

Validation documentation
Hepart raw materials

HiperScan GmbH

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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 *Hepat raw materials*.

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.

Validity scope of this document

This validation documentation describes the results of the validation of the reference database for the substance class *Hepat raw materials*. 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 database is exclusively established from spectra which have been recorded by *HiperScan GmbH* for 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.
 - In three separately evaluated validation runs, calibration spectra, spectra from independent samples and spectra from independent field samples (described further below as *Type A*, *B* or *C*) are presented to the *IdentModule* for evaluation.
 - 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*).
- For each individual substance, the unambiguous identifiability with *Apo-Ident* and the demarkation against all other database substances is proven.

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) Checking the distances between the limits of the separable substances: the distance matrix incorporates the *Mahalanobis distances* from each substance to all the others. If a distance is less than 10, both two substances must be declared as inseparable or *both two* must be removed from the database. (The spectra of removed substances remain as independent *Type B* spectra in the validation.)
- e) Testing the model based on the reference spectra. If *false positive* results arise, you must proceed as in the case of *Mahalanobis distances* which are too small.
- f) If chemometric models are available for all substance classes which meet both criteria (distance matrix and no *false positives*), they are joined together with the evaluation algorithms as an *IdentModule* and encrypted. This unit can no longer be changed. Its overall function is tested by validation.

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 established. 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 from independent samples not included in the generation of the respective model received but were measured by *HiperScan GmbH*. These also include reference spectra from other substance classes and spectra which are not declared as reference spectra.
- c) *Type C*: Spectra from independent field samples. These measurements were recorded under normal everyday conditions by pharmacy staff. The spectra belong both to substances of the substance class to be examined and to substances from different classes.

All manufacturers' batches from which spectra flow into the validation are listed by substance in this document: for substances included in the substance class *Hepat raw materials* in the respective validation reports; otherwise in attachments *A*, *B* and *C*.

Furthermore remains valid: validation spectra may only be removed if a spectrum error 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.

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 14000 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.

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, *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 $\mathbf{X}$.

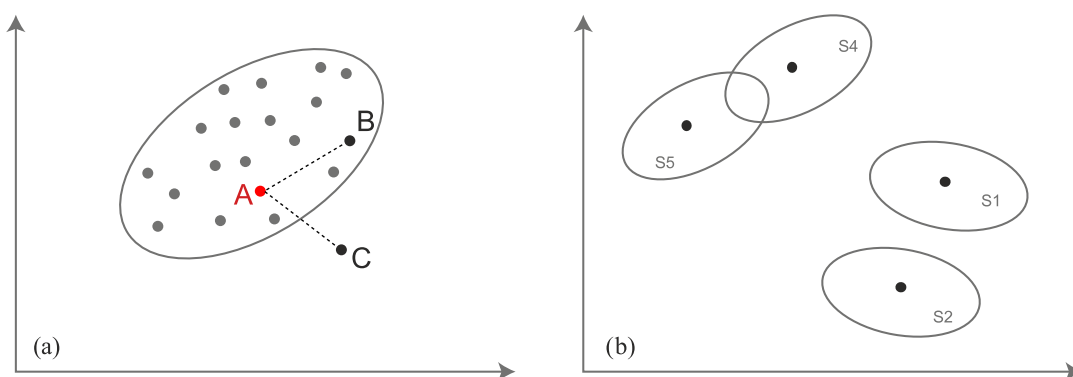


Figure 1: (a) The *Mahalanobis distance* from *A* to *B* is less than from *A* to *C*. However, the *Euclidean distances* are identical. (b) The *Mahalanobis distance* between the two measurement series *S4* and *S5* is smaller than between *S1* and *S2*. However, the *Euclidean distances* are identical.

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].

As sample applies the substance from a package. Multiple extractions of substance from the same package for spectrum recordings will be ascribed to the same sample. This also applies if multiple of such samples originate from the same batch.

Does a supplier conversely take 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 20 489 spectra from 440 different batches for a total of 153 substances were used to validate the substance class *Hepart raw materials*.

Validation samples

The validation samples can be categorised as follows:

Type 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
Hepart raw materials	102	235	9584

From category *A* a total of 9584 spectra from 235 batches for a total of 102 substances were taken into account for validation.

Type 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
Hepart raw materials	142	309	10 834

From category *B* a total of 10834 spectra from 309 batches for a total of 142 substances were taken into account for validation.

Type 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
Hepart raw materials	27	43	71

From category *C* a total of 71 spectra from 43 batches for a total of 27 substances were taken into account for validation.

Validation results

The validation runs checked whether all substances/substance groups in the substance class *Hepart raw materials* 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 *Hepart raw materials* 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	9580	4	929 648
Type B	0	6578	1122	1 053 952
Type C	0	62	9	6887

All substances/substance groups in the substance class *Hepat raw materials* 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
Type A	100.000 00 % (> 99.999 10 %)	99.974 49 % (> 99.930 50 %)
Type B	100.000 00 % (> 99.999 01 %)	84.783 59 % (> 84.712 91 %)
Type C	100.000 00 % (> 99.861 76 %)	81.275 72 % (> 79.460 09 %)

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

IdentModul 1.3-2017-05

Validated substance/substance group **Acacia gum (encapsia) / acacia gum (R001/R0141)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85084-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Acacia gum (encapsia) / acacia gum (R001/R0141)

Special notes

When selecting the *Acacia gum (encapsia) / acacia gum (R001/R0141)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Acacia gum (encapsia) / acacia gum (R001/R0141)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Acacia gum (enca...	1212002	85084	50	not required
Hepart	Acacia gum (enca...	14001701	85232	40	not required
Hepart	Acacia gum (enca...	15000744	85285	40	not required
Hepart	Acacia gum (enca...	15001443	85323	40	not required
Hepart	Acacia gum (enca...	15001837	85339	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 210 spectra of 5 reference samples from the substance/substance group *Acacia gum (encapsia) / acacia gum (R001/R0141)*. These samples are listed above in the [calibration samples](#) section.
- 9374 spectra from a total of 229 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 240 spectra of 7 reference samples from the substance/substance group *Acacia gum (encapsia) / acacia gum (R001/R0141)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Acacia gum (encapsia) / acac...	14001701	85232 [†]	20
Hepart	Acacia gum (encapsia) / acac...	15000744	85285 [†]	20
Hepart	Acacia gum (encapsia) / acac...	15001444	85322	60
Hepart	Acacia gum (encapsia) / acac...	15001443	85323 [†]	20
Hepart	Acacia gum (encapsia) / acac...	15001837	85339 [†]	20
Hepart	Acacia gum (encapsia) / acac...	16000477	85354	60
Hepart	Acacia gum (encapsia) / acac...	16001008	85430	40

- 10 594 spectra from a total of 301 batches from further 141 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.

[†]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*.

- 2 spectra from 1 *Apo-Ident* customers from 2 batches from the substance/substance group *Acacia gum (encapsia) / acacia gum (R001/R0141)*.

Supplier	Substance	Batch	Spectra
Albert Isliker	Acacia gum (encapsia) / acac...	15001837	1
Falcone Specialties	Acacia gum (encapsia) / acac...	16000477	1

- 69 spectra from 1 *Apo-Ident* customers from a total of 41 batches from a further 26 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 *Acacia gum (encapsia) / acacia gum (R001/R0141)* 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 *Acacia gum (encapsia) / acacia gum (R001/R0141)* 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	210	0	9374
Type B	0	240	0	10 514
Type C	0	2	0	69

The substance/substance group *Acacia gum (encapsia) / acacia gum (R001/R0141)* 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 % (> 99.9114 %)	100.0000 % (> 97.1429 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 97.5000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85084	85084	0.00	22.59
85232	85232	0.00	20.43
85285	85285	0.00	22.38
85323	85323	0.00	22.60
85339	85339	0.00	24.75

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **a-lipoic acid (R0003)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85227-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

a-lipoic acid (R0003)

Special notes

When selecting the *a-lipoic acid (R0003)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F *Zusatz zu den Modellen der zweiten Stufe*

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.

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 *a-lipoic acid (R0003)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	a-lipoic acid (R...	1011008	85227	40	not required
Hepart	a-lipoic acid (R...	16001690	85466	40	not required

Validation samples

A total of 20 489 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 *a-lipoic acid (R0003)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *a-lipoic acid (R0003)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	a-lipoic acid (R0003)	1011008	85227 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 1 batches from the substance/substance group *a-lipoic acid (R0003)*.

