
Sage oil	27.22	—
Citrus oil	28.54	—
Rosemary camphor oil	34.06	—
Angelica root oil	36.46	—
Myrtle oil	41.15	—
Rosemary oil	42.40	—
Marjoram oil	42.52	—
Yarrow oil	43.81	—
Niaouli oil	44.65	—
Cajeput (essentielle oil)	44.91	—
Eucalyptus oil	45.11	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Ravensara oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31635	31635	0.00	23.16
33872	33872	0.00	24.61
33854	33854	0.00	25.94

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at

least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Rose-geranium oil, organic**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30536-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Rose-geranium oil, organic; Oleum pelargonium graveolens

Special notes

When selecting the *Rose-geranium oil, organic* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Rose-geranium oil, organic	3	2	20

Second-stage model

For differentiation of the substance/substance group *Rose-geranium oil, organic* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Rose-geranium oil, organic*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Rose-geranium oi...	21027-119997	31698	60	not required
Taoasis	Rose-geranium oi...	21027-121893	31776	60	not required
Taoasis	Rose-geranium oi...	21027-121893	31951	60	not required
Taoasis	Rose-geranium oi...	1616008-125056	33036	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 220 spectra of 4 reference samples from the substance/substance group *Rose-geranium oil, organic*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 745 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Rose-geranium oil, organic*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Rose-geranium oil, organic	00492L26	34372	40
Taoasis	Rose-geranium oil, organic	2260-2430	34042	40
Taoasis	Rose-geranium oil, organic	1616008-125056	33037	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 25 spectra from 8 *Apo-Ident* customers from 20 batches from the substance/substance group *Rose-geranium oil, organic*.
- Among them are spectra of independent samples from 20 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Apomix	Rose-geranium oil, organic	2260-2431	1
Biofrid	Rose-geranium oil, organic	5010	1
Bombastus	Rose-geranium oil, organic	22625-106677	1
Primavera	Rose-geranium oil, organic	8304131	1
Taoasis	Rose-geranium oil, organic	130111-110467	1
Taoasis	Rose-geranium oil, organic	130729-113060	1
Taoasis	Rose-geranium oil, organic	130111-112615	1
Taoasis	Rose-geranium oil, organic	401011-117641	1
Taoasis	Rose-geranium oil, organic	401011-117806	2
Taoasis	Rose-geranium oil, organic	21027-119121	1
Taoasis	Rose-geranium oil, organic	21027-121337	1
Taoasis	Rose-geranium oil, organic	21027-120292	1
Taoasis	Rose-geranium oil, organic	1500969-123554	1
Taoasis	Rose-geranium oil, organic	A1616008-128497	1
Taoasis	Rose-geranium oil, organic	1840-374	2
Taoasis	Rose-geranium oil, organic	1840-128860	2
Taoasis	Rose-geranium oil, organic	2445-3346	1
Taoasis	Rose-geranium oil, organic	2445-3947	3
Taoasis	Rose-geranium oil, organic	2445-6615	1
Taoasis/Taoasis	Rose-geranium oil, organic	22625-104463	1

- 5522 spectra from 490 *Apo-Ident* customers from a total of 2698 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Rose-geranium oil, organic* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Rose-geranium oil, organic*

and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	220	0	23 745
Type B	0	120	0	20 341
Type C	0	25	0	5522

The substance/substance group *Rose-geranium oil, organic* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.2727 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7748 %)	100.0000 % (> 76.0000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Rose-geranium oil, organic* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citronella oil	25.01	—
alpha-bisabolol (racemic) at least 85%	33.21	—
Marjoram oil	49.67	—
Carrot seed oil	52.65	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Rose-geranium oil, organic* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31698	31698	0.00	33.44
31776	31776	0.00	34.51
31951	31951	0.00	34.18
33036	33036	0.00	28.11

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Rosemary camphor oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33803-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Rosemary camphor oil

Special notes

When selecting the *Rosemary camphor oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Rosemary camphor oil	2	2	0

Second-stage model

For differentiation of the substance/substance group *Rosemary camphor oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Rosemary camphor oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Rosemary camphor...	00536K25	33803	40	not required
Primavera	Rosemary camphor...	00559B26	33959	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Rosemary camphor oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Rosemary camphor oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Rosemary camphor oil	00179G26	34170	40
Primavera	Rosemary camphor oil	00631A27	34373	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Rosemary camphor oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Rosemary camphor oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Rosemary camphor oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	80	0	20 381
Type C	0	0	0	5547

The substance/substance group *Rosemary camphor oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Rosemary camphor oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Rosemary oil	19.99	—
Eucalyptus oil	20.41	—
Hyssop oil	26.01	—
Citrus oil	27.08	—
Niaouli oil	28.44	—
Ravensara oil	31.77	—
Cajeput (essentiel oil)	33.23	—
Sage oil	37.43	—
Myrtle oil	47.24	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Rosemary camphor oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33803	33803	0.00	20.41
33959	33959	0.00	19.99

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Rosewood oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31556-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Rosewood oil; Oleum aniba roseodora

Special notes

When selecting the *Rosewood oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Rosewood oil	3	2	15

Second-stage model

For differentiation of the substance/substance group *Rosewood oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Rosewood oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Rosewood oil	11572-116545	31556	60	not required
Taoasis	Rosewood oil	4381004-120355	31688	60	not required
Taoasis	Rosewood oil	42543-2657	34106	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Rosewood oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Rosewood oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Rosewood oil	00632H26	34381	40
Taoasis	Rosewood oil	5101015-124967	32801	40
Taoasis	Rosewood oil	5101015-124967	33048	40

- 20 341 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 30 spectra from 2 *Apo-Ident* customers from 15 batches from the substance/substance group *Rosewood oil*.
- Among them are spectra of independent samples from 15 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Rosewood oil	4381004-1200355	1
Taoasis	Rosewood oil	4381004-121143	2
Taoasis	Rosewood oil	4381004-122041	2
Taoasis	Rosewood oil	5101015-123299	1
Taoasis	Rosewood oil	5101017-122566	2
Taoasis	Rosewood oil	5101015-124243	1
Taoasis	Rosewood oil	5101015-124967	3
Taoasis	Rosewood oil	42543-126343	1
Taoasis	Rosewood oil	42543-127664	1
Taoasis	Rosewood oil	42543-128666	1
Taoasis	Rosewood oil	42543-128055	2
Taoasis	Rosewood oil	42543-146	4
Taoasis	Rosewood oil	42543-2053	2
Taoasis	Rosewood oil	9177-3983	2
Taoasis	Rosewood oil	109177-5788	4
Taoasis GmbH/ Taoasis	Rosewood oil	109177-5788	1

- 5517 spectra from 490 *Apo-Ident* customers from a total of 2703 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Rosewood oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Rosewood oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	120	0	20 319
Type C	0	30	0	5517

The substance/substance group *Rosewood oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9445 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7743 %)	100.0000 % (> 80.0000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Rosewood oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Thyme oil, white	40.59	–
Coriander oil	60.40	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Rosewood oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31556	31556	0.00	45.59
31688	31688	0.00	51.94
34106	34106	0.00	40.59

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Sage oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31139-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Sage oil; Oleum salviae

Special notes

When selecting the *Sage oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Sage oil	3	1	11

Second-stage model

For differentiation of the substance/substance group *Sage oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Sage oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Sage oil	526975-112642BAG90451	31139	40	not required
Taoasis	Sage oil	34052-114939	31257	40	not required
Taoasis	Sage oil	8461016-122272	31783	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Sage oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Sage oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Sage oil	8461016-126496	33034	40
Taoasis	Sage oil	8461016-126496	33035	40

- 20381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 14 spectra from 2 *Apo-Ident* customers from 11 batches from the substance/substance group *Sage oil*.
- Among them are spectra of independent samples from 11 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Sage oil	309857	1
Taoasis	Sage oil	13988-117449	1
Taoasis	Sage oil	21190-118009	1
Taoasis	Sage oil	29944-120889	1
Taoasis	Sage oil	21190-119239	1
Taoasis	Sage oil	29944-120965	1
Taoasis	Sage oil	8461016-127221	1
Taoasis	Sage oil	8461016-774	2
Taoasis	Sage oil	8461016-2158	1
Taoasis	Sage oil	8461016-3526	2
Taoasis	Sage oil	461016-6429	2

- 5533 spectra from 490 *Apo-Ident* customers from a total of 2708 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Sage oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Sage oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	80	0	20 381
Type C	0	12	2	5533

The substance/substance group *Sage oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7770 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Sage oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Rosemary camphor oil	22.82	—
Eucalyptus oil	31.39	—
Matricaria oil, roman	35.08	—
Hyssop oil	35.39	—
Ravensara oil	38.22	—
Rosemary oil	39.05	—
Silver fir oil	45.29	—
Citrus oil	51.65	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Sage oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31783	31783	0.00	31.08
31257	31257	0.00	35.97
31139	31139	0.00	35.39

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical

variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Salicylic white paraffin 10%**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31521-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Salicylic white paraffin 10%; Acidum salicylicum cum vaselino albo 10 %

Special notes

When selecting the *Salicylic white paraffin 10%* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Salicylic white paraffin 10%	3	2	9

Second-stage model

For differentiation of the substance/substance group *Salicylic white paraffin 10%* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Salicylic white paraffin 10%*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Bombastus	Salicylic white ...	287820	31521	60	not required
Bombastus	Salicylic white ...	291886	31629	75	not required
Bombastus	Salicylic white ...	310227	33473	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 175 spectra of 3 reference samples from the substance/substance group *Salicylic white paraffin 10%*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 790 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Salicylic white paraffin 10%*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Bombastus	Salicylic white paraffin 10%	302737	32741	40
Bombastus	Salicylic white paraffin 10%	309004	33416	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 10 spectra from 7 *Apo-Ident* customers from 9 batches from the substance/substance group *Salicylic white paraffin 10%*.
- Among them are spectra of independent samples from 9 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Bombastus	Salicylic white paraffin 10%	19003777	1
Bombastus	Salicylic white paraffin 10%	17000464	1
Bombastus	Salicylic white paraffin 10%	293212	1
Caelo	Salicylic white paraffin 10%	16120701	2
Caelo	Salicylic white paraffin 10%	15394702	1
Caelo	Salicylic white paraffin 10%	16214203	1
Caelo	Salicylic white paraffin 10%	16214202	1
Caelo	Salicylic white paraffin 10%	18114703	1
Eigenrezeptur	Salicylic white paraffin 10%	150702	1

- 5537 spectra from 489 *Apo-Ident* customers from a total of 2709 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Salicylic white paraffin 10%* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Salicylic white paraffin 10%* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	175	0	23 790
Type B	0	80	0	20 381
Type C	0	10	0	5537

The substance/substance group *Salicylic white paraffin 10%* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 96.5714 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7790 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Salicylic white paraffin 10%* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Wax ointment (stabilised)	46.31	—
Neribas [®] fat ointment	48.82	—
Cottonwood ointment	52.61	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Salicylic white paraffin 10%* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31521	31521	0.00	63.08
31629	31629	0.00	62.78
33473	33473	0.00	62.39

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Salmon oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33088-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Salmon oil

Special notes

When selecting the *Salmon oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Salmon oil	2	1	0

Second-stage model

For differentiation of the substance/substance group *Salmon oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Salmon oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Salmon oil	170345	33088	40	20170213*
Caelo	Salmon oil	173079	34225	40	20171116*

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Salmon oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Salmon oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Salmon oil	182524	34341	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Salmon oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Salmon oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Salmon oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Salmon oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Salmon oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Argan oil	48.03	—
Balm Bio Nature	53.75	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Salmon oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33088	33088	0.00	44.86
34225	34225	0.00	50.94

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Sandalwood oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33799-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Sandalwood oil

Special notes

When selecting the *Sandalwood oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Sandalwood oil	3	3	0

Second-stage model

For differentiation of the substance/substance group *Sandalwood oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Sandalwood oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Sandalwood oil	00891G25	33799	40	not required
Primavera	Sandalwood oil	00141L25	33801	40	not required
Taoasis	Sandalwood oil	145-505	33832	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *Sandalwood oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 845 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Sandalwood oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Sandalwood oil	00474C26	34173	40
Primavera	Sandalwood oil	00346L26	34408	40
Taoasis	Sandalwood oil	128319	33833	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Sandalwood oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Sandalwood oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Sandalwood oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	120	0	20 341
Type C	0	0	0	5547

The substance/substance group *Sandalwood oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Sandalwood oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Savory herb	115.23	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Sandalwood oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33799	33799	0.00	132.31
33832	33832	0.00	133.18
33801	33801	0.00	142.29

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Savory herb**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33820-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Savory herb

Special notes

When selecting the *Savory herb* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Savory herb	2	1	0

Second-stage model

For differentiation of the substance/substance group *Savory herb* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Savory herb*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Savory herb	498	33820	40	not required
Taoasis	Savory herb	1569-129318	33821	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Savory herb*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Savory herb*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Savory herb	1742-3729	34281	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Savory herb*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Savory herb* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Savory herb* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Savory herb* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Savory herb* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Thyme oil, red	25.17	—
Oregano oil	41.84	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Savory herb* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33820	33820	0.00	27.86
33821	33821	0.00	25.17

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Sebexol [®] formula basis / Sebexol [®] cream lotion / Wofacutan w
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	30839-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver; Hans Karrer Hydrocream MicroSilver; Sebexol[®] basic pH 5 formula basis; Sebexol[®] cream lotion pH 5; Wofacutan wash lotion

Special notes

When selecting the *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5	<i>European Pharmacopoeia 9th Edition, Basic Version 2017</i> [3]
Komm2.2.40	<i>Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident</i> [4]
AA004	<i>Erstellung und Validierung eines IdentModul-Updates</i>

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Hans Karrer Hydrocream MicroSilver	3	2	3
Sebexol [®] basic pH 5 formula basis	3	2	49
Sebexol [®] cream lotion pH 5	5	1	73
Wofacutan wash lotion	3	1	1

Second-stage model

For differentiation of the substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hans Karrer G...	Hans Karrer Hydr...	16001	33190	40	not required
Hans Karrer G...	Hans Karrer Hydr...	16002	33191	40	not required
Hans Karrer G...	Hans Karrer Hydr...	18002	34116	40	not required
Devesa	Sebexol [®] basic p...	1307	31104	40	1403098
Devesa	Sebexol [®] basic p...	1522	31961	60	not required
Devesa	Sebexol [®] basic p...	1638124	32744	40	not required
Devesa	Sebexol [®] cream l...	1220	30839	40	1403097
Devesa	Sebexol [®] cream l...	1317	31103	40	not required
Devesa	Sebexol [®] cream l...	1412	31592	45	not required
Devesa	Sebexol [®] cream l...	1531	31839	60	not required
Devesa	Sebexol [®] cream l...	1552.2	32743	40	not required
Kesla Pharma	Wofacutan wash l...	0974.12	30972	80	not required
Kesla Pharma	Wofacutan wash l...	0389.13	31065	40	not required
Kesla Pharma	Wofacutan wash l...	0868.16	33483	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 645 spectra of 14 reference samples from the substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 14 different batches.
- 23 320 spectra from a total of 477 batches from further 156 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied

Type B spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 320 spectra of 8 reference samples from the substance/substance group *Sebexol® formula basis* / *Sebexol® cream lotion* / *Wofacutan washing lotion* / *Hans Karrer Hydrocream MicroSilver*.
- Among them are spectra of independent samples from 6 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Hans Karrer GmbH	Hans Karrer Hydrocream Micro...	16003	33192	40
Hans Karrer GmbH	Hans Karrer Hydrocream Micro...	16004	33193	40
Devesa	Sebexol® basic pH 5 formula ...	1712122	33427	40
Devesa	Sebexol® basic pH 5 formula ...	1644102	33432	40
Devesa	Sebexol® cream lotion pH 5	1605101	32907	40
Kesla Pharma	Wofacutan wash lotion	0729.16	32913	40
Devesa	Sebexol® cream lotion pH 5	1605101	32908	40
Kesla Pharma	Wofacutan wash lotion	0729.16	32914	40