Supplier	Substance	Batch	Spectra
unbekannt	a-lipoic acid (R0003)	14001365	2

[†]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*.

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *a-lipoic acid (R0003)* 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 *a-lipoic acid (R0003)* 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	9504
Type B	0	20	0	10 814
Type C	0	2	0	69

The substance/substance group *a-lipoic acid (R0003)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85227	85227	0.00	100.71
85466	85466	0.00	99.77

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe

von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Artichoke extract (R0208)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85289-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Artichoke extract (R0208)

Special notes

When selecting the *Artichoke extract (R0208)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Artichoke extract (R0208)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Artichoke extrac...	15000797	85289	40	not required
Hepart	Artichoke extrac...	16000723	85371	40	not required

Validation samples

A total of 20 489 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 *Artichoke extract (R0208)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Artichoke extract (R0208)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Artichoke extract (R0208)	15000797	85289 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Artichoke extract (R0208)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Artichoke extract (R0208)* 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 *Artichoke extract (R0208)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Artichoke extract (R0208)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85289	85289	0.00	17.03
85371	85371	0.00	15.33

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Ascorbic acid (R0007)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85005-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ascorbic acid (R0007)

Special notes

When selecting the *Ascorbic acid (R0007)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Ascorbic acid (R0007)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Ascorbic acid (R...	14001127	85197	40	not required
Hepart	Ascorbic acid (R...	15000274	85253	40	not required
Hepart	Ascorbic acid (R...	15000642	85270	40	not required
Hepart	Ascorbic acid (R...	15000642/1	85277	40	not required
Hepart	Ascorbic acid (R...	16000189	85352	40	not required
Hepart	Ascorbic acid (R...	16001693	85463	40	not required

Validation samples

A total of 20 489 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 *Ascorbic acid (R0007)*. These samples are listed above in the [calibration samples](#) section.
- 9344 spectra from a total of 228 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 200 spectra of 7 reference samples from the substance/substance group *Ascorbic acid (R0007)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Ascorbic acid (R0007)	1204001	85005	40
Hepart	Ascorbic acid (R0007)	1109001	85171	40
Hepart	Ascorbic acid (R0007)	15000274	85253 [†]	20
Hepart	Ascorbic acid (R0007)	15000642	85270 [†]	20
Hepart	Ascorbic acid (R0007)	15000642/1	85277 [†]	20
Hepart	Ascorbic acid (R0007)	16000189	85352 [†]	20
Hepart	Ascorbic acid (R0007)	16000865	85408	40

- 10 634 spectra from a total of 301 batches from further 141 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 *Ascorbic acid (R0007)*.

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Ascorbic acid (R0007)* 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 *Ascorbic acid (R0007)* 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	9344
Type B	0	160	40	10 634
Type C	0	0	0	71

The substance/substance group *Ascorbic acid (R0007)* 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 % (> 99.9114 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9028 %)	80.0000 % (> 78.5000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85197	85197	0.00	89.19
85253	85253	0.00	96.62
85270	85270	0.00	93.61
85277	85277	0.00	90.39
85352	85352	0.00	90.79
85463	85463	0.00	98.66

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe

mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Ascorbyl palmitate (R0164)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85024-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ascorbyl palmitate (R0164)

Special notes

When selecting the *Ascorbyl palmitate (R0164)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Ascorbyl palmitate (R0164)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Ascorbyl palmita...	2011.06.0855	85024	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Ascorbyl palmitate (R0164)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Ascorbyl palmitate (R0164)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Ascorbyl palmitate (R0164)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Ascorbyl palmitate (R0164)* 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 *Ascorbyl palmitate (R0164)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Ascorbyl palmitate (R0164)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85024	85024	0.00	92.03

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Beta carotene 20% (R0008)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85216-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Beta carotene 20% (R0008)

Special notes

When selecting the *Beta carotene 20% (R0008)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Beta carotene 20% (R0008)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Beta carotene 20...	14001398	85216	40	not required
Hepart	Beta carotene 20...	15001163	85312	40	not required

Validation samples

A total of 20 489 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 *Beta carotene 20% (R0008)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 100 spectra of 3 reference samples from the substance/substance group *Beta carotene 20% (R0008)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Beta carotene 20% (R0008)	14001398	85216 [†]	20
Hepart	Beta carotene 20% (R0008)	14001399	85218	60
Hepart	Beta carotene 20% (R0008)	15001163	85312 [†]	20

- 10 734 spectra from a total of 305 batches from further 141 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 *Beta carotene 20% (R0008)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Beta carotene 20% (R0008)* 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 *Beta carotene 20% (R0008)* 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	9504
Type B	0	100	0	10 734
Type C	0	0	0	71

The substance/substance group *Beta carotene 20% (R0008)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 94.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85216	85216	0.00	39.34
85312	85312	0.00	41.99

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Betaine HCl (R0211)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85283-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Betaine HCl (R0211)

Special notes

When selecting the *Betaine HCl (R0211)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Betaine HCl (R0211)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Betaine HCl (R02...	15000746	85283	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Betaine HCl (R0211)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Betaine HCl (R0211)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Betaine HCl (R0211)	15000746	85283 [†]	20
Hepart	Betaine HCl (R0211)	16000706	85370	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Betaine HCl (R0211)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Betaine HCl (R0211)* 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 *Betaine HCl (R0211)* 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	40	0	9544
Type B	0	60	0	10 774
Type C	0	0	0	71

The substance/substance group *Betaine HCl (R0211)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 90.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85283	85283	0.00	185.79

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Biotin (R0010)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85048-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Biotin (R0010)

Special notes

When selecting the *Biotin (R0010)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Biotin (R0010)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Biotin (R0010)	15000241	85255	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Biotin (R0010)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 100 spectra of 3 reference samples from the substance/substance group *Biotin (R0010)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Biotin (R0010)	1209004	85048	40
Hepart	Biotin (R0010)	14000292	85179	40
Hepart	Biotin (R0010)	15000241	85255 [†]	20

- 10 734 spectra from a total of 305 batches from further 141 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 *Biotin (R0010)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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

[†]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*.

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 *Biotin (R0010)* 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 *Biotin (R0010)* 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	40	0	9544
Type B	0	68	32	10 734
Type C	0	0	0	71

The substance/substance group *Biotin (R0010)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9029 %)	68.0000 % (> 65.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85255	85255	0.00	126.23

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Black cumin extract (R0193)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85278-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Black cumin extract (R0193)

Special notes

When selecting the *Black cumin extract (R0193)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Black cumin extract (R0193)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Black cumin extr...	15000616	85278	40	not required
Hepart	Black cumin extr...	16000595	85385	40	not required

Validation samples

A total of 20 489 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 *Black cumin extract (R0193)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Black cumin extract (R0193)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Black cumin extract (R0193)	15000616	85278 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Black cumin extract (R0193)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Black cumin extract (R0193)* 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 *Black cumin extract (R0193)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Black cumin extract (R0193)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85278	85278	0.00	22.78
85385	85385	0.00	14.44

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Calcium D panthothenate (R0012)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85000-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Calcium D panthothenate (R0012)

Special notes

When selecting the *Calcium D panthothenate (R0012)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Calcium D panthothenate (R0012)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Calcium D pantho...	16000746	85375	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Calcium D panthothenate (R0012)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *Calcium D panthothenate (R0012)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Calcium D panthothenate (R00...	1203006	85000	40

- 10 794 spectra from a total of 307 batches from further 141 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 *Calcium D panthothenate (R0012)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Calcium D panthothenate (R0012)* 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 *Calcium D panthothenate (R0012)* 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	40	0	9544
Type B	0	2	38	10 794
Type C	0	0	0	71

The substance/substance group *Calcium D panthothenate (R0012)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9034 %)	5.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85375	85375	0.00	36.48

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Calcium lactate pentahydrate (R0013)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85234-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Calcium lactate pentahydrate (R0013)

Special notes

When selecting the *Calcium lactate pentahydrate (R0013)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Calcium lactate pentahydrate (R0013)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Calcium lactate ...	14001909	85234	40	not required
Hepart	Calcium lactate ...	15000242/0	85265	40	not required
Hepart	Calcium lactate ...	15000242/1	85266	40	not required