- 20 141 spectra from a total of 431 batches from further 200 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 438 spectra from 77 *Apo-Ident* customers from 123 batches from the substance/substance group *Sebexol® formula basis* / *Sebexol® cream lotion* / *Wofacutan washing lotion* / *Hans Karrer Hydrocream MicroSilver*.
- Among them are spectra of independent samples from 108 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Hans Karrer / Anzag	Hans Karrer Hydrocream Micro...	18002	1
hanskarrer / Gehe	Hans Karrer Hydrocream Micro...	18001	1
Hanskarrer / Gehe	Hans Karrer Hydrocream Micro...	18002	1
Hanskarrer / Gehe	Hans Karrer Hydrocream Micro...	18003	1
Hanskarrer / Gehe	Hans Karrer Hydrocream Micro...	18004	1
Hans-Karrer GmbH	Hans Karrer Hydrocream Micro...	18003	1
Bombastus	Sebexol® basic pH 5 formula ...	1346	2
Caelo	Sebexol® basic pH 5 formula ...	1440	1
Caelo	Sebexol® basic pH 5 formula ...	1604127	2
Caelo	Sebexol® basic pH 5 formula ...	1239	1
Caelo	Sebexol® basic pH 5 formula ...	1131	2
Caelo	Sebexol® basic pH 5 formula ...	1817126	1
devesa	Sebexol® basic pH 5 formula ...	1719111	3
Devesa	Sebexol® basic pH 5 formula ...	1307	1
Devesa	Sebexol® basic pH 5 formula ...	1232	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Devesa	Sebexol [®] basic pH 5 formula ...	1232	1
Devesa	Sebexol [®] basic pH 5 formula ...	1239	1
Devesa	Sebexol [®] basic pH 5 formula ...	1328	5
Devesa	Sebexol [®] basic pH 5 formula ...	1335	2
Devesa	Sebexol [®] basic pH 5 formula ...	1404	1
Devesa	Sebexol [®] basic pH 5 formula ...	1407	2
Devesa	Sebexol [®] basic pH 5 formula ...	1430	1
Devesa	Sebexol [®] basic pH 5 formula ...	1440	4
Devesa	Sebexol [®] basic pH 5 formula ...	1511	2
Devesa	Sebexol [®] basic pH 5 formula ...	1543	5
Devesa	Sebexol [®] basic pH 5 formula ...	1604127	4
Devesa	Sebexol [®] basic pH 5 formula ...	1620117	1
Devesa	Sebexol [®] basic pH 5 formula ...	1683124	1
Devesa	Sebexol [®] basic pH 5 formula ...	1712122	2
Devesa	Sebexol [®] basic pH 5 formula ...	1644102	3
Devesa	Sebexol [®] basic pH 5 formula ...	1719111	2
Devesa	Sebexol [®] basic pH 5 formula ...	1912118	2
Devesa	Sebexol [®] basic pH 5 formula ...	1923107	1
Devesa	Sebexol [®] basic pH 5 formula ...	1851119	1
DEVESA	Sebexol [®] basic pH 5 formula ...	1318	2
DEVESA	Sebexol [®] basic pH 5 formula ...	1328	2
DEVESA	Sebexol [®] basic pH 5 formula ...	1440	2
DEVESA	Sebexol [®] basic pH 5 formula ...	1511	1
Devesa / Kehr	Sebexol [®] basic pH 5 formula ...	1644102	1
Devesa / Noweda	Sebexol [®] basic pH 5 formula ...	1620117	1
Devesa / Noweda	Sebexol [®] basic pH 5 formula ...	170420S/1620117	1
Devesa / Noweda	Sebexol [®] basic pH 5 formula ...	170516S/1644102	1
DEVESA / Noweda	Sebexol [®] basic pH 5 formula ...	1712122	3
DEVESA /G	Sebexol [®] basic pH 5 formula ...	1912118	1
Devesa Dr.Reingraber GmbH	Sebexol [®] basic pH 5 formula ...	1425	1
DEVESA Dr.Reingraber GmbH	Sebexol [®] basic pH 5 formula ...	1328	1
Devesa Dr.Reingraber Gm...	Sebexol [®] basic pH 5 formula ...	1244	1
Devesa Dr.Reingraber Gm...	Sebexol [®] basic pH 5 formula ...	1303	1
Devesa- Phönix	Sebexol [®] basic pH 5 formula ...	1604127	1
Devesa/ Ebert	Sebexol [®] basic pH 5 formula ...	1817126	1
Devesa/ Fiebig	Sebexol [®] basic pH 5 formula ...	1338	1
Devesa/ Phoenix	Sebexol [®] basic pH 5 formula ...	1543	1
Devesa/AHD	Sebexol [®] basic pH 5 formula ...	1245	4
Devesa/AHD	Sebexol [®] basic pH 5 formula ...	1328	7
Devesa/Fiebig	Sebexol [®] basic pH 5 formula ...	1620117	2
devesa/gehe	Sebexol [®] basic pH 5 formula ...	1346	1
devesa/gehe	Sebexol [®] basic pH 5 formula ...	1356	1
Devesa/Kehr	Sebexol [®] basic pH 5 formula ...	1407	2
Devesa/Kehr	Sebexol [®] basic pH 5 formula ...	1620117	1
Devesa/Noweda	Sebexol [®] basic pH 5 formula ...	1430	1
Devesa/Noweda	Sebexol [®] basic pH 5 formula ...	1638124	1
Devesa/Noweda	Sebexol [®] basic pH 5 formula ...	1604127	1
Devesa/Noweda	Sebexol [®] basic pH 5 formula ...	1719111/05	1
Devesa/Noweda	Sebexol [®] basic pH 5 formula ...	1807113	1
DEVESA/Noweda	Sebexol [®] basic pH 5 formula ...	1543	1
Devesa/Phönix	Sebexol [®] basic pH 5 formula ...	1543	2
Devesa/Phönix	Sebexol [®] basic pH 5 formula ...	1620117	2
Devesa/Phönix	Sebexol [®] basic pH 5 formula ...	1712122	2
DEVESA/Phönix	Sebexol [®] basic pH 5 formula ...	1851119	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1440	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1522	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1543	4
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1620117	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1638124	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1644102	2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1712122	1
Devesa/Sanacorp	Sebexol [®] basic pH 5 formula ...	1719111	1
Dr Reinhard GmbH- Kehr	Sebexol [®] basic pH 5 formula ...	1620117	1
Dr. Reingraber GmbH	Sebexol [®] basic pH 5 formula ...	1708120	1
Dr.Reingraber GmbH	Sebexol [®] basic pH 5 formula ...	1232	1
Eigenherstellung	Sebexol [®] basic pH 5 formula ...	1328	1
Fagron	Sebexol [®] basic pH 5 formula ...	1425	1
Fagron	Sebexol [®] basic pH 5 formula ...	1510	2
Fiebig	Sebexol [®] basic pH 5 formula ...	1511	2
Holdermann	Sebexol [®] basic pH 5 formula ...	1307	1
Ichthyol	Sebexol [®] basic pH 5 formula ...	1232	2
Kehr/ Devesa	Sebexol [®] basic pH 5 formula ...	1644102	1
Kehr/ Devesa	Sebexol [®] basic pH 5 formula ...	1746116	4
Kehr/Devesa	Sebexol [®] basic pH 5 formula ...	1817126	2
Kehr/Devesa	Sebexol [®] basic pH 5 formula ...	1828110	2
Noweda	Sebexol [®] basic pH 5 formula ...	1328	1
Noweda / Dewesa	Sebexol [®] basic pH 5 formula ...	1719111	1
Noweda/Devesa	Sebexol [®] basic pH 5 formula ...	2x1407	1
Phoenix	Sebexol [®] basic pH 5 formula ...	1440	1
Phoenix/Devesa	Sebexol [®] basic pH 5 formula ...	1215	1
Phoenix/Devesa	Sebexol [®] basic pH 5 formula ...	1407	1
Phoenix/Devesa	Sebexol [®] basic pH 5 formula ...	1604127	1
Phönix	Sebexol [®] basic pH 5 formula ...	1313	2
Phönix	Sebexol [®] basic pH 5 formula ...	1416	1
Phönix	Sebexol [®] basic pH 5 formula ...	1425	2
Phönix / Devesa	Sebexol [®] basic pH 5 formula ...	1644102	1
Sanacorp	Sebexol [®] basic pH 5 formula ...	1313	1
Sebexol	Sebexol [®] basic pH 5 formula ...	1313	1
Sebexol	Sebexol [®] basic pH 5 formula ...	1333	1
Sebexol/ Noweda	Sebexol [®] basic pH 5 formula ...	1403	1
Sebexol/ Noweda	Sebexol [®] basic pH 5 formula ...	1430	1
Sebexol/AHD	Sebexol [®] basic pH 5 formula ...	1303	2
Astellas	Sebexol [®] cream lotion pH 5	1504	2
Caelo	Sebexol [®] cream lotion pH 5	1511	2
Caelo	Sebexol [®] cream lotion pH 5	1417	1
Caelo	Sebexol [®] cream lotion pH 5	1504	1
Caelo	Sebexol [®] cream lotion pH 5	4117E-03872	1
Caelo	Sebexol [®] cream lotion pH 5	1531	1
Caelo	Sebexol [®] cream lotion pH 5	1807113	1
Deversa/Fiebig	Sebexol [®] cream lotion pH 5	1824115	1
Deversa/Fiebig	Sebexol [®] cream lotion pH 5	1817127	1
devesa	Sebexol [®] cream lotion pH 5	1746116	1
Devesa	Sebexol [®] cream lotion pH 5	1510	4
Devesa	Sebexol [®] cream lotion pH 5	1523	3
Devesa	Sebexol [®] cream lotion pH 5	1524	1
Devesa	Sebexol [®] cream lotion pH 5	1604128	1
Devesa	Sebexol [®] cream lotion pH 5	1708120	3
Devesa	Sebexol [®] cream lotion pH 5	1417N-03872	1
Devesa	Sebexol [®] cream lotion pH 5	1651121	1
Devesa	Sebexol [®] cream lotion pH 5	1727107	1
Devesa	Sebexol [®] cream lotion pH 5	1802108/01	1
Devesa	Sebexol [®] cream lotion pH 5	1604328	1
Devesa	Sebexol [®] cream lotion pH 5	1817127	1
Devesa	Sebexol [®] cream lotion pH 5	1812223	5
Devesa	Sebexol [®] cream lotion pH 5	1824115	1
Devesa	Sebexol [®] cream lotion pH 5	1901103	1
Devesa	Sebexol [®] cream lotion pH 5	1912120	1
DEVESA	Sebexol [®] cream lotion pH 5	1505	1
DEVESA	Sebexol [®] cream lotion pH 5	1510	1
DEVESA	Sebexol [®] cream lotion pH 5	1523	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
DEVESA	Sebexol [®] cream lotion pH 5	1531	1
Devesa /	Sebexol [®] cream lotion pH 5	1511	1
DEVESA / Anzag	Sebexol [®] cream lotion pH 5	1605101	1
DEVESA / Anzag	Sebexol [®] cream lotion pH 5	1802208	1
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1517	1
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1530	2
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1651120	1
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1727107	1
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1736106	2
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1746116	3
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1824215	2
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1923108	1
Devesa / Gehe	Sebexol [®] cream lotion pH 5	1935127	1
Devesa / Gehe 08.12.18	Sebexol [®] cream lotion pH 5	1824215-S20190115Ma7	1
Devesa / Gehe 15.3.18	Sebexol [®] cream lotion pH 5	1743225-20180404Ma10	1
Devesa / Noweda	Sebexol [®] cream lotion pH 5	1531	1
Devesa / Noweda	Sebexol [®] cream lotion pH 5	1720115	1
Devesa / Noweda	Sebexol [®] cream lotion pH 5	1912119	1
Devesa / Phönix	Sebexol [®] cream lotion pH 5	1812123	1
Devesa / Phönix	Sebexol [®] cream lotion pH 5	1807113	9
Devesa GmbH /Alliance H...	Sebexol [®] cream lotion pH 5	1712223	1
Devesa GmbH /Alliance H...	Sebexol [®] cream lotion pH 5	1828111	1
Devesa GmbH /Alliance H...	Sebexol [®] cream lotion pH 5	1828110	1
devesa Noweda	Sebexol [®] cream lotion pH 5	1802208	1
Devesa/ Fiebig	Sebexol [®] cream lotion pH 5	1712223	2
Devesa/ Noweda	Sebexol [®] cream lotion pH 5	1736105	1
Devesa/ Noweda	Sebexol [®] cream lotion pH 5	1802208	1
Devesa/ Phoenix	Sebexol [®] cream lotion pH 5	1620117	1
Devesa/ Phoenix	Sebexol [®] cream lotion pH 5	1817127	1
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1524	1
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1736105	2
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1727207	1
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1736106	6
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1743225	2
Devesa/ Phönix	Sebexol [®] cream lotion pH 5	1812223	3
Devesa/Fiebig	Sebexol [®] cream lotion pH 5	1426	1
Devesa/Fiebig	Sebexol [®] cream lotion pH 5	1712123	2
Devesa/Fiebig	Sebexol [®] cream lotion pH 5	1736105	5
Devesa/Fiebig	Sebexol [®] cream lotion pH 5	1824115	2
Devesa/Gehe	Sebexol [®] cream lotion pH 5	1504	1
Devesa/Gehe	Sebexol [®] cream lotion pH 5	1712123	1
Devesa/Gehe	Sebexol [®] cream lotion pH 5	1651121	1
Devesa/Gehe	Sebexol [®] cream lotion pH 5	1836106	1
Devesa/Gehe	Sebexol [®] cream lotion pH 5	1912119	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1504/01	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1504	2
Devesa/NOW	Sebexol [®] cream lotion pH 5	1523	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1552	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1604228	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1604129	1
Devesa/NOW	Sebexol [®] cream lotion pH 5	1644102	1
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1447	3
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1605201	3
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1651120	1
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1712123	1
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1736106	1
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1736105	1
Devesa/Noweda	Sebexol [®] cream lotion pH 5	1743225	1
Devesa/Phoenix	Sebexol [®] cream lotion pH 5	1511	1
devesa/Phönix	Sebexol [®] cream lotion pH 5	1727107	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
devesa/Phönix	Sebexol [®] cream lotion pH 5	1743125	5
devesa/Phönix	Sebexol [®] cream lotion pH 5	1746116	8
devesa/Phönix	Sebexol [®] cream lotion pH 5	1802208	5
devesa/Phönix	Sebexol [®] cream lotion pH 5	1824215	2
devesa/Phönix	Sebexol [®] cream lotion pH 5	18201402	1
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1824215	1
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1828111	19
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1901102	2
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1901103	6
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1912120	3
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1923108	8
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1925121	1
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1935227	6
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1939127	5
Devesa/Phönix	Sebexol [®] cream lotion pH 5	1836105	1
DEVESA/Phönix	Sebexol [®] cream lotion pH 5	185119	1
Devesa/Sanacorp	Sebexol [®] cream lotion pH 5	1511	1
Devesa/Sanacorp	Sebexol [®] cream lotion pH 5	1530	2
Devesa/Sanacorp	Sebexol [®] cream lotion pH 5	1743125	1
Devesa/Sanacorp WE: 09...	Sebexol [®] cream lotion pH 5	1651121	1
Devesa-Fa.Gehe	Sebexol [®] cream lotion pH 5	1727207/-20180112Ma9	1
Devesa-Fa.Gehe	Sebexol [®] cream lotion pH 5	1824215-S20181115Ma2	1
Devesea	Sebexol [®] cream lotion pH 5	1604128	1
Dr. Reingraber GmbH	Sebexol [®] cream lotion pH 5	1605103	1
Fagron	Sebexol [®] cream lotion pH 5	1517	1
Fiebig	Sebexol [®] cream lotion pH 5	1605101	2
Fiebig	Sebexol [®] cream lotion pH 5	1812223	1
Fiebig	Sebexol [®] cream lotion pH 5	1828111	1
Fiebig	Sebexol [®] cream lotion pH 5	1912119	1
Fiebig	Sebexol [®] cream lotion pH 5	1912120	1
Noweda	Sebexol [®] cream lotion pH 5	1651120	1
Noweda	Sebexol [®] cream lotion pH 5	1708120	1
Noweda	Sebexol [®] cream lotion pH 5	1712223	1
Caelo	Sebexol [®] cream lotion pH 5	1712223	1
Noweda/Devesa	Sebexol [®] cream lotion pH 5	1638124	1
Phoenix/Devesa	Sebexol [®] cream lotion pH 5	1812123	1
Phönix	Sebexol [®] cream lotion pH 5	1604129	1
Phönix	Sebexol [®] cream lotion pH 5	4217A-03872	1
Phönix/Devesa	Sebexol [®] cream lotion pH 5	1712123	1
Phönix/Devesa	Sebexol [®] cream lotion pH 5	1651121	1
Phönix/Devesa	Sebexol [®] cream lotion pH 5	1824115	3
Phönix/Devesa	Sebexol [®] cream lotion pH 5	1817227	2
Phönix/Devesa	Sebexol [®] cream lotion pH 5	182811	1
Rondell Apotheke	Sebexol [®] cream lotion pH 5	1523	1
Caelo	Sebexol [®] cream lotion pH 5	1430	1
sanacorp, 27.9.16,4,312EUR	Sebexol [®] cream lotion pH 5	1604328	1
Sebexol	Sebexol [®] cream lotion pH 5	1812123	1
THC Pharma	Sebexol [®] cream lotion pH 5	1727107	1
Phönix Gotha	Wofacutan wash lotion	97913	1
Devesa	Sebexol [®] basic pH 5 formula ...	1307	5
Devesa	Sebexol [®] basic pH 5 formula ...		5
Devesa	Sebexol [®] basic pH 5 formula ...	1522	3
Devesa	Sebexol [®] basic pH 5 formula ...	1638124	2
Devesa/Gehe	Sebexol [®] basic pH 5 formula ...		1
Caelo	Sebexol [®] cream lotion pH 5		2
Devesa / Gehe	Sebexol [®] cream lotion pH 5		1
Devesa/fiebig	Sebexol [®] cream lotion pH 5		1
Devesa/NOW	Sebexol [®] cream lotion pH 5		1
Devesa/Noweda	Sebexol [®] cream lotion pH 5		1
Dr. Wolff	Sebexol [®] cream lotion pH 5		1

- 5109 spectra from 486 *Apo-Ident* customers from a total of 2595 batches from a further 139 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	645	0	23 320
Type B	0	320	0	20 141
Type C	0	432	6	5109

The substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.0698 %)
Type B	100.0000 % (> 99.9440 %)	100.0000 % (> 98.1250 %)
Type C	100.0000 % (> 98.7721 %)	98.6301 % (> 97.9452 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Sebexol[®] formula basis / Sebexol[®] cream lotion / Wofacutan washing lotion / Hans Karrer Hydrocream MicroSilver* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Excipial [®] U Hydrolotio	15.23	—
Fenistil [®] Gel	23.72	—
Dimeticone ointment 10% SR	26.55	—
Linola [®] Sept	35.02	—
Amciderm [®] Base cream	35.05	—

continued on the next page

continued from previous page

Substanz	Distance in main model	Distance in second-stage model
SyrSpend [®] SF pH4 cherry aroma	36.23	—
Abitima [®] clinic face cream	37.87	—
Aloe vera gel, 10x concentrated	42.22	—
Retterspitz external	42.76	—
SyrSpend [®] SF pH4 aroma free	43.35	—
Base cream Taoasis	44.57	—
Water	48.25	—
Bepanthen [®] solution	50.61	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Sebexol[®] formula basis* / *Sebexol[®] cream lotion* / *Wofacutan washing lotion* / *Hans Karrer Hydrocream MicroSilver* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33191	33191	0.00	22.21
34116	34116	0.00	20.63
31103	31103	0.00	20.70
31839	31839	0.00	17.64
30972	30972	0.00	21.57
31065	31065	0.00	23.12
33483	33483	0.00	23.07
31104	31104	0.00	18.34
31961	31961	0.00	16.95
32744	32744	0.00	17.04
30839	30839	0.00	21.60
31592	31592	0.00	19.91
32743	32743	0.00	20.95
33190	33190	0.00	23.76

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Siam benzoin**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31490-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Siam benzoin

Special notes

When selecting the *Siam benzoin* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Siam benzoin	3	2	0

Second-stage model

For differentiation of the substance/substance group *Siam benzoin* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Siam benzoin*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Siam benzoin	3602151	31490	60	not required
Primavera	Siam benzoin	00051M23	31844	60	not required
Primavera	Siam benzoin	00074M26	34388	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Siam benzoin*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Siam benzoin*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Siam benzoin	00218C24	32184	40
Primavera	Siam benzoin	00606B26	34171	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Siam benzoin*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Siam benzoin* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Siam benzoin* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	0	20 381
Type C	0	0	0	5547

The substance/substance group *Siam benzoin* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Siam benzoin* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Cinnamon bark oil, Ceylon	102.56	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Siam benzoin* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31490	31490	0.00	102.56
31844	31844	0.00	193.30
34388	34388	0.00	224.27

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Solutio Cordes®**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30996-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Solutio Cordes®

Special notes

When selecting the *Solutio Cordes®* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Solutio Cordes®	2	2	15

Second-stage model

For differentiation of the substance/substance group *Solutio Cordes*[®] the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Solutio Cordes*[®]:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Ichthyol	<i>Solutio Cordes</i> [®]	12B006	30996	40	not required
Ichthyol	<i>Solutio Cordes</i> [®]	13B001	31076	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Solutio Cordes*[®]. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 140 spectra of 3 reference samples from the substance/substance group *Solutio Cordes*[®].
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Ichthyol	<i>Solutio Cordes</i> [®]	15B005	32065	60
Ichthyol	<i>Solutio Cordes</i> [®]	17B007	34361	40
Ichthyol	<i>Solutio Cordes</i> [®]	15B005	32483	40

- 20 321 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 58 spectra from 18 *Apo-Ident* customers from 18 batches from the substance/substance group *Solutio Cordes®*.
- Among them are spectra of independent samples from 15 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
cordes hermann & co	Solutio Cordes®	16B010	2
Fiebig	Solutio Cordes®	22314	1
Gehe/Ichthyol	Solutio Cordes®	14b006	1
Ichthol/ Noweda 13.11.18	Solutio Cordes®	17b007	1
ichthyol	Solutio Cordes®	17B008	2
Ichthyol	Solutio Cordes®	12B005	1
Ichthyol / E	Solutio Cordes®	15B005	3
Ichthyol / G	Solutio Cordes®	14B012	1
Ichthyol / G	Solutio Cordes®	16B005	3
Ichthyol / Gehe	Solutio Cordes®	14B006	1
Ichthyol /Noweda	Solutio Cordes®	12B005	1
Ichthyol /Noweda	Solutio Cordes®	13B002	1
Ichthyol Gesellschaft	Solutio Cordes®	14B006	1
Ichthyol Gesellschaft	Solutio Cordes®	14B012	1
Ichthyol- Gesellschaft ...	Solutio Cordes®	13B001	1
Ichthyol/Phönix	Solutio Cordes®	12B0005	1
Ichthyol/Phönix	Solutio Cordes®	12B005	15
Ichthyol/Phönix	Solutio Cordes®	13B002	3
Ichthyol/Phönix	Solutio Cordes®	14B011	1
Ichthyol/Phönix	Solutio Cordes®	15B001	1
Ichthyol-Gesellschaft	Solutio Cordes®	15B005	1
Ichthyol-Gesellschaft/ ...	Solutio Cordes®	18B004	1
Ichthyol-Gesellschaft/ ...	Solutio Cordes®	18B004	1
Ichtyol	Solutio Cordes®	12B006	2
Ichtyol	Solutio Cordes®	13B002	1
Ichtyol-Gesellschaft	Solutio Cordes®	14B011	4
Ichtyol-Gesellschaft	Solutio Cordes®	15B001	2
ICHTYOL-GESELLSCHAFT	Solutio Cordes®	13B001	1
Phönix	Solutio Cordes®	13B002	1
Ichthyol	Solutio Cordes®	12B006	1
Ichthyol	Solutio Cordes®	13B001	1

- 5489 spectra from 489 *Apo-Ident* customers from a total of 2700 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Solutio Cordes*[®] can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Solutio Cordes*[®] and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	140	0	20 321
Type C	0	54	4	5489

The substance/substance group *Solutio Cordes*[®] can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 98.7732 %)	93.1034 % (> 87.9310 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Solutio Cordes*[®] in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Neuroderm [®] moisturising cream	70.90	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Solutio Cordes*[®] is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30996	30996	0.00	77.54
31076	31076	0.00	78.51

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Spearmint oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30453-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Spearmint oil; Oleum mentha spicata

Special notes

When selecting the *Spearmint oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Spearmint oil	3	1	5

Second-stage model

For differentiation of the substance/substance group *Spearmint oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Spearmint oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Spearmint oil	33894-111575BAG90451	31135	30	not required
Taoasis	Spearmint oil	946-120296	31685	60	not required
Taoasis	Spearmint oil	421012-129111	33481	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 130 spectra of 3 reference samples from the substance/substance group *Spearmint oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 835 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Spearmint oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Spearmint oil	421012-126408	33200	40
Taoasis	Spearmint oil	421012-126408	33201	40

- 20381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 5 spectra from 2 *Apo-Ident* customers from 5 batches from the substance/substance group *Spearmint oil*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Spearmint oil	27537-96244	1
Taoasis	Spearmint oil	421012-123260	1
Taoasis	Spearmint oil	421012-125373	1
Taoasis	Spearmint oil	106555-973	1
Taoasis	Spearmint oil	106555-5139	1

- 5542 spectra from 490 *Apo-Ident* customers from a total of 2713 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Spearmint oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Spearmint oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	130	0	23 835
Type B	0	80	0	20 381
Type C	0	5	0	5542

The substance/substance group *Spearmint oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.3846 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7861 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several

new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Spearmint oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Dwarf pine oil	47.55	–
Angelica root oil	54.95	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Spearmint oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31135	31135	0.00	60.26
31685	31685	0.00	56.81
33481	33481	0.00	51.09

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31032-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver fir oil; Frankincense oil; Oleum abies alba; Oleum boswellia serrata; Oleum pini sibiricum; Oleum pini silvestris; Pine silvestris oil; Silver fir oil; Spruce needle oil

Special notes

When selecting the *Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver fir oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Frankincense oil	4	4	2
Pine silvestris oil	2	3	2
Silver fir oil	4	1	2
Spruce needle oil	3	4	17

Second-stage model

For differentiation of the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Frankincense oil	15181-119714	31633	60	not required
Taoasis	Frankincense oil	1509-125625	33052	40	not required
Taoasis	Frankincense oil	4314-129238	33646	40	not required
Taoasis	Frankincense oil	1500910-128786	33650	40	not required
Taoasis	Frankincense oil	1500910-128786	33652	40	not required
Primavera	Pine silvestris ...	00664E26	34177	40	not required
Taoasis	Pine silvestris ...	1790-129074	33815	30	not required
Primavera	Silver fir oil	00287M26	34391	40	not required
Taoasis	Silver fir oil	120830-111781	31032	40	not required
Taoasis	Silver fir oil	211-114751	31255	40	not required
Taoasis	Silver fir oil	01A0B15-121623	31754	60	not required
Taoasis	Spruce needle oil	1507-122520	31819	60	not required
Taoasis	Spruce needle oil	1719-124011	32066	60	not required
Taoasis	Spruce needle oil	10213-149	33726	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 630 spectra of 14 reference samples from the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 13 different batches.
- 23 335 spectra from a total of 477 batches from further 156 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples:

In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 550 spectra of 14 reference samples from the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil*.
- Among them are spectra of independent samples from 12 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Frankincense oil	00446M26	34400	40
Taoasis	Frankincense oil	3.26550	30843	40
Taoasis	Frankincense oil	1509-122197	31820	60
Taoasis	Frankincense oil	2124-2905	34277	40
Primavera	Pine silvestris oil	00398J26	34292	40
Primavera	Pine silvestris oil	00028A27	34378	40
Taoasis	Pine silvestris oil	1790-125357BAG90451	33829	40
Taoasis	Silver fir oil	01A0B16-125623	33026	40
Caelo	Spruce needle oil	11220801	30613	40
Taoasis	Spruce needle oil	29828-103169BAG90451	30672	40
Taoasis	Spruce needle oil	1769-124969	32479	40
Taoasis	Spruce needle oil	11647-2942	34112	40
Taoasis	Pine silvestris oil	1790-129074	33815 [†]	10
Taoasis	Silver fir oil	01A0B16-125623	33027	40

- 19911 spectra from a total of 424 batches from further 200 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 32 spectra from 13 *Apo-Ident* customers from 24 batches from the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil*.
- Among them are spectra of independent samples from 23 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Apoth.Bauer&Co/Noweda	Frankincense oil	3175391505	1
Taoasis	Frankincense oil	549702-112299	1
Taoasis	Pine silvestris oil	1940-5617	1
Taoasis	Pine silvestris oil	1940-6527	1
Taoasis	Silver fir oil	212-120342	1
Taoasis	Silver fir oil	30447-125444	1
Caelo	Spruce needle oil	10185604	1
Caelo	Spruce needle oil	11324401	4
Caelo	Spruce needle oil	13152001	2
Primavera	Spruce needle oil	1670814	1

continued on the next page

[†]These spectra were recorded from material of the same package as the corresponding calibration spectra (*Type A*). Hence, these spectra are not independent and are not of *Type B*.

continued from previous page

Supplier	Substance	Batch	Spectra
Taoasis	Spruce needle oil	29828-107964	1
Taoasis	Spruce needle oil	534474-111585	1
Taoasis	Spruce needle oil	531766-109893	1
Taoasis	Spruce needle oil	534374-22869	1
Taoasis	Spruce needle oil	1769-124969	2
Taoasis	Spruce needle oil	442-113922	1
Taoasis	Spruce needle oil	1769-124949	1
Taoasis	Spruce needle oil	1769-127000	2
Taoasis	Spruce needle oil	11647-1921	3
Taoasis	Spruce needle oil	114780-6023	1
Taoasis/Sanacorp	Spruce needle oil	534474-111869	1
Taoasis/Sanacorp	Spruce needle oil	534474-113171	1
Taoasis/Sanacorp	Spruce needle oil	11647-2942	1
Apoth.Bauer&Co/Noweda	Frankincense oil		1

- 5515 spectra from 490 *Apo-Ident* customers from a total of 2694 batches from a further 139 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	630	0	23 335
Type B	0	404	146	19 911
Type C	0	17	15	5515

The substance/substance group *Spruce needle oil* / *Pine silvestris oil* / *Frankincense oil* / *Silver fir oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9597 %)	100.0000 % (> 99.0476 %)
Type B	100.0000 % (> 99.9440 %)	73.4545 % (> 72.9091 %)
Type C	100.0000 % (> 98.7742 %)	53.1250 % (> 43.7500 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver fir oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Swiss pine oil	12.34	—
Spearmint oil	20.51	—
Dwarf pine oil	26.61	—
Angelica root oil	26.96	—
Citrus oil	29.60	—
Ginger oil	29.84	—
Hyssop oil	32.57	—
Citric oil	33.75	—
Marjoram oil	34.47	—
Juniper oil	38.97	—
Cypress oil	40.34	—
Myrtle oil	40.79	—
Lime oil	41.54	—
Cumin oil	48.99	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Spruce needle oil / Pine silvestris oil / Frankincense oil / Silver fir oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31754	31754	0.00	21.84
31819	31819	0.00	16.88
34177	34177	0.00	19.65
32066	32066	0.00	19.46
33726	33726	0.00	12.34
33646	33646	0.00	13.83
34391	34391	0.00	41.54
31633	31633	0.00	74.26
33650	33650	0.00	85.93
33652	33652	0.00	83.92
33052	33052	0.00	33.90
33815	33815	0.00	15.80
31032	31032	0.00	32.57
31255	31255	0.00	36.16

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at

least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Stomahesive® adhesive paste**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30974-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Stomahesive® adhesive paste

Special notes

When selecting the *Stomahesive® adhesive paste* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Stomahesive® adhesive paste	3	2	1

Second-stage model

For differentiation of the substance/substance group *Stomahesive® adhesive paste* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Stomahesive® adhesive paste*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
ConvaTec Inc.	Stomahesive® adh...	2D117	30974	80	not required
ConvaTec Inc.	Stomahesive® adh...	2M084	31087	40	not required
ConvaTec Inc.	Stomahesive® adh...	6L039	33474	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Stomahesive® adhesive paste*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Stomahesive® adhesive paste*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
ConvaTec Inc.	Stomahesive® adhesive paste	6D079	32761	40
ConvaTec Inc.	Stomahesive® adhesive paste	5G062	32954	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 24 spectra from 4 *Apo-Ident* customers from 1 batches from the substance/substance group *Stomahesive® adhesive paste*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Convatec	Stomahesive® adhesive paste	5G062	24

- 5523 spectra from 490 *Apo-Ident* customers from a total of 2717 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Stomahesive® adhesive paste* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Stomahesive® adhesive paste* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	0	20 381
Type C	0	24	0	5523

The substance/substance group *Stomahesive® adhesive paste* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7749 %)	100.0000 % (> 75.0000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Stomahesive® adhesive paste* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Lygal® head ointment N 3%	41.24	—
Lygal® ointment base	62.00	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Stomahesive® adhesive paste* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30974	30974	0.00	53.11
31087	31087	0.00	56.50
33474	33474	0.00	56.83

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Strawberry aroma**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30643-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Strawberry aroma; Strawberry flavour

Special notes

When selecting the *Strawberry aroma* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Strawberry aroma	3	3	20

Second-stage model

For differentiation of the substance/substance group *Strawberry aroma* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Strawberry aroma*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Strawberry aroma	11178804	30643	40	1402439
Caelo	Strawberry aroma	13252407	31395	40	not required
Caelo	Strawberry aroma	15411807	32814	40	not required
Caelo	Strawberry aroma	15411807	32838	40	1704074

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 4 reference samples from the substance/substance group *Strawberry aroma*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Strawberry aroma*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Strawberry aroma	14311215	32567	40
Caelo	Strawberry aroma	170246	33056	40
Caelo	Strawberry aroma	180832	34077	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Strawberry aroma	14311215	32837	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 45 spectra from 31 *Apo-Ident* customers from 22 batches from the substance/substance group *Strawberry aroma*.
- Among them are spectra of independent samples from 20 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Strawberry aroma	12183504	2
Caelo	Strawberry aroma	13252405	1
Caelo	Strawberry aroma	12183511	1
Caelo	Strawberry aroma	9101405	1
Caelo	Strawberry aroma	13252417	1
Caelo	Strawberry aroma	13252409	1
Caelo	Strawberry aroma	15411813	2
Caelo	Strawberry aroma	17024604	2
Caelo	Strawberry aroma	17024608	2
Caelo	Strawberry aroma	17024607	1
Caelo	Strawberry aroma	10184917	1
Caelo	Strawberry aroma	18083206	1
Caelo	Strawberry aroma	15411805	6
Caelo	Strawberry aroma	14311209	5
Caelo	Strawberry aroma	14311204	1
Caelo	Strawberry aroma	18083202	2
Caelo	Strawberry aroma	17024606	3
Caelo	Strawberry aroma	11178813	1
Caelo	Strawberry aroma	12183513	4
Caelo	Strawberry aroma	14311215	2
Hedinger	Strawberry aroma	14311215	1
Caelo	Strawberry aroma	13252407	2
Caelo	Strawberry aroma	15411807	2

- 5502 spectra from 488 *Apo-Ident* customers from a total of 2696 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Strawberry aroma* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose,

all relevant spectra of the various substances were compared with *Strawberry aroma* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	160	0	20 301
Type C	0	45	0	5502

The substance/substance group *Strawberry aroma* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 96.2500 %)
Type C	100.0000 % (> 98.7735 %)	100.0000 % (> 86.6667 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Strawberry aroma* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Raspberry aroma	59.68	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Strawberry aroma* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30643	30643	0.00	98.15
32814	32814	0.00	91.51
32838	32838	0.00	65.53
31395	31395	0.00	79.58

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Swiss pine oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31553-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Swiss pine oil; Oleum pinus cembra

Special notes

When selecting the *Swiss pine oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Swiss pine oil	4	2	2

Second-stage model

For differentiation of the substance/substance group *Swiss pine oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Swiss pine oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Swiss pine oil	4892-117271	31553	60	not required
Taoasis	Swiss pine oil	3023-120087	31680	60	not required
Taoasis	Swiss pine oil	12069-127103	32934	40	not required
Taoasis	Swiss pine oil	10304-128929	33645	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Swiss pine oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Swiss pine oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Swiss pine oil	00661A27	34386	40
Taoasis	Swiss pine oil	201610159-126370	32793	40

- 20 381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 2 spectra from 2 *Apo-Ident* customers from 2 batches from the substance/substance group *Swiss pine oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Swiss pine oil	6158653	1
Oswald	Swiss pine oil	9971217	1

- 5545 spectra from 490 *Apo-Ident* customers from a total of 2716 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Swiss pine oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Swiss pine oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	40	40	20 381
Type C	0	2	0	5545

The substance/substance group *Swiss pine oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9443 %)	50.0000 % (> 46.2500 %)
Type C	100.0000 % (> 98.8074 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to

exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Swiss pine oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Frankincense oil	14.59	—
Pine silvestris oil	19.06	—
Spruce needle oil	20.55	—
Angelica root oil	22.12	—
Silver fir oil	23.13	—
Dwarf pine oil	25.26	—
Spearmint oil	26.44	—
Ginger oil	32.02	—
Citrus oil	34.17	—
Cypress oil	38.25	—
Marjoram oil	40.14	—
Juniper oil	55.78	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Swiss pine oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31553	31553	0.00	21.29
32934	32934	0.00	28.92
31680	31680	0.00	14.59
33645	33645	0.00	17.83

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Tea tree oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30959-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Tea tree oil; Oleum melaleuca alternifolia

Special notes

When selecting the *Tea tree oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Tea tree oil	3	3	19