Validation samples

A total of 20 489 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 *Calcium lactate pentahydrate (R0013)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 4 reference samples from the substance/substance group *Calcium lactate pentahydrate (R0013)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Calcium lactate pentahydrate...	14001909	85234 [†]	20
Hepart	Calcium lactate pentahydrate...	14001908	85235	60
Hepart	Calcium lactate pentahydrate...	15000242/0	85265 [†]	20
Hepart	Calcium lactate pentahydrate...	15000242/1	85266 [†]	20

- 10 714 spectra from a total of 304 batches from further 141 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 *Calcium lactate pentahydrate (R0013)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Calcium lactate pentahydrate (R0013)* 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 *Calcium lactate pentahydrate (R0013)* 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	9464
Type B	0	120	0	10 714
Type C	0	0	0	71

The substance/substance group *Calcium lactate pentahydrate (R0013)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85234	85234	0.00	39.91
85265	85265	0.00	51.41
85266	85266	0.00	54.60

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR

bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Calmegh extract (R0201)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85300-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Calmegh extract (R0201)

Special notes

When selecting the *Calmegh extract (R0201)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Calmegh extract (R0201)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Calmegh extract ...	15000785	85300	40	not required
Hepart	Calmegh extract ...	16000716	85398	40	not required

Validation samples

A total of 20 489 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 *Calmegh extract (R0201)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Calmegh extract (R0201)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Calmegh extract (R0201)	15000785	85300 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Calmegh extract (R0201)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Calmegh extract (R0201)* 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 *Calmegh extract (R0201)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Calmegh extract (R0201)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85300	85300	0.00	19.06
85398	85398	0.00	25.73

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Chaga extract (R0016)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85219-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Chaga extract (R0016)

Special notes

When selecting the *Chaga extract (R0016)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Chaga extract (R0016)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Chaga extract (R...	16000964	85384	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Chaga extract (R0016)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 1 reference samples from the substance/substance group *Chaga extract (R0016)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Chaga extract (R0016)	14001400	85219	60

- 10 774 spectra from a total of 307 batches from further 141 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 *Chaga extract (R0016)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Chaga extract (R0016)* 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 *Chaga extract (R0016)* 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	40	0	9544
Type B	0	0	60	10 774
Type C	0	0	0	71

The substance/substance group *Chaga extract (R0016)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9031 %)	0.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85384	85384	0.00	27.17

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Chili extract (R0198)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85291-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Chili extract (R0198)

Special notes

When selecting the *Chili extract (R0198)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Chili extract (R0198)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Chili extract (R...	15000788	85291	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Chili extract (R0198)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Chili extract (R0198)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Chili extract (R0198)	15000788	85291 [†]	20
Hepart	Chili extract (R0198)	16000713	85367	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Chili extract (R0198)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Chili extract (R0198)* 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 *Chili extract (R0198)* 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	40	0	9544
Type B	0	20	40	10 774
Type C	0	0	0	71

The substance/substance group *Chili extract (R0198)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9031 %)	33.3333 % (> 28.3333 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85291	85291	0.00	22.08

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Cholecalciferol (vitamin D3) (R0018) / Menaquino...**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85256-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134); Cholecalciferol (vitamin D3) (R0018); Menaquinone-7 0.2% (R0134)

Special notes

When selecting the *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Cholecalciferol ...	15000387	85256	40	not required
Hepart	Menaquinone-7 0...	15000367	85280	40	not required
Hepart	Cholecalciferol ...	15001075	85310	40	not required
Hepart	Cholecalciferol ...	16000539	85389	40	not required
Hepart	Menaquinone-7 0...	16001501	85454	40	not required

Validation samples

A total of 20 489 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 *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)*. These samples are listed above in the [calibration samples](#) section.
- 9384 spectra from a total of 229 batches from further 100 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 180 spectra of 6 reference samples from the substance/substance group *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Cholecalciferol (vitamin D3)...	1203007	85001	40
Hepart	Menaquinone-7 0.2% (R0134)	1208014	85049	40
Hepart	Cholecalciferol (vitamin D3)...	15000387	85256 [†]	20
Hepart	Menaquinone-7 0.2% (R0134)	15000367	85280 [†]	20
Hepart	Cholecalciferol (vitamin D3)...	15001075	85310 [†]	20
Hepart	Menaquinone-7 0.2% (R0134)	16000527	85386	40

- 10 654 spectra from a total of 302 batches from further 140 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.

[†]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*.

- 1 spectra from 1 *Apo-Ident* customers from 1 batches from the substance/substance group *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)*.

Supplier	Substance	Batch	Spectra
IMCD Switzerland AG	Menaquinone-7 0.2% (R0134)	16000527	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)* 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 *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)* 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	9384
Type B	0	140	40	10654
Type C	0	1	0	70

The substance/substance group *Cholecalciferol (vitamin D3) (R0018) / Menaquinone-7 0.2% (R0134)* 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 % (> 99.9114 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9028 %)	77.7778 % (> 76.1111 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85256	85256	0.00	23.64
85280	85280	0.00	30.17
85310	85310	0.00	22.64
85389	85389	0.00	22.89
85454	85454	0.00	89.99

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Choline chloride (R0019)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85014-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Choline chloride (R0019)

Special notes

When selecting the *Choline chloride (R0019)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Choline chloride (R0019)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Choline chloride...	1209009	85110	40	not required
Hepart	Choline chloride...	15000266	85263	40	not required
Hepart	Choline chloride...	16000866	85413	40	not required

Validation samples

A total of 20 489 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 *Choline chloride (R0019)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 4 reference samples from the substance/substance group *Choline chloride (R0019)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Choline chloride (R0019)	1205003	85014	20
Hepart	Choline chloride (R0019)	15000266	85263 [†]	20
Hepart	Choline chloride (R0019)	16000187	85356	60
Hepart	Choline chloride (R0019)	16001694	85464	40

- 10 694 spectra from a total of 304 batches from further 141 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 *Choline chloride (R0019)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Choline chloride (R0019)* 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 *Choline chloride (R0019)* 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	9464
Type B	0	137	3	10 694
Type C	0	0	0	71

The substance/substance group *Choline chloride (R0019)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9028 %)	97.8571 % (> 95.7143 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85110	85110	0.00	67.44
85263	85263	0.00	44.04
85413	85413	0.00	75.45

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Citric acid monohydrate (R0143)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85304-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Citric acid monohydrate (R0143)

Special notes

When selecting the *Citric acid monohydrate (R0143)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 acid monohydrate (R0143)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Citric acid mono...	15000903	85304	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Citric acid monohydrate (R0143)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Citric acid monohydrate (R0143)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Citric acid monohydrate (R01...	15000903	85304 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Citric acid monohydrate (R0143)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Citric acid monohydrate (R0143)* 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 acid monohydrate (R0143)* 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	40	0	9544
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Citric acid monohydrate (R0143)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85304	85304	0.00	31.07

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Citrus bioflavonoids 60% (R0021)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85004-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Citrus bioflavonoids 60% (R0021)

Special notes

When selecting the *Citrus bioflavonoids 60% (R0021)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 bioflavonoids 60% (R0021)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Citrus bioflavon...	1208018	85122	40	not required
Hepart	Citrus bioflavon...	14000663	85176	40	not required
Hepart	Citrus bioflavon...	14001194	85206	40	not required
Hepart	Citrus bioflavon...	16001143	85406	40	not required

Validation samples

A total of 20 489 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 *Citrus bioflavonoids 60% (R0021)*. These samples are listed above in the [calibration samples](#) section.
- 9424 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 3 reference samples from the substance/substance group *Citrus bioflavonoids 60% (R0021)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Citrus bioflavonoids 60% (R0...	1203003	85004	40
Hepart	Citrus bioflavonoids 60% (R0...	14001176	85207	40
Hepart	Citrus bioflavonoids 60% (R0...	17000142	85473	40

- 10 714 spectra from a total of 305 batches from further 141 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 *Citrus bioflavonoids 60% (R0021)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 bioflavonoids 60% (R0021)* 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 bioflavonoids 60% (R0021)* 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	9424
Type B	0	80	40	10 714
Type C	0	0	0	71