Second-stage model

For differentiation of the substance/substance group *Tea tree oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Tea tree oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Tea tree oil	533902-109942BAG91303	30959	40	not required
Taoasis	Tea tree oil	34828-113642BAG91303	31134	40	not required
Taoasis	Tea tree oil	44737-121997	31762	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 3 reference samples from the substance/substance group *Tea tree oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 825 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Tea tree oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Tea tree oil	00667A27	34396	40
Taoasis	Tea tree oil	52642-125539	33017	40
Taoasis	Tea tree oil	52642-124527	33018	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 38 spectra from 9 *Apo-Ident* customers from 19 batches from the substance/substance group *Tea tree oil*.
- Among them are spectra of independent samples from 19 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Tea tree oil	15337105	1
Caelo	Tea tree oil	15051806	2
Caelo	Tea tree oil	15051807	1
Caelo	Tea tree oil	15337106	1
Taoasis	Tea tree oil	1469-117418	2
Taoasis	Tea tree oil	20269-116833	2
Taoasis	Tea tree oil	28348-119841	1
Taoasis	Tea tree oil	28348-121597	2
Taoasis	Tea tree oil	28348-121515	1
Taoasis	Tea tree oil	52642-124559	1
Taoasis	Tea tree oil	52642-124919	1
Taoasis	Tea tree oil	52642-12078	1
Taoasis	Tea tree oil	52642-125539BAG91303	12
Taoasis	Tea tree oil	76283-129307	2
Taoasis	Tea tree oil	76283-778	1
Taoasis	Tea tree oil	90725-2423	1
Taoasis	Tea tree oil	92962-3626	2
Taoasis	Tea tree oil	92962-3613	1
Taoasis	Tea tree oil	92962-5142	3

- 5509 spectra from 489 *Apo-Ident* customers from a total of 2699 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Tea tree oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Tea tree oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	140	0	23 825
Type B	0	120	0	20 341
Type C	0	38	0	5509

The substance/substance group *Tea tree oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 98.7738 %)	100.0000 % (> 84.2105 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Tea tree oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Marjoram oil	19.85	—
Carrot seed oil	43.84	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Tea tree oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30959	30959	0.00	51.41
31134	31134	0.00	53.83
31762	31762	0.00	58.85

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Thuja oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33828-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Thuja oil; Thuja (essential oil)

Special notes

When selecting the *Thuja oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Thuja oil	2	1	0

Second-stage model

For differentiation of the substance/substance group *Thuja oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Thuja oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Thuja oil	66255-969	33828	40	not required
Taoasis	Thuja oil	66255-2932	34287	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Thuja oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Thuja oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Thuja oil	28508-121881	34038	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Thuja oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Thuja oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Thuja oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	40	0	20 421
Type C	0	0	0	5547

The substance/substance group *Thuja oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Thuja oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Cumin oil	44.86	—
Common wormwood oil	64.55	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Thuja oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33828	33828	0.00	43.20
34287	34287	0.00	46.25

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Thyme oil, red**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30929-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Thyme oil, red; Oleum thymus vulgaris

Special notes

When selecting the *Thyme oil, red* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Thyme oil, red	5	1	18

Second-stage model

For differentiation of the substance/substance group *Thyme oil, red* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Thyme oil, red*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Thyme oil, red	31911-109378	30929	40	not required
Taoasis	Thyme oil, red	9434-115427	31259	40	not required
Taoasis	Thyme oil, red	56081-124964	32482	40	not required
Taoasis	Thyme oil, red	1829-125364	32981	40	not required
Taoasis	Thyme oil, red	1976-2943	34103	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 5 reference samples from the substance/substance group *Thyme oil, red*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 5 different batches.
- 23 765 spectra from a total of 485 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 40 spectra of 1 reference samples from the substance/substance group *Thyme oil, red*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Thyme oil, red	40517-121881	32472	40

- 20 421 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 25 spectra from 3 *Apo-Ident* customers from 18 batches from the substance/substance group *Thyme oil, red*.
- Among them are spectra of independent samples from 18 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Thyme oil, red	33092-111620	1
Taoasis	Thyme oil, red	14381-117385	1
Taoasis	Thyme oil, red	25394-118296	1
Taoasis	Thyme oil, red	32444-118785	4
Taoasis	Thyme oil, red	9434-115525	1
Taoasis	Thyme oil, red	40517-121881	2
Taoasis	Thyme oil, red	33635-120088	1
Taoasis	Thyme oil, red	43637-122713	1
Taoasis	Thyme oil, red	43637-123574	1
Taoasis	Thyme oil, red	43637-122852	1
Taoasis	Thyme oil, red	43637-124964	1
Taoasis	Thyme oil, red	56081-126921	1
Taoasis	Thyme oil, red	56081-127214	1
Taoasis	Thyme oil, red	1976-3100	2
Taoasis	Thyme oil, red	1976-3455	1
Taoasis	Thyme oil, red	1976-5867	2
Taoasis	Thyme oil, red	1976-6717	1
Taoasis	Thyme oil, red	1976-5865	1
Taoasis/Sanacorp	Thyme oil, red	1976-3455	1

- 5522 spectra from 490 *Apo-Ident* customers from a total of 2700 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Thyme oil, red* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Thyme oil, red* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	40	0	20 421
Type C	0	20	5	5522

The substance/substance group *Thyme oil, red* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9446 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 98.7748 %)	80.0000 % (> 68.0000 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Thyme oil, red* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Savory herb	19.73	—
Oregano oil	21.96	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Thyme oil, red* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30929	30929	0.00	26.48
32482	32482	0.00	34.18
31259	31259	0.00	21.50
32981	32981	0.00	24.75
34103	34103	0.00	27.76

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Thyme oil, white / Coriander oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31552-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Thyme oil, white / Coriander oil; Coriander oil; Oleum coriandri; Thyme oil, white

Special notes

When selecting the *Thyme oil, white / Coriander oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Coriander oil	4	2	6
Thyme oil, white	3	3	0

Second-stage model

For differentiation of the substance/substance group *Thyme oil, white* / *Coriander oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Thyme oil, white* / *Coriander oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Coriander oil	9324-114961	31552	60	not required
Taoasis	Coriander oil	25134-117444	31690	60	not required
Taoasis	Coriander oil	104709-126301	32792	40	not required
Taoasis	Coriander oil	109291-2941	34286	40	not required
Primavera	Thyme oil, white	01067J25	33796	40	not required
Primavera	Thyme oil, white	00593E26	34176	40	not required
Taoasis	Thyme oil, white	111400-970	33818	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 320 spectra of 7 reference samples from the substance/substance group *Thyme oil, white* / *Coriander oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 7 different batches.
- 23 645 spectra from a total of 483 batches from further 158 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 200 spectra of 5 reference samples from the substance/substance group *Thyme oil, white* / *Coriander oil*.
- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Coriander oil	104709-127188	33053	40
Taoasis	Coriander oil	9291-1307	33990	40
Primavera	Thyme oil, white	00146J26	34293	40
Primavera	Thyme oil, white	00535M26	34369	40
Taoasis	Thyme oil, white	925	33819	40

- 20 261 spectra from a total of 432 batches from further 202 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 6 spectra from 6 *Apo-Ident* customers from 6 batches from the substance/substance group *Thyme oil, white / Coriander oil*.
- Among them are spectra of independent samples from 6 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Coriander oil	15229607	1
Caelo	Coriander oil	16140401	1
GEHE	Coriander oil	17050403	1
Sanacorp	Coriander oil	18125703	1
taoasis	Coriander oil	104709127	1
Taoasis	Coriander oil	9291-1307	1

- 5541 spectra from 489 *Apo-Ident* customers from a total of 2712 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Thyme oil, white / Coriander oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Thyme oil, white / Coriander oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	320	0	23 645
Type B	0	200	0	20 261
Type C	0	6	0	5541

The substance/substance group *Thyme oil, white / Coriander oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 98.1250 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 97.0000 %)
Type C	100.0000 % (> 98.7838 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Thyme oil, white / Coriander oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Matricaria oil, morrocan	20.26	—
Rosewood oil	47.28	—
Carrot seed oil	52.35	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Thyme oil, white / Coriander oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32792	32792	0.00	59.96
33796	33796	0.00	37.51
34176	34176	0.00	40.36
31552	31552	0.00	57.43
31690	31690	0.00	69.02
34286	34286	0.00	55.40
33818	33818	0.00	60.70

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances,

thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Vetiver bourbon oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31546-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Vetiver bourbon oil; Oleum vetiveria zizanoides

Special notes

When selecting the *Vetiver bourbon oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Vetiver bourbon oil	3	1	9

Second-stage model

For differentiation of the substance/substance group *Vetiver bourbon oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Vetiver bourbon oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Vetiver bourbon ...	7141-116418	31546	60	not required
Taoasis	Vetiver bourbon ...	7141-119962	31684	60	not required
Taoasis	Vetiver bourbon ...	7141-128198	33647	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 160 spectra of 3 reference samples from the substance/substance group *Vetiver bourbon oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 3 different batches.
- 23 805 spectra from a total of 487 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Vetiver bourbon oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Vetiver bourbon oil	7141-124922	32810	40
Taoasis	Vetiver bourbon oil	7141-124922	33046	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 15 spectra from 1 *Apo-Ident* customers from 9 batches from the substance/substance group *Vetiver bourbon oil*.
- Among them are spectra of independent samples from 9 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Taoasis	Vetiver bourbon oil	7141-119174	1
Taoasis	Vetiver bourbon oil	7141-122195	2
Taoasis	Vetiver bourbon oil	7141-124600	2
Taoasis	Vetiver bourbon oil	7141-123924	1
Taoasis	Vetiver bourbon oil	7141-137885	1
Taoasis	Vetiver bourbon oil	108-232	1
Taoasis	Vetiver bourbon oil	2060-1665	2
Taoasis	Vetiver bourbon oil	2060-5667	4
Taoasis	Vetiver bourbon oil	2060-3449	1

- 5532 spectra from 490 *Apo-Ident* customers from a total of 2709 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Vetiver bourbon oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Vetiver bourbon oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	160	0	23 805
Type B	0	80	0	20 381
Type C	0	15	0	5532

The substance/substance group *Vetiver bourbon oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9600 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7767 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Vetiver bourbon oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citus oil	27.48	—
Myrtle oil	29.21	—
Immortelle oil	29.95	—
Manuka oil	35.06	—
Ginger oil	39.49	—
Hyssop oil	42.44	—
Lemon grass oil	44.28	—
Marjoram oil	44.59	—
Cypress oil	52.57	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Vetiver bourbon oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31546	31546	0.00	32.33
31684	31684	0.00	30.72
33647	33647	0.00	30.98

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Wart ointment InfectoPharm® (NRF 11.31)**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30730-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Wart ointment InfectoPharm® (NRF 11.31)

Special notes

When selecting the *Wart ointment InfectoPharm® (NRF 11.31)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Wart ointment InfectoPharm® (NRF 11.31)	2	3	30

Second-stage model

For differentiation of the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31) the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31):

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Infectopharm	Wart ointment In...	S031201.1	30730	40	not required
Infectopharm	Wart ointment In...	S031201.1	30905	40	not required
Infectopharm	Wart ointment In...	S121103.1	30906	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 120 spectra of 3 reference samples from the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31). These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 845 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a †. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31).
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Infectopharm	Wart ointment InfectoPharm® ...	S021601.1	32593	40
Infectopharm	Wart ointment InfectoPharm® ...	S071602.1	32953	40
Infectopharm	Wart ointment InfectoPharm® ...	S061801.1	34517	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Infectopharm	Wart ointment InfectoPharm [®] ...	S071602.1	33515	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 134 spectra from 65 *Apo-Ident* customers from 37 batches from the substance/substance group *Wart ointment InfectoPharm[®] (NRF 11.31)*.
- Among them are spectra of independent samples from 7 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Infectopharm	Wart ointment InfectoPharm [®] ...	3013I-07003	1
Infectopharm	Wart ointment InfectoPharm [®] ...	S041301	1
Infectopharm	Wart ointment InfectoPharm [®] ...	S111202	1
InfectoPharm	Wart ointment InfectoPharm [®] ...	S0215011	1
Infectopharm GmbH	Wart ointment InfectoPharm [®] ...	s061801-1	1
InfectoPharm/Anzag	Wart ointment InfectoPharm [®] ...	716A-03898	1
Löwen City-Apotheke Bar...	Wart ointment InfectoPharm [®] ...	8032013	1
PX/Infectop	Wart ointment InfectoPharm [®] ...	S0215011	3
AHD	Wart ointment InfectoPharm [®] ...		1
Caelo	Wart ointment InfectoPharm [®] ...		2
Eigenherstellung	Wart ointment InfectoPharm [®] ...		1
Euro OTC	Wart ointment InfectoPharm [®] ...		1
Fagron	Wart ointment InfectoPharm [®] ...		4
Gehe	Wart ointment InfectoPharm [®] ...		1
GEHE	Wart ointment InfectoPharm [®] ...		3
gehe/infecto	Wart ointment InfectoPharm [®] ...		1
Ichthyol-Gesellschaft C...	Wart ointment InfectoPharm [®] ...		1
Infec/ Phönix	Wart ointment InfectoPharm [®] ...		1
Infect/PX	Wart ointment InfectoPharm [®] ...		2
infectipharm/Phönix	Wart ointment InfectoPharm [®] ...		1
Infecto/Gehe	Wart ointment InfectoPharm [®] ...		1
Infecto/Spangro	Wart ointment InfectoPharm [®] ...		1
infectopharm	Wart ointment InfectoPharm [®] ...		2
Infectopharm	Wart ointment InfectoPharm [®] ...		39
InfectoPharm	Wart ointment InfectoPharm [®] ...		6
Infectopharm (Phoenix)	Wart ointment InfectoPharm [®] ...		1
Infectopharm / Alliance...	Wart ointment InfectoPharm [®] ...		1
InfectoPharm / Alliance...	Wart ointment InfectoPharm [®] ...		2
Infectopharm / Gehe	Wart ointment InfectoPharm [®] ...		1
InfectoPharm / Gehe	Wart ointment InfectoPharm [®] ...		1
Infectopharm Arzneimittel	Wart ointment InfectoPharm [®] ...		8
InfectoPharm/ E	Wart ointment InfectoPharm [®] ...		1
Infectopharm/ Noweda	Wart ointment InfectoPharm [®] ...		1
InfectoPharm/AHD	Wart ointment InfectoPharm [®] ...		1
Infectopharm/Alliance H...	Wart ointment InfectoPharm [®] ...		1
Infectopharm/Anzag	Wart ointment InfectoPharm [®] ...		1
InfectoPharm/Anzag	Wart ointment InfectoPharm [®] ...		2

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Infectopharm/G	Wart ointment InfectoPharm® ...		1
Infectopharm/Gehe	Wart ointment InfectoPharm® ...		6
InfectoPharm/Gehe	Wart ointment InfectoPharm® ...		1
InfectoPharm/GEHE	Wart ointment InfectoPharm® ...		1
INFECTOPHARM/GEHE 02.05...	Wart ointment InfectoPharm® ...		1
INFECTOPHARM/GEHE 07.07...	Wart ointment InfectoPharm® ...		1
INFECTOPHARM/GEHE 28.09...	Wart ointment InfectoPharm® ...		1
Infectopharm/K	Wart ointment InfectoPharm® ...		1
Infectopharm/Kehr	Wart ointment InfectoPharm® ...		1
Infectopharm/Noweda	Wart ointment InfectoPharm® ...		5
InfectoPharm/Noweda	Wart ointment InfectoPharm® ...		2
Infectopharm/Phoenix	Wart ointment InfectoPharm® ...		2
Infectopharm/Phoenix Le...	Wart ointment InfectoPharm® ...		1
Infectopharm/Phönix	Wart ointment InfectoPharm® ...		3
InfectoPharma	Wart ointment InfectoPharm® ...		1
InfectopharmNoweda	Wart ointment InfectoPharm® ...		1
Infectopharm	Wart ointment InfectoPharm® ...		1
nfectoPharm	Wart ointment InfectoPharm® ...		1
Noweda/Infectopharm	Wart ointment InfectoPharm® ...		1
Phönix Gotha	Wart ointment InfectoPharm® ...		1
Sanacorp	Wart ointment InfectoPharm® ...		2

- 5413 spectra from 481 *Apo-Ident* customers from a total of 2682 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31) can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Wart ointment InfectoPharm®* (NRF 11.31) and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	120	0	23 845
Type B	0	160	0	20 301
Type C	0	130	4	5413

The substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31) can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9601 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 96.2500 %)
Type C	100.0000 % (> 98.7725 %)	97.0149 % (> 94.7761 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31) in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Salicylic white paraffin 10%	137.04	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Wart ointment InfectoPharm®* (NRF 11.31) is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
30730	30730	0.00	221.29
30905	30905	0.00	220.13
30906	30906	0.00	218.55

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Water and aqueous solutions
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	31047-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Water and aqueous solutions; Aloe Vera gel, 1:1; Aloe vera gel, 10x concentrated; Aqua; Bepanthen[®] solution; Retterspitz external; SyrSpend[®] SF pH4 cherry aroma; SyrSpend[®] SF pH4 aroma free; Water

Special notes

When selecting the *Water and aqueous solutions* substance/substance group, the following information is displayed to the user:

- Advice for the identification of water: Preserved, purified and distilled water can not be conclusively distinguished by spectral analysis. An additional analysis of identity may be required.