The substance/substance group *Citrus bioflavonoids 60% (R0021)* 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 % (> 99.9115 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9029 %)	66.6667 % (> 64.1667 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85122	85122	0.00	21.69
85176	85176	0.00	24.78
85206	85206	0.00	25.59
85406	85406	0.00	44.61

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Coenzyme Q10 (R0022)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85063-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Coenzyme Q10 (R0022)

Special notes

When selecting the *Coenzyme Q10 (R0022)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Coenzyme Q10 (R0022)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Coenzyme Q10 (R0...	1007-018	85063	60	not required
Hepart	Coenzyme Q10 (R0...	14001313	85229	40	not required
Hepart	Coenzyme Q10 (R0...	15001651	85332	40	not required
Hepart	Coenzyme Q10 (R0...	16000193	85337	40	not required

Validation samples

A total of 20 489 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 *Coenzyme Q10 (R0022)*. These samples are listed above in the [calibration samples](#) section.
- 9404 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 200 spectra of 6 reference samples from the substance/substance group *Coenzyme Q10 (R0022)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Coenzyme Q10 (R0022)	14000029	85183	40
Hepart	Coenzyme Q10 (R0022)	14001313	85229 [†]	20
Hepart	Coenzyme Q10 (R0022)	15001651	85332 [†]	20
Hepart	Coenzyme Q10 (R0022)	16000185	85336	60
Hepart	Coenzyme Q10 (R0022)	16000193	85337 [†]	20
Hepart	Coenzyme Q10 (R0022)	16001481	85444	40

- 10 634 spectra from a total of 302 batches from further 141 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 *Coenzyme Q10 (R0022)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	Coenzyme Q10 (R0022)	15001651	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Coenzyme Q10 (R0022)* 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 *Coenzyme Q10 (R0022)* 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	9404
Type B	0	160	40	10 634
Type C	0	1	0	70

The substance/substance group *Coenzyme Q10 (R0022)* 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 % (> 99.9115 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9028 %)	80.0000 % (> 78.5000 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85063	85063	0.00	54.45
85229	85229	0.00	48.81
85332	85332	0.00	45.90
85337	85337	0.00	44.98

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Coriolus extract (R0207)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85288-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Coriolus extract (R0207)

Special notes

When selecting the *Coriolus extract (R0207)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Coriolus extract (R0207)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Coriolus extract...	15000795	85288	40	not required
Hepart	Coriolus extract...	16000722	85363	40	not required

Validation samples

A total of 20 489 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 *Coriolus extract (R0207)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Coriolus extract (R0207)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Coriolus extract (R0207)	15000795	85288 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Coriolus extract (R0207)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Coriolus extract (R0207)* 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 *Coriolus extract (R0207)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Coriolus extract (R0207)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85288	85288	0.00	14.14
85363	85363	0.00	17.68

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Creatine monohydrate (R0048)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85067-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Creatine monohydrate (R0048)

Special notes

When selecting the *Creatine monohydrate (R0048)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Creatine monohydrate (R0048)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Creatine monohyd...	060701	85067	60	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 60 spectra of 1 reference samples from the substance/substance group *Creatine monohydrate (R0048)*. These samples are listed above in the [calibration samples](#) section.
- 9524 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Creatine monohydrate (R0048)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Creatine monohydrate (R0048)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Creatine monohydrate (R0048)* 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 *Creatine monohydrate (R0048)* 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	60	0	9524
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Creatine monohydrate (R0048)* 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 % (> 99.9122 %)	100.0000 % (> 90.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85067	85067	0.00	40.59

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Curcumin 95% extract (R0023)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85191-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Curcumin 95% extract (R0023)

Special notes

When selecting the *Curcumin 95% extract (R0023)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Curcumin 95% extract (R0023)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Curcumin 95% ext...	14001177	85214	40	not required
Hepart	Curcumin 95% ext...	16000741	85405	40	not required

Validation samples

A total of 20 489 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 *Curcumin 95% extract (R0023)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 3 reference samples from the substance/substance group *Curcumin 95% extract (R0023)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Curcumin 95% extract (R0023)	130816500	85191	40
Hepart	Curcumin 95% extract (R0023)	14001177	85214 [†]	20
Hepart	Curcumin 95% extract (R0023)	16000422	85348	60

- 10 714 spectra from a total of 305 batches from further 141 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 *Curcumin 95% extract (R0023)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Curcumin 95% extract (R0023)* 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 *Curcumin 95% extract (R0023)* 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	9504
Type B	0	109	11	10 714
Type C	0	0	0	71

The substance/substance group *Curcumin 95% extract (R0023)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	90.8333 % (> 88.3333 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85214	85214	0.00	110.63
85405	85405	0.00	102.56

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Cyanocobalamin (R0024)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85274-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Cyanocobalamin (R0024)

Special notes

When selecting the *Cyanocobalamin (R0024)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Cyanocobalamin (R0024)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Cyanocobalamin (...)	15000619	85274	40	not required
Hepart	Cyanocobalamin (...)	16001695	85458	40	not required

Validation samples

A total of 20 489 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 *Cyanocobalamin (R0024)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Cyanocobalamin (R0024)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Cyanocobalamin (R0024)	15000619	85274 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Cyanocobalamin (R0024)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Cyanocobalamin (R0024)* 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 *Cyanocobalamin (R0024)* 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	9504
Type B	0	13	7	10 814
Type C	0	0	0	71

The substance/substance group *Cyanocobalamin (R0024)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	65.0000 % (> 50.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85274	85274	0.00	36.07
85458	85458	0.00	33.12

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **D-(+)-mannose (R0136)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85103-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

D-(+)-mannose (R0136)

Special notes

When selecting the D-(+)-mannose (R0136) substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F *Zusatz zu den Modellen der zweiten Stufe*

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.

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 D-(+)-mannose (R0136):

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	D-(+)-mannose (R...	061101	85103	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group D-(+)-mannose (R0136). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group D-(+)-mannose (R0136).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	D-(+)-mannose (R0136)	16000524	85387	40

- 10 794 spectra from a total of 307 batches from further 141 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 D-(+)-mannose (R0136).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 D-(+)-mannose (R0136) 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 D-(+)-mannose (R0136) 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	40	0	9544
Type B	0	0	40	10 794
Type C	0	0	0	71

The substance/substance group D-(+)-mannose (R0136) 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9034 %)	0.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85103	85103	0.00	37.73

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	D-alpha tocopheryl acetate 50% dry CWS (R0081)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85317-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

D-alpha tocopheryl acetate 50% dry CWS (R0081)

Special notes

When selecting the *D-alpha tocopheryl acetate 50% dry CWS (R0081)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *D-alpha tocopheryl acetate 50% dry CWS (R0081)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	D-alpha tocopher...	15001162	85317	40	not required
Hepart	D-alpha tocopher...	16001030	85414	40	not required

Validation samples

A total of 20 489 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 *D-alpha tocopheryl - acetate 50% dry CWS (R0081)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *D-alpha tocopheryl - acetate 50% dry CWS (R0081)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	D-alpha tocopheryl acetate 5...	15001162	85317 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *D-alpha tocopheryl acetate 50% dry CWS (R0081)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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

[†]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*.

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 *D-alpha tocopheryl acetate 50% dry CWS (R0081)* 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 *D-alpha tocopheryl acetate 50% dry CWS (R0081)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *D-alpha tocopheryl acetate 50% dry CWS (R0081)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85317	85317	0.00	79.65
85414	85414	0.00	81.62

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **D-galactose (R0135)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85096-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

D-galactose (R0135)

Special notes

When selecting the *D-galactose (R0135)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *D-galactose (R0135)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	D-galactose (R01...	061201	85096	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group D-galactose (R0135). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group D-galactose (R0135).
- 10 834 spectra from a total of 308 batches from further 142 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 D-galactose (R0135).

Supplier	Substance	Batch	Spectra
unbekannt	D-galactose (R0135)	15000485	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *D-galactose (R0135)* 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 *D-galactose (R0135)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	1	70

The substance/substance group *D-galactose (R0135)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 87.1676 %)	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.

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
85096	85096	0.00	74.28

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	DL-methionine (R0209)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85303-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

DL-methionine (R0209)

Special notes

When selecting the DL-methionine (R0209) substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	European Pharmacopoeia 8th Edition, Basic Version 2014 [3]
Komm2.2.40	Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident [4]
AA004	Erstellung und Validierung eines IdentModul-Updates
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 DL-methionine (R0209):

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	DL-methionine (R...	15000799	85303	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group DL-methionine (R0209). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group DL-methionine (R0209).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	DL-methionine (R0209)	15000799	85303 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 DL-methionine (R0209).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group DL-methionine (R0209) 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 DL-methionine (R0209) 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	40	0	9544
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group DL-methionine (R0209) 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85303	85303	0.00	47.85

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **D-ribose (R0137)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85104-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

D-ribose (R0137)

Special notes

When selecting the D-ribose (R0137) substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F *Zusatz zu den Modellen der zweiten Stufe*

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.

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 D-ribose (R0137):

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	D-ribose (R0137)	061001	85104	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group D-ribose (R0137). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 1 reference samples from the substance/substance group D-ribose (R0137).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	D-ribose (R0137)	15001757	85329	60

- 10 774 spectra from a total of 307 batches from further 141 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 1 batches from the substance/substance group D-ribose (R0137).

Supplier	Substance	Batch	Spectra
unbekannt	D-ribose (R0137)	15001757	2

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *D-ribose (R0137)* 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 *D-ribose (R0137)* 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	40	0	9544
Type B	0	49	11	10 774
Type C	0	1	1	69

The substance/substance group *D-ribose (R0137)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9031 %)	81.6667 % (> 76.6667 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85104	85104	0.00	69.21

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Folic acid (R0027)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85167-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Folic acid (R0027)

Special notes

When selecting the *Folic acid (R0027)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Folic acid (R0027)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Folic acid (R0027)	077301	85167	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Folic acid (R0027)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Folic acid (R0027)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Folic acid (R0027)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Folic acid (R0027)* 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 *Folic acid (R0027)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Folic acid (R0027)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85167	85167	0.00	78.53

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Galactomannans (R0035/R0094)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85010-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Galactomannans (R0035/R0094)

Special notes

When selecting the *Galactomannans (R0035/R0094)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Galactomannans (R0035/R0094)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Galactomannans (...)	1208006	85105	40	not required
Hepart	Galactomannans (...)	1211002	85107	40	not required
Hepart	Galactomannans (...)	1208002	85115	40	not required
Hepart	Galactomannans (...)	1208007	85120	40	not required
Hepart	Galactomannans (...)	14000084	85174	40	not required

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Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Galactomannans (...)	15000407	85259	40	not required
Hepart	Galactomannans (...)	15000685	85286	40	not required
Hepart	Galactomannans (...)	15000673	85287	40	not required
Hepart	Galactomannans (...)	15001293	85307	40	not required
Hepart	Galactomannans (...)	15001463	85319	40	not required
Hepart	Galactomannans (...)	15001362	85320	40	not required
Hepart	Galactomannans (...)	15001581	85326	40	not required
Hepart	Galactomannans (...)	15001729	85330	40	not required
Hepart	Galactomannans (...)	15001683	85331	40	not required
Hepart	Galactomannans (...)	16000652	85380	40	not required
Hepart	Galactomannans (...)	16000775	85418	40	not required
Hepart	Galactomannans (...)	16001114	85420	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 680 spectra of 17 reference samples from the substance/substance group *Galactomannans* (R0035/R0094). These samples are listed above in the [calibration samples](#) section.
- 8904 spectra from a total of 217 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 580 spectra of 19 reference samples from the substance/substance group *Galactomannans* (R0035/R0094).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Galactomannans (R0035/R0094)	1205010	85010	40
Hepart	Galactomannans (R0035/R0094)	1204003	85011	40
Hepart	Galactomannans (R0035/R0094)	1206007	85032	40
Hepart	Galactomannans (R0035/R0094)	15000407	85259 [†]	20
Hepart	Galactomannans (R0035/R0094)	15000685	85286 [†]	20
Hepart	Galactomannans (R0035/R0094)	15000673	85287 [†]	20
Hepart	Galactomannans (R0035/R0094)	15001293	85307 [†]	20
Hepart	Galactomannans (R0035/R0094)	15001463	85319 [†]	20
Hepart	Galactomannans (R0035/R0094)	15001362	85320 [†]	20
Hepart	Galactomannans (R0035/R0094)	15001581	85326 [†]	20
Hepart	Galactomannans (R0035/R0094)	15001729	85330 [†]	20

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Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Galactomannans (R0035/R0094)	15001683	85331 [†]	20
Hepart	Galactomannans (R0035/R0094)	16000994	85419	40
Hepart	Galactomannans (R0035/R0094)	16001195	85424	40
Hepart	Galactomannans (R0035/R0094)	16001131	85425	40
Hepart	Galactomannans (R0035/R0094)	16001405	85438	40
Hepart	Galactomannans (R0035/R0094)	16001579	85450	40
Hepart	Galactomannans (R0035/R0094)	16001510	85455	40
Hepart	Galactomannans (R0035/R0094)	16001642	85456	40

- 10 254 spectra from a total of 289 batches from further 141 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 1 *Apo-Ident* customers from 3 batches from the substance/substance group *Galactomannans (R0035/R0094)*.

Supplier	Substance	Batch	Spectra
unbekannt	Galactomannans (R0035/R0094)	15001463	1
Swissgum	Galactomannans (R0035/R0094)	15001729	1
swissgum	Galactomannans (R0035/R0094)	16001405	1

- 68 spectra from 1 *Apo-Ident* customers from a total of 40 batches from a further 26 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 *Galactomannans (R0035/R0094)* 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 *Galactomannans (R0035/R0094)* 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	680	0	8904
Type B	0	580	0	10 254
Type C	0	3	0	68

[†]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*.

The substance/substance group *Galactomannans (R0035/R0094)* 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 % (> 99.9112 %)	100.0000 % (> 99.1176 %)
Type B	100.0000 % (> 99.9027 %)	100.0000 % (> 98.9655 %)
Type C	100.0000 % (> 86.5978 %)	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.

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
85105	85105	0.00	25.50
85107	85107	0.00	24.57
85115	85115	0.00	20.98
85120	85120	0.00	23.14
85174	85174	0.00	24.88
85259	85259	0.00	30.89
85286	85286	0.00	26.60
85287	85287	0.00	29.63
85307	85307	0.00	24.58
85319	85319	0.00	23.99
85320	85320	0.00	26.39
85326	85326	0.00	21.91
85330	85330	0.00	23.56
85331	85331	0.00	21.87
85380	85380	0.00	35.85
85418	85418	0.00	31.00
85420	85420	0.00	32.84

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Gamma oryzanol (R0194)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85396-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Gamma oryzanol (R0194)

Special notes

When selecting the *Gamma oryzanol (R0194)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Gamma oryzanol (R0194)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Gamma oryzanol (...)	16000594	85396	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Gamma oryzanol (R0194)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Gamma oryzanol (R0194)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Gamma oryzanol (R0194)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Gamma oryzanol (R0194)* 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 *Gamma oryzanol (R0194)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Gamma oryzanol (R0194)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85396	85396	0.00	84.12

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Garcinia Cambogia (R0028)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85119-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Garcinia Cambogia (R0028)

Special notes

When selecting the *Garcinia Cambogia (R0028)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Garcinia Cambogia (R0028)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Garcinia Cambogi...	1003-010	85119	39	not required
Hepart	Garcinia Cambogi...	16000421	85350	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 79 spectra of 2 reference samples from the substance/substance group *Garcinia Cambogia* (R0028). These samples are listed above in the [calibration samples](#) section.
- 9505 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 180 spectra of 4 reference samples from the substance/substance group *Garcinia Cambogia* (R0028).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Garcinia Cambogia (R0028)	130816501	85193	40
Hepart	Garcinia Cambogia (R0028)	16000421	85350 [†]	20
Hepart	Garcinia Cambogia (R0028)	14001695	85351	60
Hepart	Garcinia Cambogia (R0028)	15000482	85353	60

- 10 654 spectra from a total of 304 batches from further 141 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 *Garcinia Cambogia* (R0028).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Garcinia Cambogia (R0028)* 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 *Garcinia Cambogia (R0028)* 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	79	0	9505
Type B	0	95	85	10 654
Type C	0	0	0	71