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]

Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]

AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Aloe Vera gel, 1:1	3	6	1
Aloe vera gel, 10x concentrated	3	3	1
Bepanthen [®] solution	3	2	0

continued on the next page

continued from previous page

Substance	Type A	Type B	Type C
Retterspitz external	3	2	2
SyrSpend® SF pH4 cherry aroma	2	2	22
SyrSpend® SF pH4 aroma free	2	2	22
Water	3	21	83

Second-stage model

For differentiation of the substance/substance group *Water and aqueous solutions* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Water and aqueous solutions*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Aloe Vera gel, 1:1	13025802	31145	40	not required
Caelo	Aloe Vera gel, 1:1	15329203	31866	60	not required
Caelo	Aloe Vera gel, 1:1	153292	31880	60	20151111*
Caelo	Aloe Vera gel, 1:1	153292	31881	60	20151111*
Caelo	Aloe vera gel, 1...	13045901	31146	40	not required
Caelo	Aloe vera gel, 1...	15185503	31862	60	not required
Caelo	Aloe vera gel, 1...	161922	32313	40	20160707*
Bayer	Bepanthen® solut...	KP08DR1	31047	40	not required
Bayer	Bepanthen® solut...	KP0ASHC	31857	60	not required
Bayer	Bepanthen® solut...	KP0C3FU	33612	40	not required
Retterspitz G...	Retterspitz exte...	016100	32785	40	not required
Retterspitz G...	Retterspitz exte...	017058	33430	40	not required
Retterspitz G...	Retterspitz exte...	016240	33431	40	not required
Fagron	SyrSpend® SF pH4...	1503D017	31671	60	not required
Fagron	SyrSpend® SF pH4...	1503D017	31723	60	not required
Fagron	SyrSpend® SF pH4...	1704492/1	33787	40	not required
Fagron	SyrSpend® SF pH4...	1503D009	31670	60	not required
Fagron	SyrSpend® SF pH4...	1412D002	31722	60	not required
Caelo	Water	15068701	31675	45	not required
Caelo	Water	153943	32079	40	20151215*
Hedinger	Water	219066	31623	60	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 1045 spectra of 21 reference samples from the substance/substance group *Water and aqueous solutions*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 19 different batches.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

- 22 920 spectra from a total of 471 batches from further 153 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 1605 spectra of 41 reference samples from the substance/substance group *Water and aqueous solutions*.
- Among them are spectra of independent samples from 38 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Aloe Vera gel, 1:1	162489	32580	40
Caelo	Aloe Vera gel, 1:1	162912	32899	40
Caelo	Aloe Vera gel, 1:1	171341	33411	40
Caelo	Aloe Vera gel, 1:1	172891	33736	40
Caelo	Aloe Vera gel, 1:1	172890	33970	40
Caelo	Aloe Vera gel, 1:1	181943	34251	40
Caelo	Aloe vera gel, 10x concentra...	17082002	33511	40
Caelo	Aloe vera gel, 10x concentra...	181255	34342	40
Caelo	Aloe vera gel, 10x concentra...	192411	34714	40
Bayer	Bepanthen [®] solution	KPOB60L	32719	40
Bayer	Bepanthen [®] solution	KPOBJ61	32949	40
Retterspitz GmbH	Retterspitz external	016179	32784	30
Retterspitz GmbH	Retterspitz external	017192	34049	40
Fagron	SyrSpend [®] SF pH4 cherry aroma	1503255	32738	40
Fagron	SyrSpend [®] SF pH4 cherry aroma	1603252/2	32842	40
Fagron	SyrSpend [®] SF pH4 aroma free	1507402	32737	40
Fagron	SyrSpend [®] SF pH4 aroma free	1704493	33501	40
Caelo	Water	153944	32081	40
Caelo	Water	153712	32083	40
Caelo	Water	162553	32895	40
Caelo	Water	162867	32896	40
Caelo	Water	163533	33176	40
Caelo	Water	170018	33177	40
Caelo	Water	172191	33578	40
Caelo	Water	172192	33579	40
Caelo	Water	172220	33580	40
Caelo	Water	172533	33741	40
Caelo	Water	172827	33742	40
Caelo	Water	172861	33743	40
Caelo	Water	172862	33744	40
Caelo	Water	172771	33745	40
Caelo	Water	171147	33977	40
Caelo	Water	172957	33978	40
Caelo	Water	180045	34136	40

continued on the next page

continued from previous page

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Water	181105	34137	40
Caelo	Water	181354	34139	40
Caelo	Water	182286	34243	40
Caelo	Water	181952	34244	40
Fagron	SyrSpend [®] SF pH4 aroma free	1507402	32843	40
Fagron	SyrSpend [®] SF pH4 aroma free	1704493	33631	40
Caelo	Water	15068701	31675 [†]	15

- 18 856 spectra from a total of 398 batches from further 197 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 322 spectra from 116 *Apo-Ident* customers from 135 batches from the substance/substance group *Water and aqueous solutions*.
- Among them are spectra of independent samples from 130 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Aloe Vera gel, 1:1	17289003	1
Caelo	Aloe vera gel, 10x concentra...	15185512	1
Retterspitz/ Phoenix	Retterspitz external	17224	1
Retterspitz/ Phoenix	Retterspitz external	18045	1
Apomix/ Sanacorp	SyrSpend [®] SF pH4 cherry aroma	15C19/C	1
Caelo	SyrSpend [®] SF pH4 cherry aroma	1507318	3
Caelo	SyrSpend [®] SF pH4 cherry aroma	1702015	2
Fagron	SyrSpend [®] SF pH4 cherry aroma	15C19/C	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1503255	17
Fagron	SyrSpend [®] SF pH4 cherry aroma	1507318	4
Fagron	SyrSpend [®] SF pH4 cherry aroma	1603252/2	10
Fagron	SyrSpend [®] SF pH4 cherry aroma	1612631	18
Fagron	SyrSpend [®] SF pH4 cherry aroma	1701543/3	4
Fagron	SyrSpend [®] SF pH4 cherry aroma	1707302/1	7
Fagron	SyrSpend [®] SF pH4 cherry aroma	1702015(2Flaschen)	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1712024	6
Fagron	SyrSpend [®] SF pH4 cherry aroma	2x1712024	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1800673/2	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1803724/2	11
Fagron	SyrSpend [®] SF pH4 cherry aroma	1806233/2	7
Fagron	SyrSpend [®] SF pH4 cherry aroma	720023-0003	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1800673	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1806233/1	2
Fagron	SyrSpend [®] SF pH4 cherry aroma	18000673/1	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1702015	12
Fagron	SyrSpend [®] SF pH4 cherry aroma	1900093	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1909673	1

continued on the next page

[†]These spectra were recorded from material of the same package as the corresponding calibration spectra (*Type A*). Hence, these spectra are not independent and are not of *Type B*.

continued from previous page

Supplier	Substance	Batch	Spectra
Fragron	SyrSpend [®] SF pH4 cherry aroma	1702015	1
Gehe	SyrSpend [®] SF pH4 cherry aroma	1803724/2	1
GEHE	SyrSpend [®] SF pH4 cherry aroma	1712024	1
GEHE	SyrSpend [®] SF pH4 cherry aroma	1803724/2	3
GEHE	SyrSpend [®] SF pH4 cherry aroma	1806233/2	2
Caelo	SyrSpend [®] SF pH4 cherry aroma	1704492	1
Ichthyol/Gehe	SyrSpend [®] SF pH4 cherry aroma	1900093	1
PHÖNIX	SyrSpend [®] SF pH4 cherry aroma	1704492/1	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1800673/1	5
Caelo	SyrSpend [®] SF pH4 aroma free	1507402	1
Caelo	SyrSpend [®] SF pH4 aroma free	1704493	1
Caelo	SyrSpend [®] SF pH4 aroma free	1605291	1
Caelo	SyrSpend [®] SF pH4 aroma free	1712023/2	1
Fagron	SyrSpend [®] SF pH4 aroma free	1507402	13
Fagron	SyrSpend [®] SF pH4 aroma free	15C12/E	1
Fagron	SyrSpend [®] SF pH4 aroma free	15C12E	1
Fagron	SyrSpend [®] SF pH4 aroma free	1615584/2	2
Fagron	SyrSpend [®] SF pH4 aroma free	1704493	9
Fagron	SyrSpend [®] SF pH4 aroma free	1609686	1
Fagron	SyrSpend [®] SF pH4 aroma free	161558412	1
Fagron	SyrSpend [®] SF pH4 aroma free	1706769/1	3
Fagron	SyrSpend [®] SF pH4 aroma free	1706769	1
Fagron	SyrSpend [®] SF pH4 aroma free	1712018	4
Fagron	SyrSpend [®] SF pH4 aroma free	1712023/1	8
Fagron	SyrSpend [®] SF pH4 aroma free	27121704	1
Fagron	SyrSpend [®] SF pH4 aroma free	1712023/2	12
Fagron	SyrSpend [®] SF pH4 aroma free	102653/1	1
Fagron	SyrSpend [®] SF pH4 aroma free	1802653/4	2
Fagron	SyrSpend [®] SF pH4 aroma free	1804245/1	2
Fagron	SyrSpend [®] SF pH4 aroma free	1812150/2	1
Fagron	SyrSpend [®] SF pH4 aroma free	1802654	1
Fagron	SyrSpend [®] SF pH4 aroma free	1808206/1	1
Fagron	SyrSpend [®] SF pH4 aroma free	1605291	7
Fagron	SyrSpend [®] SF pH4 aroma free	1410D020	4
Fagron	SyrSpend [®] SF pH4 aroma free	1808206/2	2
Herkel B.V./Kehr	SyrSpend [®] SF pH4 aroma free	1808206/2	1
Tiofarma B.V.	SyrSpend [®] SF pH4 aroma free	1410D020	1
Caelo	Water	17145001	3
apomix/ Fiebig	Water	17H24-T09-044709	1
Caelo	Water	16F13-T16-034297	1
Caelo	Water	16F13-T18-34301	1
Caelo	Water	LOTAP0041	1
Caelo	Water	17114801	1
Caelo	Water	13121720	1
Caelo	Water	17277102	2
Caelo	Water	17282701	2
Caelo	Water	18042901	1
Caelo	Water	18093501	1
Caelo	Water	17K27-T16-050588	1
Caelo	Water	151005027617	1
Caelo	Water	18G16-T05-058132	1
Caelo	Water	16F13-T11-034264	1
Caelo	Water	18178302	2
Caelo	Water	LOTAP0078	1
Caelo	Water	19152801	1
Caelo	Water	17219101	1
Caelo	Water	18110401	1
Caelo	Water	1733981	1
Caelo	Water	17211201	1
Caelo	Water	15394201	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Water	16223801	2
Caelo	Water	14IL38	1
Caelo	Water	17K27-T10-050547	1
Caelo	Water	18178401	1
Caelo	Water	18263401	1
Caelo	Water	18254801	1
Caelo	Water	18305401	1
Caesar & Loretz/Noweda	Water	15394501	1
Euro OTC	Water	16F14-T07-034326	1
Fagron	Water	15D13-T09-021469	1
Fagron	Water	16F13-T16-034297	1
Fagron	Water	16F14-T09-034330	1
Fagron	Water	16L12-T11-039624	1
Fagron	Water	16L12-T25-039642	2
Fagron	Water	17F23-T06-045760	1
Fagron	Water	17H24-T11-047713	1
Fagron	Water	17E05T07044067	1
Fagron	Water	17K27-T09-050544	1
Fagron	Water	18C19-T25	1
Fagron	Water	15L15-T01-028672	1
Fagron	Water	18E25-T01-056423	1
Fagron	Water	15H25-T21-025683	1
Fagron	Water	17C31-T05-043064	1
Fagron	Water	16C23-T06-031423	1
Fagron	Water	17L20-T02-051255	1
Fagron	Water	18c13-T14-053737	1
Fagron	Water	18C19-T28-054003	1
Fagron	Water	19A18-T07-063531	1
Fagron	Water	15H25-T14-025670	1
Fagron	Water	16K25-C20-17409	1
Fagron	Water	18G16-T04-058129	1
Fagron	Water	17K27-T11-050552	3
Fagron	Water	15L14-T14-028664	1
Fagron	Water	15H25-T18-025678	1
Fagron	Water	18C19-T30-054012	2
Fargon/Kehr	Water	16F13-T18-034301	1
Fresenius /Noweda	Water	19KK24GA	1
Gehe	Water	17219101	1
GEHE	Water	17114801	1
Caelo	Water	18228801	2
Hedinger	Water	219140	1
Caelo	Water	18065601	3
Fagron	Water	17E05-T01-044045	1
Fagron	Water	18E07-T08-055699	1
L30	Water	17291301	1
Midas	Water	16C22-T07-031410	1
Midas	Water	16L12-T25-039642	1
Fagron	Water	15K10-T08-027626	1
Phoenix	Water	15L14-T14-028664	1
Phönix EK:8,37 EUR 2L	Water	17B10-T18-041564	1
Fagron	Water	15D13-T07-021465	1
wepa	Water	LOTAP0019	1
wepa	Water	LOTAP0034	1
wepa	Water	LOTAP0075	1
Wepa	Water	LOTAP0031	1
Wepa	Water	LOTAP0020	1
Wepa	Water	AP0072	1
Wepa	Water	LOTAP0072	1
Wepa	Water	LOTAP0087	1
WEPA	Water	LOTAP0015	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Wepa Apothekenbedarf	Water	LOTAP0050	1
WEPA Apothekenbedarf Gm...	Water	LOTAP0095	1
Wepa/Wepa	Water	LOTAP0037	1
WEPA/WEPA	Water	LOTAP0088	1
Caelo	Aloe vera gel, 10x concentra...	15185503	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1704492/1	1
Fagron	SyrSpend [®] SF pH4 cherry aroma	1503D017	1
Fagron	SyrSpend [®] SF pH4 aroma free	1503D009	1
Caelo	Water		1

- 5225 spectra from 474 *Apo-Ident* customers from a total of 2583 batches from a further 137 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Water and aqueous solutions* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Water and aqueous solutions* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	1045	0	22 920
Type B	0	1603	2	18 716
Type C	0	317	5	5213

The substance/substance group *Water and aqueous solutions* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9596 %)	100.0000 % (> 99.4258 %)
Type B	100.0000 % (> 99.9442 %)	99.8754 % (> 99.6885 %)
Type C	100.0000 % (> 98.7630 %)	98.4472 % (> 97.5155 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Water and aqueous solutions* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Fenistil [®] Gel	14.55	—
Sebexol [®] cream lotion pH 5	26.49	—
Sebexol [®] basic pH 5 formula basis	27.67	—
Wofacutan wash lotion	32.23	—
Hans Karrer Hydrocream MicroSilver	34.96	—
Dimeticone ointment 10% SR	35.40	—
Excipial [®] U Hydrolotio	40.61	—
Abitima [®] clinic face cream	46.65	—
Hans Karrer Lipolotion MicroSilver	65.61	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Water and aqueous solutions* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31857	31857	0.00	26.70
31862	31862	0.00	29.83
33612	33612	0.00	26.29
32313	32313	0.00	29.04
31145	31145	0.00	31.05
31866	31866	0.00	32.64
31671	31671	0.00	31.51
31880	31880	0.00	33.62
31723	31723	0.00	29.99
31881	31881	0.00	32.46
32785	32785	0.00	19.23
33787	33787	0.00	29.55
33430	33430	0.00	25.58
33431	33431	0.00	25.82
31670	31670	0.00	30.89
31722	31722	0.00	29.86
31623	31623	0.00	31.45
31675	31675	0.00	33.82
32079	32079	0.00	32.79
31047	31047	0.00	26.87
31146	31146	0.00	29.65

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group	Wax ointment (stabilised)
Substance class	APIs & excipients, liquid/semi-solid (other)
Report date	12/03/2020
Report number	31111-2020-03-12
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Wax ointment (stabilised); Unguentum cereum

Special notes

When selecting the *Wax ointment (stabilised)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Wax ointment (stabilised)	5	5	55

Second-stage model

For differentiation of the substance/substance group *Wax ointment (stabilised)* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Wax ointment (stabilised)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	Wax ointment (st...	13072102	31111	40	not required
Caelo	Wax ointment (st...	13307701	31167	40	not required
Caelo	Wax ointment (st...	14073701	31444	40	not required
Caelo	Wax ointment (st...	154243	31911	60	20151217*
Caelo	Wax ointment (st...	154244	31912	60	20151217*

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 240 spectra of 5 reference samples from the substance/substance group *Wax ointment (stabilised)*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 5 different batches.
- 23 725 spectra from a total of 485 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 200 spectra of 5 reference samples from the substance/substance group *Wax ointment (stabilised)*.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

- Among them are spectra of independent samples from 5 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	Wax ointment (stabilised)	12352501	30967	40
Caelo	Wax ointment (stabilised)	161215	32117	40
Caelo	Wax ointment (stabilised)	161334	32118	40
Caelo	Wax ointment (stabilised)	171714	33550	40
Caelo	Wax ointment (stabilised)	172942	34024	40

- 20 261 spectra from a total of 432 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 316 spectra from 120 *Apo-Ident* customers from 58 batches from the substance/substance group *Wax ointment (stabilised)*.
- Among them are spectra of independent samples from 55 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
AHD	Wax ointment (stabilised)	14073701	1
Anzag 07.12.12	Wax ointment (stabilised)	12128702	1
Caelo	Wax ointment (stabilised)	1218702	2
Caelo/Phönix	Wax ointment (stabilised)	16121501	2
Caelo	Wax ointment (stabilised)	11355202	1
Caelo	Wax ointment (stabilised)	7071204	1
Caelo	Wax ointment (stabilised)	12033602	2
Caelo	Wax ointment (stabilised)	12209401	3
Caelo	Wax ointment (stabilised)	20051012-1	1
Caelo	Wax ointment (stabilised)	1021303	1
Caelo	Wax ointment (stabilised)	12378701	5
Caelo	Wax ointment (stabilised)	U-150513-2	1
Caelo	Wax ointment (stabilised)	12352051	1
Caelo	Wax ointment (stabilised)	11355201	2
Caelo	Wax ointment (stabilised)	20121305	1
Caelo	Wax ointment (stabilised)	14073801	7
Caelo	Wax ointment (stabilised)	140737701	1
Caelo	Wax ointment (stabilised)	1407301	1
Caelo	Wax ointment (stabilised)	140737012	1
Caelo	Wax ointment (stabilised)	14236001	2
Caelo	Wax ointment (stabilised)	15025801	16
Caelo	Wax ointment (stabilised)	28051511	1
Caelo	Wax ointment (stabilised)	14236002	3
Caelo	Wax ointment (stabilised)	15424402	4
Caelo	Wax ointment (stabilised)	16121502	4
Caelo	Wax ointment (stabilised)	16121501	6
Caelo	Wax ointment (stabilised)	16133401	14
Caelo	Wax ointment (stabilised)	1524401	1
Caelo	Wax ointment (stabilised)	17015002	1
Caelo	Wax ointment (stabilised)	17171401	8
Caelo	Wax ointment (stabilised)	18034601	3
Caelo	Wax ointment (stabilised)	18258501	2
Caelo	Wax ointment (stabilised)	19040001	4