The substance/substance group *Garcinia Cambogia (R0028)* 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 % (> 99.9119 %)	100.0000 % (> 92.4051 %)
Type B	100.0000 % (> 99.9028 %)	52.7778 % (> 51.1111 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85119	85119	0.00	18.13
85350	85350	0.00	40.23

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Ginger extract (R0199)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85290-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ginger extract (R0199)

Special notes

When selecting the *Ginger extract (R0199)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 extract (R0199)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Ginger extract (...)	15000800	85290	40	not required
Hepart	Ginger extract (...)	16000714	85372	40	not required

Validation samples

A total of 20 489 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 *Ginger extract (R0199)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Ginger extract (R0199)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Ginger extract (R0199)	15000800	85290 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Ginger extract (R0199)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Ginger extract (R0199)* 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 extract (R0199)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Ginger extract (R0199)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85290	85290	0.00	25.85
85372	85372	0.00	30.38

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Ginkgo extract (R0093)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85114-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ginkgo extract (R0093)

Special notes

When selecting the *Ginkgo extract (R0093)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Ginkgo extract (R0093)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Ginkgo extract (...)	1010006	85114	40	not required
Hepart	Ginkgo extract (...)	050101	85150	50	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 90 spectra of 2 reference samples from the substance/substance group *Ginkgo extract (R0093)*. These samples are listed above in the [calibration samples](#) section.
- 9494 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 10 spectra of 1 reference samples from the substance/substance group *Ginkgo extract (R0093)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Ginkgo extract (R0093)	50101	85150 [†]	10

- 10 824 spectra from a total of 307 batches from further 141 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 *Ginkgo extract (R0093)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Ginkgo extract (R0093)* 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 *Ginkgo extract (R0093)* 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	90	0	9494
Type B	0	10	0	10 824
Type C	0	0	0	71

The substance/substance group *Ginkgo extract (R0093)* 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 % (> 99.9118 %)	100.0000 % (> 93.3333 %)
Type B	100.0000 % (> 99.9058 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85114	85114	0.00	67.92
85150	85150	0.00	57.52

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Ginseng Extract (R0029) / Lutein 20% (R0052)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85151-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Ginseng Extract (R0029) / Lutein 20% (R0052); Ginseng extract (R0029); Lutein 20% (R0052)

Special notes

When selecting the *Ginseng Extract (R0029) / Lutein 20% (R0052)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Ginseng Extract (R0029) / Lutein 20% (R0052)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Ginseng extract ...	068001	85151	40	not required
Hepart	Ginseng extract ...	14001403	85224	40	not required
Hepart	Lutein 20% (R0052)	14001179	85228	40	not required
Hepart	Lutein 20% (R0052)	16001144	85401	40	not required

Validation samples

A total of 20 489 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 *Ginseng Extract (R0029)* / *Lutein 20% (R0052)*. These samples are listed above in the [calibration samples](#) section.
- 9424 spectra from a total of 230 batches from further 100 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 170 spectra of 6 reference samples from the substance/substance group *Ginseng Extract (R0029)* / *Lutein 20% (R0052)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Lutein 20% (R0052)	1203009	85003	40
Hepart	Ginseng extract (R0029)	68001	85151 [†]	10
Hepart	Lutein 20% (R0052)	130708600	85177	40
Hepart	Lutein 20% (R0052)	14000664	85182	40
Hepart	Ginseng extract (R0029)	14001403	85224 [†]	20
Hepart	Lutein 20% (R0052)	14001179	85228 [†]	20

- 10 664 spectra from a total of 302 batches from further 140 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 *Ginseng Extract (R0029)* / *Lutein 20% (R0052)*.

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Ginseng Extract (R0029)* / *Lutein 20% (R0052)* 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 *Ginseng Extract (R0029)* / *Lutein 20% (R0052)* 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	9424
Type B	0	144	26	10 664
Type C	0	0	0	71

The substance/substance group *Ginseng Extract (R0029)* / *Lutein 20% (R0052)* 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 % (> 99.9115 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9028 %)	84.7059 % (> 82.9412 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85151	85151	0.00	37.29
85224	85224	0.00	17.97
85228	85228	0.00	45.27
85401	85401	0.00	49.89

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe

mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Glucosamine sulfate 2KCl (R0030)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85170-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Glucosamine sulfate 2KCl (R0030)

Special notes

When selecting the *Glucosamine sulfate 2KCl (R0030)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Glucosamine sulfate 2KCl (R0030)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Glucosamine sulf...	14000030	85170	40	not required
Hepart	Glucosamine sulf...	16001125	85427	40	not required

Validation samples

A total of 20 489 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 *Glucosamine sulfate 2KCl (R0030)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 3 reference samples from the substance/substance group *Glucosamine sulfate 2KCl (R0030)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Glucosamine sulfate 2KCl (R0...	16000867	85428	40
Hepart	Glucosamine sulfate 2KCl (R0...	16001696	85452	40
Hepart	Glucosamine sulfate 2KCl (R0...	16001667	85453	40

- 10 714 spectra from a total of 305 batches from further 141 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.

- 9 spectra from 1 *Apo-Ident* customers from 4 batches from the substance/substance group *Glucosamine sulfate 2KCl (R0030)*.

Supplier	Substance	Batch	Spectra
unbekannt	Glucosamine sulfate 2KCl (R0...	150001429	1
unbekannt	Glucosamine sulfate 2KCl (R0...	15001429	5
unbekannt	Glucosamine sulfate 2KCl (R0...	15001429/7	1
unbekannt	Glucosamine sulfate 2KCl (R0...	16001125	2

- 62 spectra from 1 *Apo-Ident* customers from a total of 39 batches from a further 26 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 *Glucosamine sulfate 2KCl (R0030)* 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 *Glucosamine sulfate 2KCl (R0030)* 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	9504
Type B	0	120	0	10 714
Type C	0	9	0	62

The substance/substance group *Glucosamine sulfate 2KCl (R0030)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 86.4079 %)	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.

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
85170	85170	0.00	86.27
85427	85427	0.00	97.64

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das

alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Glutathione (reduced form) (R0032)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85261-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Glutathione (reduced form) (R0032)

Special notes

When selecting the *Glutathione (reduced form) (R0032)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Glutathione (reduced form) (R0032)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Glutathione (red...	15000418	85261	40	not required
Hepart	Glutathione (red...	16000695	85379	40	not required

Validation samples

A total of 20 489 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 *Glutathione (reduced form)* (R0032). These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Glutathione (reduced form)* (R0032).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Glutathione (reduced form) (...)	15000418	85261 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Glutathione (reduced form)* (R0032).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Glutathione (reduced form)* (R0032) 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 *Glutathione (reduced form)* (R0032) 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Glutathione (reduced form)* (R0032) 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85261	85261	0.00	82.70
85379	85379	0.00	92.01

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Glycine (R0033)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85050-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Glycine (R0033)

Special notes

When selecting the *Glycine (R0033)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Glycine (R0033)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Glycine (R0033)	1212001	85131	40	not required
Hepart	Glycine (R0033)	14000031	85173	40	not required

Validation samples

A total of 20 489 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 *Glycine (R0033)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 3 reference samples from the substance/substance group *Glycine (R0033)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Glycine (R0033)	1006010	85050	40
Hepart	Glycine (R0033)	15000641	85273	60
Hepart	Glycine (R0033)	16001698	85472	40

- 10 694 spectra from a total of 305 batches from further 141 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 *Glycine (R0033)*.