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
Caelo	Wax ointment (stabilised)	12209402	1
Caelo	Wax ointment (stabilised)	14072801	1
Caelo	Wax ointment (stabilised)	15025702	11
Caelo	Wax ointment (stabilised)	13159302	7
Caelo	Wax ointment (stabilised)	19040002	1
Caelo	Wax ointment (stabilised)	15424401	6
Caelo	Wax ointment (stabilised)	17015001	11
Caelo	Wax ointment (stabilised)	17294201	8
Caelo	Wax ointment (stabilised)	15205402	12
Caelo	Wax ointment (stabilised)	1524301	1
Caelo	Wax ointment (stabilised)	2113Q-03212	1
Caelo	Wax ointment (stabilised)	17014901	18
Caelo	Wax ointment (stabilised)	12033701	4
Caelo	Wax ointment (stabilised)	12352501	4
Caelo	Wax ointment (stabilised)	14235901	12
Caelo	Wax ointment (stabilised)	18162201	2
Caelo	Wax ointment (stabilised)	1114E3212	1
Caelo	Wax ointment (stabilised)	15424301	13
Caelo	Wax ointment (stabilised)	18034602	4
Caelo	Wax ointment (stabilised)	13159303	2
Caelo	Wax ointment (stabilised)	11321302	1
Caelo/Phoenix	Wax ointment (stabilised)	15424301	1
Caesar & Loretz GmbH	Wax ointment (stabilised)	13072102	1
Caesar & Loretz GmbH	Wax ointment (stabilised)	18258501	2
Caesar & Loretz GmbH	Wax ointment (stabilised)	19040002	1
Caesar & Loretz GmbH/Ph...	Wax ointment (stabilised)	19040001	1
Caesar und Loretz GmbH	Wax ointment (stabilised)	17015001	1
Cealo/Sanacorp	Wax ointment (stabilised)	18034602	1
Celo	Wax ointment (stabilised)	15424402	1
Gehe	Wax ointment (stabilised)	13072102	1
Gehe	Wax ointment (stabilised)	16133401	1
GEHE	Wax ointment (stabilised)	17171401	1
Caelo	Wax ointment (stabilised)	17294202	9
Caelo	Wax ointment (stabilised)	18162202	6
Hedinger GmbH & Co KG	Wax ointment (stabilised)	18034602	1
Henry Lamotte Olis GmbH...	Wax ointment (stabilised)	15424301	1
Noweda	Wax ointment (stabilised)	17171401	1
Caelo	Wax ointment (stabilised)	13307802	13
Sanacoro W.E:06.03.18 ...	Wax ointment (stabilised)	17171401	1
Sanacorp	Wax ointment (stabilised)	12352501	1
Sanacorp	Wax ointment (stabilised)	14073701	1
Sanacorp	Wax ointment (stabilised)	15205402	2
Sanacorp	Wax ointment (stabilised)	17015001	1
VDL;6,45EUR;21.10.14	Wax ointment (stabilised)	14235901	1
Caelo	Wax ointment (stabilised)	13307701	16
Caelo	Wax ointment (stabilised)	13072102	11
Caelo	Wax ointment (stabilised)	14073701	14

- 5231 spectra from 480 *Apo-Ident* customers from a total of 2660 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Wax ointment (stabilised)* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this

purpose, all relevant spectra of the various substances were compared with *Wax ointment (stabilised)* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	240	0	23 725
Type B	0	200	0	20 261
Type C	0	314	2	5231

The substance/substance group *Wax ointment (stabilised)* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9598 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9441 %)	100.0000 % (> 97.0000 %)
Type C	100.0000 % (> 98.7722 %)	99.3671 % (> 98.4177 %)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Wax ointment (stabilised)* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Cottonwood ointment	25.61	—
Neribas [®] fat ointment	26.35	—
Marjoram ointment	26.90	—
Protegin [®] XN	32.15	—
Excipial [®] almond oil ointment	37.52	—
Balm Bio Nature	38.08	—
Salicylic white paraffin 10%	42.42	—
White paraffin oil	43.39	—
Argan oil	44.62	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Wax ointment (stabilised)* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31111	31111	0.00	36.48
31167	31167	0.00	38.18
31444	31444	0.00	35.81
31911	31911	0.00	31.83
31912	31912	0.00	39.35

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **White paraffin oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 32342-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

White paraffin oil; Oleum Vaselini album

Special notes

When selecting the *White paraffin oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
White paraffin oil	2	1	3

Second-stage model

For differentiation of the substance/substance group *White paraffin oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *White paraffin oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Caelo	White paraffin oil	162192	32342	40	20160729*
Caelo	White paraffin oil	15380806	32565	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *White paraffin oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *White paraffin oil*.
- Among them are spectra of independent samples from 1 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Supplier	Substance	Batch	Sample ID	Spectra
Caelo	White paraffin oil	14338604	32454	40
Caelo	White paraffin oil	14338604	32846	40

- 20 381 spectra from a total of 436 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 3 spectra from 3 *Apo-Ident* customers from 3 batches from the substance/substance group *White paraffin oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	White paraffin oil	18226101	1
Caelo	White paraffin oil	17175506	1
Cealo / Spangro	White paraffin oil	16219204	1

- 5544 spectra from 489 *Apo-Ident* customers from a total of 2715 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *White paraffin oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *White paraffin oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	80	0	20 381
Type C	0	3	0	5544

The substance/substance group *White paraffin oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate* (*specificity*) and the weighted *true positive rate* (*recognition rate*) are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9443 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 98.7956 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *White paraffin oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Neribas [®] fat ointment	21.11	—
Cottonwood ointment	24.44	—
Marjoram ointment	25.66	—
Protegin [®] XN	25.73	—
Asche Basis [®] fat ointment	27.70	—
Wax ointment (stabilised)	44.07	—
Lygal [®] head ointment N 3%	45.14	—
Excipial [®] almond oil ointment	60.98	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *White paraffin oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
32342	32342	0.00	24.90
32565	32565	0.00	25.72

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Wintergreen oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 30455-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Wintergreen oil; Oleum gaultheria procumbens

Special notes

When selecting the *Wintergreen oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Wintergreen oil	2	2	9

Second-stage model

For differentiation of the substance/substance group *Wintergreen oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Wintergreen oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Taoasis	Wintergreen oil	5411006-117696	31543	56	not required
Taoasis	Wintergreen oil	1828-125286	32807	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 96 spectra of 2 reference samples from the substance/substance group *Wintergreen oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 869 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 160 spectra of 4 reference samples from the substance/substance group *Wintergreen oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Wintergreen oil	00129A27	34399	40
Taoasis	Wintergreen oil	1953-128607	33624	40
Taoasis	Wintergreen oil	1828-125286	32936	40
Taoasis	Wintergreen oil	1953-128607	33625	40

- 20 301 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 10 spectra from 9 *Apo-Ident* customers from 10 batches from the substance/substance group *Wintergreen oil*.
- Among them are spectra of independent samples from 9 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.

Supplier	Substance	Batch	Spectra
Caelo	Wintergreen oil	10318703	1
Caelo	Wintergreen oil	10318714	1
Caelo	Wintergreen oil	13099205	1
Caelo	Wintergreen oil	15087406	1
Caelo	Wintergreen oil	13099202	1
Taoasis	Wintergreen oil	423121-90971	1
Taoasis	Wintergreen oil	97540	1
Taoasis	Wintergreen oil	1303-121125	1
Taoasis	Wintergreen oil	2170-291	1
Taoasis	Wintergreen oil		1

- 5537 spectra from 490 *Apo-Ident* customers from a total of 2708 batches from a further 142 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Wintergreen oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Wintergreen oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	96	0	23 869
Type B	0	159	1	20 301
Type C	0	9	1	5537

The substance/substance group *Wintergreen oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9602 %)	100.0000 % (> 93.7500 %)
Type B	100.0000 % (> 99.9441 %)	99.3750 % (> 97.5000 %)
Type C	100.0000 % (> 98.7790 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Wintergreen oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Clove oil	276.43	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Wintergreen oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
31543	31543	0.00	298.49
32807	32807	0.00	299.51

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Yarrow oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 33795-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Yarrow oil

Special notes

When selecting the *Yarrow oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Yarrow oil	2	3	0

Second-stage model

For differentiation of the substance/substance group *Yarrow oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Yarrow oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Yarrow oil	00516E25	33795	40	not required
Taoasis	Yarrow oil	2041-316	33822	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 80 spectra of 2 reference samples from the substance/substance group *Yarrow oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 2 different batches.
- 23 885 spectra from a total of 488 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 120 spectra of 3 reference samples from the substance/substance group *Yarrow oil*.
- Among them are spectra of independent samples from 3 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Primavera	Yarrow oil	00677E26	34174	40
Primavera	Yarrow oil	00197J26	34295	40
Taoasis	Yarrow oil	128700	33823	40

- 20 341 spectra from a total of 434 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Yarrow oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Yarrow oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Yarrow oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	80	0	23 885
Type B	0	107	13	20 341
Type C	0	0	0	5547

The substance/substance group *Yarrow oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9604 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9441 %)	89.1667 % (> 86.6667 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra (*Rule of Three* [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Yarrow oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Citrus oil	20.96	—
Myrtle oil	21.97	—
Hyssop oil	24.83	—
Marjoram oil	27.35	—
Angelica root oil	33.53	—
Ravensara oil	40.62	—
Spearmint oil	41.44	—
Juniper oil	43.74	—
Cypress oil	46.04	—
Dwarf pine oil	47.29	—
Sage oil	49.30	—
Cedar wood oil	50.03	—

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Yarrow oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
33822	33822	0.00	21.11
33795	33795	0.00	52.07

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50 % greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

VALIDATION REPORT

IdentModule 2.1-2020-01

Validated substance/substance group **Ylang-ylang oil**
Substance class APIs & excipients, liquid/semi-solid (other)
Report date 12/03/2020
Report number 31506-2020-03-12
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ylang-ylang oil; Oleum ylang-ylang

Special notes

When selecting the *Ylang-ylang oil* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-6679-5 *European Pharmacopoeia 9th Edition, Basic Version 2017* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*

Validation method

Validation is performed after every change to the chemometric model (also “database”) in three steps:

1. The chemometric model is calculated from the calibration spectra using a *PCA algorithm*. The calibration spectra originate from the calibration samples of all substances in this class.
2. In the *chemometric model* generated, the distances between all separable substances are checked for compliance with the specified safety distances.
3. All spectra are presented to the generated chemometric model for evaluation. In three runs, the reference spectra (*Type A*), spectra from independent samples (*Type B*), and spectra from the field (*Type C*) are presented successively. Here, no single *false positive* result is permitted.

Finally, a report is generated from the validation run results and is archived together with the parameters of the model generation in audit-compliant manner.

Number of independent samples (batches) in calibration and validation

A sample is considered independent if no sample from the same batch has been included in the calibration of the chemometric model.

Substance	Type A	Type B	Type C
Ylang-ylang oil	4	2	0

Second-stage model

For differentiation of the substance/substance group *Ylang-ylang oil* the following second-stage model is used:

no second-stage model

Calibration samples

Only spectra which have been recorded by *HiperScan GmbH* from traceable samples are used for the generation of the [chemometric models](#). The following samples have been obtained from the substance/substance group *Ylang-ylang oil*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Primavera	Ylang-ylang oil	00403M26	34382	40	not required
Taoasis	Ylang-ylang oil	140114-115612	31506	60	not required
Taoasis	Ylang-ylang oil	07122-119828	31653	60	not required
Taoasis	Ylang-ylang oil	41813-124965	32808	40	not required

Validation samples

A total of 49 973 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 200 spectra of 4 reference samples from the substance/substance group *Ylang-ylang oil*. These samples are listed above in the [calibration samples](#) section. The reference samples come from 4 different batches.
- 23 765 spectra from a total of 486 batches from further 159 substances. These spectra were recorded by *HiperScan GmbH*. *Type A* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type A* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix A](#). The samples in [Appendix A](#) were added for model generation not with the intention to have the model identify these substances, but with the intention to make the model reject them despite their similarity to substances identifiable.

Type B Spectra from independent samples not included in the database structure. Measurement is carried out by *HiperScan GmbH*.

Samples from batches of which no spectra have been included in the database structure are considered as independent samples. The number of batches from which independent samples supplied *Type B* spectra for validation is shown below, representing the number of independent *Type B* samples. Samples, of which some of the spectra have been included in the database structure and other spectra in the validation, are marked with a [†]. The following applies to the remaining unmarked samples: In the same batch, there was at least one additional sample (other sales container, other sample ID) from which reference spectra (*Type A*) were included in the database structure.

- 80 spectra of 2 reference samples from the substance/substance group *Ylang-ylang oil*.
- Among them are spectra of independent samples from 2 batches from which no spectra have been included in the database structure. They are sorted upwards in the following table and separated from the additional samples by a line.

Supplier	Substance	Batch	Sample ID	Spectra
Taoasis	Ylang-ylang oil	43197-126348	33049	40
Taoasis	Ylang-ylang oil	B966015-128199	33648	40

- 20381 spectra from a total of 435 batches from further 203 substances. These spectra were recorded by *HiperScan GmbH*. *Type B* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type B* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix B](#).

Type C Spectra of independent samples not included in the database structure. *Apo-Ident* customers carry out the measurements. *HiperScan GmbH* generally does not verify the information provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Ylang-ylang oil*.
- Among them are spectra of independent samples from 0 batches from which no spectra have been included in the database structure. These are sorted upwards in the following table.
- 5547 spectra from 490 *Apo-Ident* customers from a total of 2718 batches from a further 143 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within this entire report. If the substance can be identified with this [chemometric model](#), the samples are listed in the *Type C* section of each substance page. If the substance cannot be identified by this model, the samples are listed in [Appendix C](#).

Validation results

The validation runs checked whether the substance/substance group *Ylang-ylang oil* can clearly be distinguished from all other substances using NIR spectroscopy with *Apo-Ident*. For this purpose, all relevant spectra of the various substances were compared with *Ylang-ylang oil* and it was evaluated how many matches (positive) and rejections (negative) were correct or incorrect. The following table breaks down the numbers of correct and incorrect results according to the expected result (*positive/negative*) and the validation spectrum type (*A/B/C*).

	False positive	True positive	False negative	True negative
Type A	0	200	0	23 765
Type B	0	34	46	20 381
Type C	0	0	0	5547

The substance/substance group *Ylang-ylang oil* can be clearly distinguished from all other substances. In order to make these figures comparable, the weighted *true negative rate (specificity)* and the weighted *true positive rate (recognition rate)* are determined:

	Specificity	Recognition rate
Type A	100.0000 % (> 99.9599 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9443 %)	42.5000 % (> 38.7500 %)
Type C	100.0000 % (> 98.7982 %)	n/a (n/a)

In order to ensure that each substance is entered with the same weight irrespective of the number of spectra available, each spectrum is weighted with the reciprocal value of its number. (If several new spectra of a substance with a very distinctive spectrum are added, the values for *specificity* and *recognition rate* are safer, but are by no means idealised.)

In order to illustrate the impact of the number of spectra, a comparison is made in parentheses as to how the *specificity* or *recognition rate* would worsen if three additional incorrect results were to exist amongst the spectra ([Rule of Three](#) [10, 11]). The larger the number of spectra, the lower the deterioration if the three hypothetical *incorrect results* were added.

Where the number of spectra does not exceed 20, no *recognition rate* is provided.

Nearest chemometric neighbours

The following table lists the closest chemometric neighbours of the substance/substance group *Ylang-ylang oil* in the substance class *APIs & excipients, liquid/semi-solid (other)*. Furthermore, their *Mahalanobis distance* is specified within the main model and, where appropriate, within the second-stage model.

Substance	Distance in main model	Distance in second-stage model
Clary sage oil	39.11	–
Petitgrain oil	50.88	–

The list stops after the first substance with a *Mahalanobis distance* greater than 50. If the substance/substance group *Ylang-ylang oil* is separated from critical neighbours in a second-stage model, all the remaining substances in the second-stage model follow.

Identity according to identity test using NIR spectroscopy

For each substance, a certificate of the correct identity is obtained from an independent GMP-certified test laboratory. If the identity of the sample can be provided using NIR on an independently tested reference sample, in the following table the *Mahalanobis distance* to the reference sample is specified as well as the *Mahalanobis distance* to the next non-identical substance:

Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
34382	34382	0.00	69.33
32808	32808	0.00	74.66
31506	31506	0.00	86.43
31653	31653	0.00	35.78

The identity of a sample will be confirmed by NIR if the distance to the next foreign sample is at least 50% greater than the distance to a reference sample whose identity has been established by laboratory testing. This criterion is always considered in the chemometric model, which contains all substances of the substance class, even if a second-stage dissolves a subgroup of similar substances, thereby increasing the distances between them. The samples confirmed by NIR support the statistical variance of the original reference substance, but cannot add new aspects or forms of the substance.

Appendix A: Additional calibration samples (Type A)

Not required.

Appendix B: Additional validation samples (Type B)

It is necessary that spectra also enter the validation which cannot be identified with this model. In this manner, it is verified that the model also rejects unknown substances. The spectra for these samples were recorded by *HiperScan GmbH*. They are allocated to the *Type B*. They also include the calibration spectra for other models.

The samples originate from 77 batches. From these 3330 spectra were recorded. The spectra recorded on independent samples of substances which can be identified with the model are listed respectively in the section *Type B* for the individual substances and do not appear again elsewhere in this list.

Supplier	Substance	Batch	Spectra	Certificate
Actavis	Abitima [®] clinic body lotion	145054	40	not required
Actavis	Abitima [®] clinic body lotion	159997	40	not required
Actavis	Abitima [®] clinic body lotion	159997	40	not required
Dr. Wolff	Anefug [®] Simplex	234280	40	not required
Dr. Wolff	Anefug [®] Simplex	237590	40	1407216
Primavera	Anise seed oil	00480L26	40	not required
Taoasis	Black cumin oil	504511-115611	40	not required
Koko	dermaviduals [®] base gel	L003L13	60	not required
Allergika	Dermifant [®] kids lotion	1301020	80	not required
Allergika	Dermifant [®] kids lotion	1306020	40	not required
Allergika	Dermifant [®] kids lotion	1607080	40	not required
Allergika	Dermifant [®] kids lotion	1705081	40	not required
Primavera	Douglas fir oil	00539M26	40	not required
Fagron	Fitalite TM	14B18-T01-010352	60	not required
Fagron	Fitalite TM	14B18-T01-010352	60	not required
Fagron	Fitalite TM	1503259	40	not required
Fagron	Fitalite TM	1503259	40	not required
Fagron	Fitalite TM	1503259	40	not required
Pharmapol	Glycerol trinitrate 5%	228718	40	not required
Pharmapol	Glycerol trinitrate 5%	232961	60	not required
Primavera	Ho leaf oil	00388M26	40	not required
Primavera	Jasmine 4% in alcohol	00184A27	40	not required
Spirig Pharma	Kerasal [®] base ointment	M031	40	not required
Spirig Pharma	Kerasal [®] base ointment	N011	40	not required
Primavera	Lavandin oil	00508L26	40	not required
Primavera	Lemon verbena leaf oil	00540M26	40	not required
Dr. Wolff	Linola [®] acute 0.5%	334620	40	not required
Dr. Wolff	Linola [®] sun protection SPF 50 lotion	134530	40	not required
Primavera	Litsea oil	00496L26	40	not required
Caelo	Milking grease Special without Osmaron [®]	162049	40	20160711*
Paddock	Ora-Blend [®]	2280130	40	not required
Perrigo	Ora-Blend [®] SF	3112578	40	not required
Fagron	Ora-Plus [®]	3334081	60	not required
Perrigo	Ora-Plus [®]	3334081	40	not required
Fagron	Ora-Sweet [®]	3062252	40	not required
Perrigo	Ora-Sweet [®]	3062252	40	not required
Stiefel	Physiogel [®] hypoallergenic cream	343P	40	not required
Stiefel	Physiogel [®] hypoallergenic cream	6940	40	not required
Caelo	Pine oil rubbing alcohol	162091	40	20160713*
Stoko	Praecutan [®] lotion F	0915777806	40	not required
Stoko	Praecutan [®] lotion F	011657101571	40	not required
Einhorn-Apoth. . .	Rizol raw material	AL0413-1	60	not required
Primavera	Rose oil 10%	00721716	40	not required
Primavera	Rose oil, pure	00099L26	40	not required

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra	Certificate
Taoasis	Rose oil, pure	12014-120330H08	40	not required
Salderman Gmb. . .	Salderman base emulsion	180123	40	not required
Primavera	Seabuckthorn oil, organic	00346E26	40	not required
Primavera	Spanish sage oil	00057G26	40	not required
Bene	Thrombocid [®] gel	401B101	40	not required
Bene	Thrombocid [®] gel	401B101	40	not required
Bene	Thrombocid [®] gel	403I143	40	not required
Bene	Thrombocid [®] gel	403I143	40	not required
Bene	Thrombocid [®] gel	403I143	40	not required
Bene	Thrombocid [®] ointment	410B113	40	not required
Bene	Thrombocid [®] ointment	410B113	40	not required
Bene	Thrombocid [®] ointment	408C141	40	not required
Bene	Thrombocid [®] ointment	409A151	40	not required
Taoasis	Tolu res. 50% oil	493887-105383BAC90451	40	not required
Primavera	Tolu Resinoid	00115A25	40	not required
Taoasis	Tonka extract	3636K08	40	not required
Bayer	Ultrabas [®]	33851A	40	not required
Bayer	Ultrapril [®]	22100A	40	not required
Bayer	Ultrasicc [®]	33614A	40	not required
Caelo	Ultrasound contact gel	12031301	40	not required
Taoasis	Vanilla extract oil	789171-114788	40	not required
Caelo	Vario base cream	12077902	50	1405329
Caelo	Vario base cream	13257102	40	1405330
Fagron	Versatile TM	14B19-T02-010391	60	not required
Fagron	Versatile TM	14B19-T02-010391	60	not required
Fagron	Versatile TM	1503256	40	not required
Fagron	Versatile TM	1503256	40	not required
Fagron	Versatile TM	1503256	40	not required
Fagron	Versatile TM Rich	14B19-T08-010395	60	not required
Fagron	Versatile TM Rich	14B19-T04-010395	60	not required
Fagron	Versatile TM Rich	1503257	40	not required
Fagron	Versatile TM Rich	1503257	40	not required
Fagron	Versatile TM Rich	1503257	40	not required

*The spectra were taken from a part of the same sample which the supplier used for its analysis (identity, purity, content). In this case the manufacturer certificates proof the identity and quality of the sample from those the spectra descend.

Appendix C: Additional validation samples (Type C)

Spectra for substances from the field which cannot be identified with this model also enter the validation. In this manner, it is verified that the model also rejects unknown substances. The spectra for these samples were recorded by *Apo-Ident* customers. They belong to *Type C*. The information provided by the customer regarding the manufacturer and batch number is taken over by *HiperScan GmbH* to a large extent unchecked.

The samples originate from 84 batches. From these, 142 spectra were recorded. The spectra recorded on independent samples of substances from the field which can be identified with the model are listed respectively in the section *Type C* for the individual substances and do not appear again elsewhere in this list.

Supplier	Substance	Batch	Spectra
Dr. Wolff	Anefug [®] Simplex	136840	1
Anzag	Capsaicin liquid extr...	120503801	1
Euro OTC	Capsaicin liquid extr...	6061204	1
Euro OTC	Capsaicin liquid extr...	12111205	1
Euro OTC	Capsaicin liquid extr...	1201010-01	1
Euro OTC	Capsaicin liquid extr...	1205038-01	2
EUro/AHD	Capsaicin liquid extr...	1205038-02	1
Allergika/Kehr	Dermifant [®] kids lotion	1604060	1
Sanacorp EK:10,80 ...	Dermifant [®] kids lotion	1705111	1
Fagron	Fitalite TM	1503259	2
Gehe	Glycerol trinitrate 5%	214895	1
Gehe	Glycerol trinitrate 5%	221414	3
Pharmapohl	Glycerol trinitrate 5%	18102013A	1
Pharmapol	Glycerol trinitrate 5%	219108	4
Pharmapol	Glycerol trinitrate 5%	224310	5
Pharmapol	Glycerol trinitrate 5%	224310(ex)224658(in)	1
Pharmapol	Glycerol trinitrate 5%	226578	9
Pharmapol	Glycerol trinitrate 5%	228718	11
Pharmapol	Glycerol trinitrate 5%	25041301	1
Pharmapol	Glycerol trinitrate 5%	AKD81	1
Pharmapol	Glycerol trinitrate 5%	232961	3
Pharmapol	Glycerol trinitrate 5%	234783	2
Pharmapol Arzneimitte...	Glycerol trinitrate 5%	232961	6
Pharmapol/Zentrum Apo	Glycerol trinitrate 5%	2913A-07002	1
Anzag/Galderma	Kerasal [®] base ointment	S075	1
Galderma/Gehe	Kerasal [®] base ointment	S061	1
Galderma/Anzag	Kerasal [®] base ointment	S041	4
Spirig	Kerasal [®] base ointment	L0TR012	1
Spirig Pharma	Kerasal [®] base ointment	N021	1
Spirig/Gehe	Kerasal [®] base ointment	S076	1
Spirig/Sanacorp	Kerasal [®] base ointment	N011	1
Caelo	Milk Cordes [®] O/W Emul...	13D001	2
Ichthyol	Milk Cordes [®] O/W Emul...	60613	1
Ichthyol - Gesellschaft	Milk Cordes [®] O/W Emul...	11D037	1
Ichthyol / Noweda	Milk Cordes [®] O/W Emul...	12D008	5
IchthyolGmbH/Anzag	Milk Cordes [®] O/W Emul...	12D003	2
Ichthyol, Noweda	Milk Cordes [®] O/W Emul...	13d007	1
Fagron	Ora-Blend [®] SF	3745164	1
Fagron	Ora-Blend [®] SF	4136370	1
Gehe	Ora-Blend [®] SF	2038178	1
Gehe	Ora-Blend [®] SF	3112578	1
Perrigo	Ora-Blend [®] SF	2088609	1
Phönix	Ora-Blend [®] SF	3434856	2
Phönix	Ora-Blend [®] SF	3475164	1
Fagron	Ora-Sweet [®]	3414679	1
Fagron	Ora-Sweet [®]	4247427	2
GSK Stiefel	Physiogel [®] hypoallerg...	859R	1

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra
GSK/Stiefel	Physiogel [®] hypoallerg...	538T	1
PHOENIX 21.10.2013	Physiogel [®] hypoallerg...	1142N	1
Phoenix/Stiefel	Physiogel [®] hypoallerg...	399P	1
Stiefel	Physiogel [®] hypoallerg...	926Q	1
Stiefel	Physiogel [®] hypoallerg...	270T	1
Stiefel	Physiogel [®] hypoallerg...	537T	1
Stiefel/Noweda	Physiogel [®] hypoallerg...	163R	1
Stiefel/Sanacorp	Physiogel [®] hypoallerg...	10000	1
Dyckerhoff	Regeneresen	60611dü-2	1
Dyckerhoff	Regeneresen	150173th-2	1
Dyckerhoff	Regeneresen	1202920v-2	1
Dyckerhoff	Regeneresen	120323Lu-2	1
Dyckerhoff	Regeneresen	120313Kn-2	1
Dyckerhoff	Regeneresen	1503839-Na	1
Dyckerhoff	Regeneresen	120333NN-2	1
Dyckerhoff	Regeneresen	120053NNR-2	1
Arkeo Immun UG	Rizol raw material	1192HJ	2
Caelo	Rizol raw material	15144304	1
Steidl/Phytolab	Rizol raw material	200812174102290	1
Taoasis	Tolu res. 50% oil	493887-105384	1
Taoasis	Tolu res. 50% oil	546022-114802	2
Taoasis	Tolu res. 50% oil	546022-122636	1
Taoasis	Tolu res. 50% oil	23772-118646	1
Taoasis	Tolu res. 50% oil	23772-119167	1
Caelo	Vario base cream	13143401	1
Caelo	Vario base cream	14331902	4
Caelo	Vario base cream	16032402	1
Caelo	Vario base cream	13257102	2
Caelo	Vario base cream	12077902	1
Bombastus	Vario base cream	12375801	1
Fagron	Versatile TM	14B19-T02-010391	2
Fagron	Versatile TM Rich	247224-0002	1
Fagron	Versatile TM Rich	14B19-T04-0130395	1
Fagron	Versatile TM Rich	1503257	4
Phönix	Versatile TM Rich	1503258	1
Taoasis	Wild rose oil	99149-99474	1
Taoasis	Wild rose oil	106177-106175	1

Appendix D: Requirements of validation

In order to ensure adherence to the safe scientific status, the individual methods for manufacturing and testing must be validated under certain circumstances (compare § 34 para. 1 no. 3, § 35 para. 1 no. 4 and para. 4 sentence 1 no. 2 b, para. 6 sentence 3 *ApoBetrO* [Pharmacies Rules and Regulations]). The *ApoBetrO* [Pharmacies Rules and Regulations] incorporates a legal definition in § 1 a para. 16 (quotation translated):

“Validation is the provision of documented proof which with a high degree of safety documents that, via a specific process or standard work process, a medicinal product is manufactured and tested, which is in accordance with previously determined quality features.”

Validation documentation can be used to prove that methods or devices which are not described in the Pharmacopoeia within the meaning of § 6 para. 1 sentence 3 *ApBetrO* [Pharmacies Rules and Regulations] achieve the same results as those in the Pharmacopoeia. On the other hand, with the requirements of the demanded validation it must be observed whether the respective testing method is already incorporated in the Pharmacopoeia.

NIR spectroscopy as a general testing method need not be validated in accordance with the express ruling in the *Ph. Eur. Section 1.1* [3], as it is already described in *Section 2.2.40* of the *Ph. Eur.* as an area of application for the identification of raw materials.

However, a special validation requirement exists for the reference database. This requirement is met with the existing document. Further requirements or rules as to how this proof must be furnished do not exist. It is required that the processes guarantee the same results as the methods and devices in the Pharmacopoeia [17].

Carrying out identity tests with *Apo-Ident* is therefore also possible if the NIR spectroscopy process is not required in the Pharmacopoeia monograph of the substance for identity testing. All NIR analyses with *Apo-Ident* prove several, often all molecule groups and are therefore comparable with a series of individual, targeted chemical proofs [4]. Therefore, the identity proof with *Apo-Ident* replaces the monograph test series (with two or more test combinations).

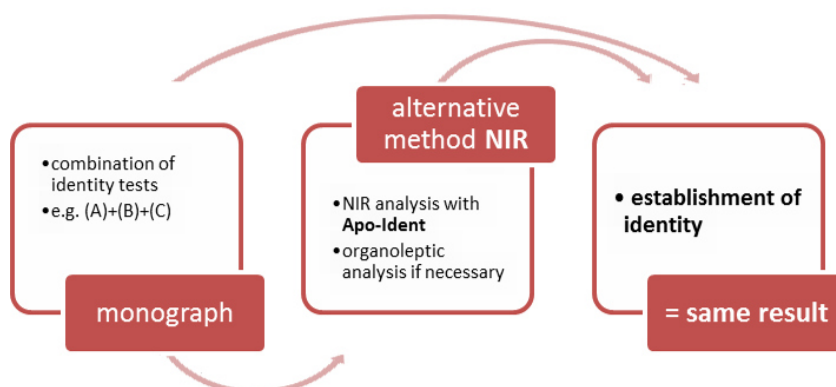


Figure 2: The combination of tests of the monograph is replaced by the alternative method NIR spectroscopy using *Apo-Ident*. This is permissible because both test procedures result in the establishment of the identity of the raw material.

With this validation documentation, proof is furnished that identical results are achieved with *Apo-Ident* and Pharmacopoeia methods, i.e. confirmation of the identity of the raw material [2].

Appendix E: Conformity of Apo-Ident with the European pharmacopeia

According to *Ph. Eur. Section 2.2.40*, NIR spectroscopy is basically suitable for: “Identification of agents, excipients, dosage forms, intermediate manufacturing products, chemical raw materials and packaging materials” ([3], quotation translated).

The fact that *Apo-Ident* meets the further criteria of the European Pharmacopoeia under the headings in *Section 2.2.40*

- Apparatus
- Measurement methods
- Sample preparation and presentation
- Testing the functionality of the instrument
- Identification and characterisation (qualitative analysis)
- Quantitative analysis
- Ongoing model evaluation
- Transfer of databases
- Data storage

can be proven based on the *HiperScan GmbH* documentation of “Meeting 2.2.40 *Ph. Eur.* by *Apo-Ident*” [4].

References

- [1] ABDA – BUNDESVEREINIGUNG DEUTSCHER APOTHEKERVERBÄNDE: Verordnung über den Betrieb von Apotheken (Apothekenbetriebsordnung – ApBetrO), 2012
- [2] REIMANN, B. ; REGIERUNGSPRÄSIDIUM DARMSTADT: Hinweise zur ordnungsgemäßen Prüfung von Arzneimitteln und Ausgangsstoffen (§§ 6 und 11 *ApBetrO*), 2007
- [3] *Europäisches Arzneibuch, Grundwerk 2017*. 9. Ausgabe. Deutscher Apotheker Verlag (978-3-7692-6679-5)
- [4] HIPERSCAN GMBH: Erfüllung von 2.2.40 Ph. Eur. durch Apo-Ident, 2013
- [5] ARBEITSGEMEINSCHAFT DER PHARMAZIERÄTE DEUTSCHLANDS (APD): Resolution in Verbindung mit §§ 6 und 11 *ApBetrO* Verwendung eines Nah-Infrarot-Spektrometers (NIR) zur Identitätsprüfung, 16. 10. 2013, DAZ 48, November 2013
- [6] ARBEITSGEMEINSCHAFT DER PHARMAZIERÄTE DEUTSCHLANDS (APD): Resolution 2014, Arbeitsgemeinschaft der Pharmazieräte Deutschlands (APD), Oktober 2014
- [7] *DAC/NRF*. Govi-Verlag (978-3-7741-0044-2)
- [8] KESSLER, W.: *Multivariate Datenanalyse*. WILEY-VCH Verlag, 2007 (978-3-527-31262-7)
- [9] NÆS, T. ; ISAKSSON, T. ; FEARN, T. ; DAVIES, T.: *Multivariate Calibration and Classification*. NIR Publications, 2002 (978 0 9528666 2 6)
- [10] HANLEY, J. A. ; LIPPMAN-HAND, A.: If nothing goes wrong, is everything all right? In: *Journal of the American Medical Association* 249 (1983), S. 1743–1745
- [11] JOVANOVIĆ, B. D. ; LEVY, P. S.: A Look at the Rule of Three. In: *The American Statistician* 51 (1997), S. 137–139
- [12] BRONSTEIN, I. N. ; SEMENDJAJEW, K. A. ; MUSIOL, G. ; MÜHLIG, H.: *Taschenbuch der Mathematik*. 5. überarbeitete und erweiterte Auflage. Verlag Harri Deutsch, 2000 (3-8171-2015-2)
- [13] MAHALANOBIS, P.: On the generalized distance in statistics. In: *Proc. Nat. Inst. Sci. India (Calcutta)* 2 (1936), S. 49–55
- [14] YAMBOR, B. ; DRAPER, W. ; BEVERIDGE, R.: Analyzing PCA-based face recognition algorithms: Eigenvector selection and distance measures. In: *Second Workshop Empirical Evaluation in Computer Vision* (2000)
- [15] HIPERSCAN GMBH: Identifikationsmethodik Apo-Ident, 2012
- [16] HIPERSCAN GMBH: Datenvorbehandlung des Identifikationssystems Apo-Ident, 2012
- [17] CYRAN ; RÖTTA: Apothekenbetriebsordnung, Kommentar § 6 Rn. 10, 2010