Supplier	Substance	Batch	Spectra
unbekannt	Glycine (R0033)	14001121	1
unbekannt	Glycine (R0033)	15000641	1

- 69 spectra from 1 *Apo-Ident* customers from a total of 41 batches from a further 26 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 *Glycine (R0033)* 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 *Glycine (R0033)* 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	9504
Type B	0	123	17	10 694
Type C	0	1	1	69

The substance/substance group *Glycine (R0033)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9028 %)	87.8571 % (> 85.7143 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85131	85131	0.00	93.44
85173	85173	0.00	69.78

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR

bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Grape polyphenols (R0084)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85123-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Grape polyphenols (R0084)

Special notes

When selecting the *Grape polyphenols (R0084)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Grape polyphenols (R0084)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Grape polyphenol...	1209022	85123	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Grape polyphenols (R0084)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Grape polyphenols (R0084)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Grape polyphenols (R0084)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Grape polyphenols (R0084)* 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 *Grape polyphenols (R0084)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Grape polyphenols (R0084)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85123	85123	0.00	52.11

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Green tea extract (R0034)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85019-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Green tea extract (R0034)

Special notes

When selecting the *Green tea extract (R0034)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Green tea extract (R0034)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Green tea extrac...	058901	85095	40	not required
Hepart	Green tea extrac...	1208017	85117	40	not required
Hepart	Green tea extrac...	130430-GT12	85190	40	not required

Validation samples

A total of 20 489 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 *Green tea extract (R0034)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group *Green tea extract (R0034)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Green tea extract (R0034)	1110014	85019	40
Hepart	Green tea extract (R0034)	1008-004	85188	40

- 10 754 spectra from a total of 306 batches from further 141 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 *Green tea extract (R0034)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Green tea extract (R0034)* 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 *Green tea extract (R0034)* 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	9464
Type B	0	40	40	10 754
Type C	0	0	0	71

The substance/substance group *Green tea extract (R0034)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9030 %)	50.0000 % (> 46.2500 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85095	85095	0.00	29.36
85117	85117	0.00	16.37
85190	85190	0.00	12.94

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Hydrangea extract (R0203)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85295-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Hydrangea extract (R0203)

Special notes

When selecting the *Hydrangea extract (R0203)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Hydrangea extract (R0203)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Hydrangea extrac...	15000792	85295	40	not required
Hepart	Hydrangea extrac...	16000718	85368	40	not required

Validation samples

A total of 20 489 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 *Hydrangea extract (R0203)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Hydrangea extract (R0203)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Hydrangea extract (R0203)	15000792	85295 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Hydrangea extract (R0203)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Hydrangea extract (R0203)* 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 *Hydrangea extract (R0203)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Hydrangea extract (R0203)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85295	85295	0.00	20.73
85368	85368	0.00	18.76

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Hydroxypropyl methyl cellulose (R0038)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85154-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Hydroxypropyl methyl cellulose (R0038)

Special notes

When selecting the *Hydroxypropyl methyl cellulose (R0038)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Hydroxypropyl methyl cellulose (R0038)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Hydroxypropyl me...	131028505	85154	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Hydroxypropyl methyl cellulose (R0038)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Hydroxypropyl methyl cellulose (R0038)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Hydroxypropyl methyl cellulose (R0038)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Hydroxypropyl methyl cellulose (R0038)* 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 *Hydroxypropyl methyl cellulose (R0038)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Hydroxypropyl methyl cellulose (R0038)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85154	85154	0.00	158.60

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Hyssop extract (R0205)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85292-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Hyssop extract (R0205)

Special notes

When selecting the *Hyssop extract (R0205)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Hyssop extract (R0205)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Hyssop extract (...)	15000787	85292	40	not required
Hepart	Hyssop extract (...)	16000719	85378	40	not required

Validation samples

A total of 20 489 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 *Hyssop extract (R0205)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Hyssop extract (R0205)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Hyssop extract (R0205)	15000787	85292 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Hyssop extract (R0205)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Hyssop extract (R0205)* 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 *Hyssop extract (R0205)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Hyssop extract (R0205)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85292	85292	0.00	20.08
85378	85378	0.00	19.00

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Inositol (myo-) (R0039)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85009-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Inositol (myo-) (R0039)

Special notes

When selecting the *Inositol (myo-) (R0039)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Inositol (myo-) (R0039)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Inositol (myo-) ...	1209006	85091	40	not required
Hepart	Inositol (myo-) ...	15000233	85258	40	not required

Validation samples

A total of 20 489 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 *Inositol (myo-) (R0039)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 3 reference samples from the substance/substance group *Inositol (myo-) (R0039)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Inositol (myo-) (R0039)	1205009	85009	40
Hepart	Inositol (myo-) (R0039)	15000233	85258 [†]	20
Hepart	Inositol (myo-) (R0039)	16000188	85358	60

- 10 714 spectra from a total of 305 batches from further 141 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 *Inositol (myo-) (R0039)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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

[†]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*.

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 *Inositol (myo-) (R0039)* 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 *Inositol (myo-) (R0039)* 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	9504
Type B	0	98	22	10 714
Type C	0	0	0	71

The substance/substance group *Inositol (myo-) (R0039)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	81.6667 % (> 79.1667 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85091	85091	0.00	100.62
85258	85258	0.00	105.80

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Inositol hexanicotinate (R0040)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85044-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Inositol hexanicotinate (R0040)

Special notes

When selecting the *Inositol hexanicotinate (R0040)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Inositol hexanicotinate (R0040)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Inositol hexanic...	14001130	85205	40	not required
Hepart	Inositol hexanic...	16000696	85382	40	not required

Validation samples

A total of 20 489 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 *Inositol hexanicotinate* (R0040). These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group *Inositol hexanicotinate* (R0040).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Inositol hexanicotinate (R00...	51201	85044	40
Hepart	Inositol hexanicotinate (R00...	63501	85186	40

- 10 754 spectra from a total of 306 batches from further 141 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 *Inositol hexanicotinate* (R0040).

Supplier	Substance	Batch	Spectra
unbekannt	Inositol hexanicotinate (R00...	14001130	1
unbekannt	Inositol hexanicotinate (R00...	16000106	1

- 69 spectra from 1 *Apo-Ident* customers from a total of 41 batches from a further 26 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 *Inositol hexanicotinate (R0040)* 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 *Inositol hexanicotinate (R0040)* 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	9504
Type B	0	79	1	10 754
Type C	0	2	0	69

The substance/substance group *Inositol hexanicotinate (R0040)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9030 %)	98.7500 % (> 95.0000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85205	85205	0.00	46.06
85382	85382	0.00	49.92

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe

von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Inulin (R0041)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85109-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Inulin (R0041)

Special notes

When selecting the *Inulin (R0041)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Inulin (R0041)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Inulin (R0041)	1209021	85109	40	not required
Hepart	Inulin (R0041)	14001196	85226	40	not required
Hepart	Inulin (R0041)	15000234	85242	40	not required

Validation samples

A total of 20 489 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 *Inulin (R0041)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 4 reference samples from the substance/substance group *Inulin (R0041)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Inulin (R0041)	14001196	85226 [†]	20
Hepart	Inulin (R0041)	15000234	85242 [†]	20
Hepart	Inulin (R0041)	15000747	85281	60
Hepart	Inulin (R0041)	16001666	85441	40

- 10 694 spectra from a total of 304 batches from further 141 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 1 batches from the substance/substance group *Inulin (R0041)*.

Supplier	Substance	Batch	Spectra
unbekannt	Inulin (R0041)	14001196	2

[†]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*.

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Inulin (R0041)* 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 *Inulin (R0041)* 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	9464
Type B	0	140	0	10 694
Type C	0	2	0	69

The substance/substance group *Inulin (R0041)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85109	85109	0.00	22.90
85226	85226	0.00	22.19
85242	85242	0.00	19.69

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe

mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Isoflavones 10% (R0042)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85092-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Isoflavones 10% (R0042)

Special notes

When selecting the *Isoflavones 10% (R0042)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Isoflavones 10% (R0042)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Isoflavones 10% ...	057001	85092	40	not required
Hepart	Isoflavones 10% ...	16001515	85445	40	not required

Validation samples

A total of 20 489 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 *Isoflavones 10% (R0042)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 100 spectra of 2 reference samples from the substance/substance group *Isoflavones 10% (R0042)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Isoflavones 10% (R0042)	14001396	85225	60
Hepart	Isoflavones 10% (R0042)	16001515	85457	40

- 10 734 spectra from a total of 306 batches from further 141 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 *Isoflavones 10% (R0042)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Isoflavones 10% (R0042)* 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 *Isoflavones 10% (R0042)* 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	9504
Type B	0	40	60	10 734
Type C	0	0	0	71

The substance/substance group *Isoflavones 10% (R0042)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	40.0000 % (> 37.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85092	85092	0.00	76.49
85445	85445	0.00	46.20

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Isomaltulose (R0236)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85395-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Isomaltulose (R0236)