Index

- Abitima[®] clinic body cream, *see* Hydrophilic ointments, [223](#)
- Abitima[®] clinic face cream, *see* Hydrophilic ointments, [223](#)
- Acidum dichloroaceticum, *see* Dichloroacetic acid, [163](#)
- Acidum salicylicum cum vaselino albo 10 %, *see* Salicylic white paraffin 10%, [419](#)
- Alfason Basis Cresa[®], [21](#)
- Alfason[®] Repair, *see* Linola[®] fat creme / Linola[®] H fat N / Alfason[®] Repair, [281](#)
- Allergika evening primrose oil cream 20%, *see* Allergika evening primrose oil cream 20% / Dermifant[®] kids cream, [27](#)
- Allergika evening primrose oil cream 20% / Dermifant[®] kids cream, [27](#)
- Allergika[®] Base cream, *see* Hydrophilic ointments, [223](#)
- Aloe vera gel, 10x concentrated, *see* Water and aqueous solutions, [509](#)
- Aloe Vera gel, 1:1, *see* Water and aqueous solutions, [509](#)
- alpha-bisabolol (racemic) at least 85%, [33](#)
- Amciderm[®] Base cream, *see* Liniment ointments, [273](#)
- Angelica root oil, [37](#)
- Anise oil, organic, [41](#)
- Aqua, *see* Water and aqueous solutions, [509](#)
- Argan oil, [47](#)
- Asche Basis[®] cream, *see* Hydrophilic ointments, [223](#)
- Asche Basis[®] fat ointment, *see* Fat ointments, [193](#)
- Asche Basis[®] lotion, *see* Hydrophilic ointments, [223](#)
- Asche Basis[®] ointment, *see* Ointment ash basis / Neribas[®], [347](#)
- Balm Bio Nature, [51](#)
- Banana aroma, [55](#)
- Banana flavour, *see* Banana aroma, [55](#)
- Base cream Taoasis, *see* Hydrophilic ointments, [223](#)
- Basil oil, [59](#)
- Benzoin siam oil 20%, [63](#)
- Bepanthen[®] solution, *see* Water and aqueous solutions, [509](#)
- Bepanthen[®] Wund- und Heilsalbe, [69](#)
- Bergamot oil, [73](#)
- Blood orange oil, *see* Grapefruit oil organic / Orange oil / Blood orange oil, [217](#)
- Cajeput (essentiell oil), *see* Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil, [79](#)
- Cajeput oil / Eucalyptus oil / Niaouli oil / Rosmary oil, [79](#)
- Camphor oil, [87](#)
- Cardamom (essential oil), *see* Cardamom oil, [91](#)
- Cardamom oil, [91](#)
- Carrot seed oil, [95](#)
- Cedar wood oil, [99](#)
- Chamomile (essential oil), [105](#)
- Cinnamon bark oil, Ceylon, [109](#)
- Citric oil, *see* Citric oil / Lime oil, [113](#)
- Citric oil / Lime oil, [113](#)
- Citronella oil, [119](#)
- Citrus oil, *see* Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil, [123](#)
- Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil, [123](#)
- Clary sage oil, *see* Citrus oil / Lavender oil / Clary sage oil / Myrtle oil / Petitgrain oil / Hyssop oil, [123](#)
- Clove oil, [129](#)
- Common wormwood oil, [133](#)
- Contramarum aroma, [137](#)
- Contramarum flavour, *see* Contramarum aroma, [137](#)
- Coriander oil, *see* Thyme oil, white / Coriander oil, [493](#)
- Cottonwood ointment, *see* Fat ointments, [193](#)
- Cumin oil, [143](#)
- Cymbopogonis aetheroleum, *see* Lemon grass oil, [267](#)
- Cypress oil, [147](#)
- Dermatest base ointment, *see* Hydrophilic ointments, [223](#)
- Dermatop[®] base cream, *see* Hydrophilic ointments, [223](#)
- Dermatop[®] base ointment, [153](#)
- Dermifant[®] kids cream, *see* Allergika evening primrose oil cream 20% / Dermifant[®] kids cream, [27](#)
- Dexeryl[®], [157](#)
- Dichloroacetic acid, [163](#)
- Dimeticone ointment 10% SR, *see* Dimeticone ointment 10% SR / Optiderm[®] lotion, [167](#)
- Dimeticone ointment 10% SR / Optiderm[®] lotion, [167](#)
- DMS[®] base cream classic, *see* Hydrophilic ointments, [223](#)

- DMS® base cream high classic, *see*
Hydrophilic ointments, [223](#)
- DMS® base cream high classic plus, *see*
Hydrophilic ointments, [223](#)
- Dwarf pine oil, [173](#)
- Ethanol 70% pure / denatured, [177](#)
- Ethanolum 70% rein / vergällt, *see* Ethanol
70% pure / denatured, [177](#)
- Eucalyptus oil, *see* Cajeput oil / Eucalyptus
oil / Niaouli oil / Rosemary oil, [79](#)
- Eucerinum O/W basis, *see* Hydrophilic
ointments, [223](#)
- Eucerinum W/O basis, *see* Hydrophilic
ointments, [223](#)
- Excipial® almond oil ointment, [187](#)
- Excipial® hydro cream, *see* Hydrophilic
ointments, [223](#)
- Excipial® lipo cream, *see* Hydrophilic
ointments, [223](#)
- Excipial® U Hydrolotio, *see* Liniment
ointments, [273](#)
- Excipial® U Lipolotio, *see* Hydrophilic
ointments, [223](#)
- Excipial® U10 Lipolotio, *see* Hydrophilic
ointments, [223](#)
- Fabitop® base cream, *see* Hydrophilic
ointments, [223](#)
- Fat ointments, [193](#)
- Fenistil® Gel, [203](#)
- Fennel oil, [207](#)
- Frankincense oil, *see* Spruce needle oil / Pine
silvestris oil / Frankincense oil /
Silver fir oil, [459](#)
- Ginger oil, [211](#)
- Grapefruit oil organic / Orange oil / Blood
orange oil, [217](#)
- Grapefruit oil, organic, *see* Grapefruit oil
organic / Orange oil / Blood orange
oil, [217](#)
- Hans Karrer Hydrocream MicroSilver, *see*
Sebexol® formula basis / Sebexol®
cream lotion / Wofacutan washing
lotion / Hans Karrer Hydrocream
MicroSilver, [435](#)
- Hans Karrer Lipocream MicroSilver, *see*
Hydrophilic ointments, [223](#)
- Hans Karrer Lipolotion MicroSilver, *see*
Hydrophilic ointments, [223](#)
- Hydrophilic ointments, [223](#)
- Hyssop oil, *see* Citus oil / Lavender oil /
Clary sage oil / Myrtle oil /
Petitgrain oil / Hyssop oil, [123](#)
- Immortelle oil, [249](#)
- Juniper oil, [253](#)
- La Roche-Posay Cold Cream Naturel, [257](#)
- La Roche-Posay Toleriane, [261](#)
- Lavender oil, *see* Citus oil / Lavender oil /
Clary sage oil / Myrtle oil /
Petitgrain oil / Hyssop oil, [123](#)
- Lemon grass oil, [267](#)
- Lime oil, *see* Citric oil / Lime oil, [113](#)
- Liniment ointments, [273](#)
- Linola® body milk, *see* Hydrophilic
ointments, [223](#)
- Linola® fat cream, *see* Linola® fat creme /
Linola® H fat N / Alfason® Repair,
[281](#)
- Linola® fat creme / Linola® H fat N /
Alfason® Repair, [281](#)
- Linola® H fat N, *see* Linola® fat creme /
Linola® H fat N / Alfason® Repair,
[281](#)
- Linola® O/W cream, *see* Liniment
ointments, [273](#)
- Linola® Sept, *see* Liniment ointments, [273](#)
- Lipoderm® lotion, *see* Hydrophilic ointments,
[223](#)
- Lipolotio urea 5% F body lotion, [287](#)
- Lygal® head ointment N 3%, [291](#)
- Lygal® ointment base, [295](#)
- Majoranae aetheroleum, *see* Marjoram oil,
[309](#)
- Mandarin oil, green, [301](#)
- Manuka oil, [305](#)
- Marjoram oil, [309](#)
- Marjoram ointment, *see* Fat ointments, [193](#)
- Matricaria oil, morrocan, [315](#)
- Matricaria oil, roman, [319](#)
- Melissa 30% (essential oil), *see* Melissa oil
30%, [327](#)
- Melissa oil, [323](#)
- Melissa oil 30%, [327](#)
- Myrrh oil, [331](#)
- Myrtle oil, *see* Citus oil / Lavender oil /
Clary sage oil / Myrtle oil /
Petitgrain oil / Hyssop oil, [123](#)
- Neribas® cream, *see* Hydrophilic ointments,
[223](#)
- Neribas® fat ointment, *see* Fat ointments,
[193](#)
- Neribas® ointment, *see* Ointment ash basis /
Neribas®, [347](#)
- Neroli oil, [335](#)
- Neuroderm® care lotion, *see* Hydrophilic
ointments, [223](#)
- Neuroderm® moisturising cream, *see*
Hydrophilic ointments, [223](#)
- Neuroderm® moisturising cream lipo, [339](#)

- Niaouli oil, *see* Cajeput oil / Eucalyptus oil /
Niaouli oil / Rosemary oil, [79](#)
- Nicotine, [343](#)
- Nourivan™ Antiox, *see* Liniment ointments,
[273](#)
- Ointment ash basis / Neribas®, [347](#)
- Oleum abies alba, *see* Spruce needle oil /
Pine silvestris oil / Frankincense oil
/ Silver fir oil, [459](#)
- Oleum angelicae (e radice), *see* Angelica root
oil, [37](#)
- Oleum aniba roseodora, *see* Rosewood oil, [409](#)
- Oleum Anisi stellati, *see* Anise oil, organic, [41](#)
- Oleum anthemis nobilis, *see* Matricaria oil,
roman, [319](#)
- Oleum Arganiae, *see* Argan oil, [47](#)
- Oleum artemisia vulgaris, *see* Common
wormwood oil, [133](#)
- Oleum boswellia serrata, *see* Spruce needle oil
/ Pine silvestris oil / Frankincense
oil / Silver fir oil, [459](#)
- Oleum Cajeputi artificiale, *see* Cajeput oil /
Eucalyptus oil / Niaouli oil /
Rosemary oil, [79](#)
- Oleum caryophylli, *see* Clove oil, [129](#)
- Oleum cedrus deodara, *see* Cedar wood oil, [99](#)
- Oleum cinnamomi ceylanici, *see* Cinnamon
bark oil, Ceylon, [109](#)
- Oleum citri, *see* Citric oil / Lime oil, [113](#)
- Oleum citrus aurantifolia, *see* Citric oil /
Lime oil, [113](#)
- Oleum citrus aurantium, *see* Citus oil /
Lavender oil / Clary sage oil /
Myrtle oil / Petitgrain oil / Hyssop
oil, [123](#)
- Oleum citrus bergamia, *see* Bergamot oil, [73](#)
- Oleum citrus paradisi, *see* Grapefruit oil
organic / Orange oil / Blood orange
oil, [217](#)
- Oleum citrus sinensis, *see* Grapefruit oil
organic / Orange oil / Blood orange
oil, [217](#)
- Oleum coriandri, *see* Thyme oil, white /
Coriander oil, [493](#)
- Oleum cuminum cyminum, *see* Cumin oil, [143](#)
- Oleum cupressus sempervirens, *see* Cypress
oil, [147](#)
- Oleum cymbopogon winterianus, *see*
Citronella oil, [119](#)
- Oleum daucus carota, *see* Carrot seed oil, [95](#)
- Oleum eucalypti, *see* Cajeput oil /
Eucalyptus oil / Niaouli oil /
Rosemary oil, [79](#)
- Oleum foeniculum vulgare var. dulce, *see*
Fennel oil, [207](#)
- Oleum gaultheria procumbens, *see*
Wintergreen oil, [529](#)
- Oleum helichrysum italicum, *see* Immortelle
oil, [249](#)
- Oleum hyssopus officinalis, *see* Citus oil /
Lavender oil / Clary sage oil /
Myrtle oil / Petitgrain oil / Hyssop
oil, [123](#)
- Oleum juniperi e baccarae, *see* Juniper oil,
[253](#)
- Oleum lavendula officinalis, *see* Citus oil /
Lavender oil / Clary sage oil /
Myrtle oil / Petitgrain oil / Hyssop
oil, [123](#)
- Oleum leptospermum scoparium, *see* Manuka
oil, [305](#)
- Oleum melaleuca alternifolia, *see* Tea tree oil,
[479](#)
- Oleum mentha spicata, *see* Spearmint oil, [455](#)
- Oleum menthae piperitae dopp. rectific., *see*
Peppermint oil, [377](#)
- Oleum myrrha, *see* Myrrh oil, [331](#)
- Oleum neroli, *see* Neroli oil, [335](#)
- Oleum niaouli, *see* Cajeput oil / Eucalyptus
oil / Niaouli oil / Rosemary oil, [79](#)
- Oleum ocimum basilicum, *see* Basil oil, [59](#)
- Oleum origani cretici, *see* Oregano oil, [361](#)
- Oleum ormenis multicaulis, *see* Matricaria
oil, morrocan, [315](#)
- Oleum palmarosae, *see* Palmarosa oil,
organic, [365](#)
- Oleum pelargonium graveolens, *see*
Rose-geranium oil, organic, [399](#)
- Oleum pini pumilionis, *see* Dwarf pine oil, [173](#)
- Oleum pini sibiricum, *see* Spruce needle oil /
Pine silvestris oil / Frankincense oil
/ Silver fir oil, [459](#)
- Oleum pini silvestris, *see* Spruce needle oil /
Pine silvestris oil / Frankincense oil
/ Silver fir oil, [459](#)
- Oleum pinus cembra, *see* Swiss pine oil, [475](#)
- Oleum pogostemon cablin, *see* Patchouli oil,
[373](#)
- Oleum rosmarini, *see* Cajeput oil /
Eucalyptus oil / Niaouli oil /
Rosemary oil, [79](#)
- Oleum salviae, *see* Sage oil, [413](#)
- Oleum salviae sclarea, *see* Citus oil /
Lavender oil / Clary sage oil /
Myrtle oil / Petitgrain oil / Hyssop
oil, [123](#)
- Oleum styrax tonkinensis, *see* Benzoin siam
oil 20%, [63](#)
- Oleum thymus vulgaris, *see* Thyme oil, red,
[487](#)
- Oleum vanillae planifoliae, *see* Perfume oil
vanilla, [383](#)
- Oleum Vaselini album, *see* White paraffin oil,

- 525
- Oleum vetiveria zizanoides, *see* Vetiver
bourbon oil, 499
- Oleum ylang-ylang, *see* Ylang-ylang oil, 537
- Oleum zingiber officinalis, *see* Ginger oil, 211
- Optiderm® lotion, *see* Dimeticone ointment
10% SR / Optiderm® lotion, 167
- Orange aroma, 355
- Orange flavour, *see* Orange aroma, 355
- Orange oil, *see* Grapefruit oil organic /
Orange oil / Blood orange oil, 217
- Oregano oil, 361
- Palmarosa oil, organic, 365
- Panthenol ointment Lichtenstein, 369
- Patchouli oil, 373
- Peppermint oil, 377
- Perfume oil vanilla, 383
- Petitgrain oil, *see* Citrus oil / Lavender oil /
Clary sage oil / Myrtle oil /
Petitgrain oil / Hyssop oil, 123
- Pine silvestris oil, *see* Spruce needle oil / Pine
silvestris oil / Frankincense oil /
Silver fir oil, 459
- Protegin® XN, *see* Fat ointments, 193
- Raspberry aroma, 387
- Raspberry flavour, *see* Raspberry aroma, 387
- Ravensara (essentielle oil), *see* Ravensara oil,
393
- Ravensara oil, 393
- Retterspitz external, *see* Water and aqueous
solutions, 509
- Rose-geranium oil, organic, 399
- Rosemary camphor oil, 405
- Rosemary oil, *see* Cajeput oil / Eucalyptus
oil / Niaouli oil / Rosemary oil, 79
- Rosewood oil, 409
- Sage oil, 413
- Salicylic white paraffin 10%, 419
- Salmon oil, 423
- Sandalwood oil, 427
- Savory herb, 431
- Sebexol® basic pH 5 formula basis, *see*
Sebexol® formula basis / Sebexol®
cream lotion / Wofacutan washing
lotion / Hans Karrer Hydrocream
MicroSilver, 435
- Sebexol® cream lotion pH 5, *see* Sebexol®
formula basis / Sebexol® cream
lotion / Wofacutan washing lotion /
Hans Karrer Hydrocream
MicroSilver, 435
- Sebexol® formula basis / Sebexol® cream
lotion / Wofacutan washing lotion /
- Hans Karrer Hydrocream
MicroSilver, 435
- Siam benzoin, 445
- Silver fir oil, *see* Spruce needle oil / Pine
silvestris oil / Frankincense oil /
Silver fir oil, 459
- Solutio Cordes®, 449
- Spearmint oil, 455
- Spruce needle oil, *see* Spruce needle oil / Pine
silvestris oil / Frankincense oil /
Silver fir oil, 459
- Spruce needle oil / Pine silvestris oil /
Frankincense oil / Silver fir oil, 459
- Stomahesive® adhesive paste, 465
- Strawberry aroma, 469
- Strawberry flavour, *see* Strawberry aroma,
469
- Swiss pine oil, 475
- SyrSpend® SF pH4 aroma free, *see* Water
and aqueous solutions, 509
- SyrSpend® SF pH4 cherry aroma, *see* Water
and aqueous solutions, 509
- Tea tree oil, 479
- Thuja (essential oil), *see* Thuja oil, 483
- Thuja oil, 483
- Thyme oil, red, 487
- Thyme oil, white, *see* Thyme oil, white /
Coriander oil, 493
- Thyme oil, white / Coriander oil, 493
- Unguentum cereum, *see* Wax ointment
(stabilised), 517
- Unguentum dimeticoni 10% SR, *see*
Dimeticone ointment 10% SR /
Optiderm® lotion, 167
- Unguentum majoranae, *see* Fat ointments,
193
- Unguentum Populi, *see* Fat ointments, 193
- Vetiver bourbon oil, 499
- Wart ointment InfectoPharm® (NRF 11.31),
503
- Water, *see* Water and aqueous solutions, 509
- Water and aqueous solutions, 509
- Wax ointment (stabilised), 517
- White paraffin oil, 525
- Wintergreen oil, 529
- Wofacutan wash lotion, *see* Sebexol® formula
basis / Sebexol® cream lotion /
Wofacutan washing lotion / Hans
Karrer Hydrocream MicroSilver, 435
- Yarrow oil, 533
- Ylang-ylang oil, 537