Special notes

When selecting the *Isomaltulose (R0236)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Isomaltulose (R0236)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Isomaltulose (R0...	16000382	85395	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Isomaltulose (R0236)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Isomaltulose (R0236)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Isomaltulose (R0236)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Isomaltulose (R0236)* 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 *Isomaltulose (R0236)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Isomaltulose (R0236)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85395	85395	0.00	59.33

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Kutki herb extract (R0210)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85297-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Kutki herb extract (R0210)

Special notes

When selecting the *Kutki herb extract (R0210)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Kutki herb extract (R0210)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Kutki herb extra...	15000793	85297	40	not required
Hepart	Kutki herb extra...	16000721	85366	40	not required

Validation samples

A total of 20 489 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 *Kutki herb extract (R0210)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Kutki herb extract (R0210)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Kutki herb extract (R0210)	15000793	85297 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Kutki herb extract (R0210)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Kutki herb extract (R0210)* 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 *Kutki herb extract (R0210)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Kutki herb extract (R0210)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85297	85297	0.00	20.64
85366	85366	0.00	20.04

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-5-hydroxytryptophan (R0050)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85208-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-5-hydroxytryptophan (R0050)

Special notes

When selecting the *L-5-hydroxytryptophan (R0050)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-5-hydroxytryptophan (R0050)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-5-hydroxytrypt...	1103004	85208	35	not required
Hepart	L-5-hydroxytrypt...	15000794	85309	40	not required
Hepart	L-5-hydroxytrypt...	15000794	85349	40	not required
Hepart	L-5-hydroxytrypt...	16000693	85390	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 155 spectra of 4 reference samples from the substance/substance group L-5-hydroxytryptophan (R0050). These samples are listed above in the [calibration samples](#) section.
- 9429 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 45 spectra of 3 reference samples from the substance/substance group L-5-hydroxytryptophan (R0050).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-5-hydroxytryptophan (R0050)	1103004	85208 [†]	5
Hepart	L-5-hydroxytryptophan (R0050)	15000794	85309 [†]	20
Hepart	L-5-hydroxytryptophan (R0050)	15000794	85349 [†]	20

- 10 789 spectra from a total of 306 batches from further 141 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 L-5-hydroxytryptophan (R0050).

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *L-5-hydroxytryptophan (R0050)* 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 *L-5-hydroxytryptophan (R0050)* 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	155	0	9429
Type B	0	45	0	10 789
Type C	0	0	0	71

The substance/substance group *L-5-hydroxytryptophan (R0050)* 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 % (> 99.9115 %)	100.0000 % (> 96.1290 %)
Type B	100.0000 % (> 99.9033 %)	100.0000 % (> 86.6667 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85208	85208	0.00	177.61
85309	85309	0.00	186.29
85349	85349	0.00	204.84
85390	85390	0.00	210.51

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe

von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-arginine base (R0006)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85012-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-arginine base (R0006)

Special notes

When selecting the *L-arginine base (R0006)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-arginine base (R0006)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-arginine base ...	1209011	85094	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *L-arginine base (R0006)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group *L-arginine base (R0006)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-arginine base (R0006)	1205005	85012	40
Hepart	L-arginine base (R0006)	16001692	85461	40

- 10 754 spectra from a total of 306 batches from further 141 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.

- 9 spectra from 1 *Apo-Ident* customers from 3 batches from the substance/substance group *L-arginine base (R0006)*.

Supplier	Substance	Batch	Spectra
unbekannt	L-arginine base (R0006)	15001020	3
unbekannt	L-arginine base (R0006)	16000206	5
unbekannt	L-arginine base (R0006)	16000206/2	1

- 62 spectra from 1 *Apo-Ident* customers from a total of 40 batches from a further 26 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 *L-arginine base (R0006)* 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 *L-arginine base (R0006)* 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	40	0	9544
Type B	0	67	13	10 754
Type C	0	7	2	62

The substance/substance group *L-arginine base (R0006)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9030 %)	83.7500 % (> 80.0000 %)
Type C	100.0000 % (> 86.4079 %)	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.

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
85094	85094	0.00	106.42

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-carnitine-L-tartrate (R0014)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85086-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-carnitine-L-tartrate (R0014)

Special notes

When selecting the *L-carnitine-L-tartrate (R0014)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-carnitine-L-tartrate (R0014)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-carnitine-L-ta...	058101	85086	50	not required
Hepart	L-carnitine-L-ta...	14001129	85198	40	not required
Hepart	L-carnitine-L-ta...	16000165	85345	40	not required

Validation samples

A total of 20 489 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 L-carnitine-L-tartrate (R0014). These samples are listed above in the [calibration samples](#) section.
- 9454 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group L-carnitine-L-tartrate (R0014).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-carnitine-L-tartrate (R0014)	16000165	85345 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 L-carnitine-L-tartrate (R0014).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *L-carnitine-L-tartrate (R0014)* 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 *L-carnitine-L-tartrate (R0014)* 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	9454
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *L-carnitine-L-tartrate (R0014)* 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 % (> 99.9116 %)	100.0000 % (> 95.3846 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85086	85086	0.00	96.04
85198	85198	0.00	79.69
85345	85345	0.00	88.09

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-carnosine (R0015)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85097-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-carnosine (R0015)

Special notes

When selecting the *L-carnosine (R0015)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-carnosine (R0015)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-carnosine (R00...	050801	85097	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *L-carnosine (R0015)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *L-carnosine (R0015)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *L-carnosine (R0015)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *L-carnosine (R0015)* 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 *L-carnosine (R0015)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *L-carnosine (R0015)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85097	85097	0.00	79.48

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-glutamine (R0031)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85016-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-glutamine (R0031)

Special notes

When selecting the *L-glutamine (R0031)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-glutamine (R0031)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-glutamine (R00...	1209007	85118	40	not required
Hepart	L-glutamine (R00...	14001120	85200	40	not required
Hepart	L-glutamine (R00...	15001426	85318	40	not required
Hepart	L-glutamine (R00...	15001604	85327	40	not required

Validation samples

A total of 20 489 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 L-glutamine (R0031). These samples are listed above in the [calibration samples](#) section.
- 9424 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 215 spectra of 6 reference samples from the substance/substance group L-glutamine (R0031).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-glutamine (R0031)	1205002	85016	40
Hepart	L-glutamine (R0031)	15001426	85318 [†]	20
Hepart	L-glutamine (R0031)	15001604	85327 [†]	20
Hepart	L-glutamine (R0031)	16000178	85343	55
Hepart	L-glutamine (R0031)	16000868	85422	40
Hepart	L-glutamine (R0031)	16001697	85469	40

- 10 619 spectra from a total of 302 batches from further 141 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 L-glutamine (R0031).

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	L-glutamine (R0031)	15001604	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-glutamine (R0031)* 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 *L-glutamine (R0031)* 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	156	4	9424
Type B	0	215	0	10 619
Type C	0	1	0	70

The substance/substance group *L-glutamine (R0031)* 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 % (> 99.9115 %)	97.5000 % (> 95.6250 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 97.2093 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85118	85118	0.00	75.94
85200	85200	0.00	73.99
85318	85318	0.00	80.28
85327	85327	0.00	80.29

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-histidine base (R0037)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85099-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-histidine base (R0037)

Special notes

When selecting the *L-histidine base (R0037)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-histidine base (R0037)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-histidine base...	051801	85099	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *L-histidine base (R0037)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *L-histidine base (R0037)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-histidine base (R0037)	14001055	85192	40

- 10 794 spectra from a total of 307 batches from further 141 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 *L-histidine base (R0037)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *L-histidine base (R0037)* 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 *L-histidine base (R0037)* 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	40	0	9544
Type B	0	0	40	10 794
Type C	0	0	0	71

The substance/substance group *L-histidine base (R0037)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9034 %)	0.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85099	85099	0.00	57.76

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-isoIeucine (R0043)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85076-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-isoIeucine (R0043)

Special notes

When selecting the *L-isoIeucine (R0043)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-isoIeucine (R0043)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-isoIeucine (R0...	1109011	85076	50	not required
Hepart	L-isoIeucine (R0...	15000638	85272	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 90 spectra of 2 reference samples from the substance/substance group *L-isoleucine (R0043)*. These samples are listed above in the [calibration samples](#) section.
- 9494 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group *L-isoleucine (R0043)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-isoleucine (R0043)	15000638	85272 [†]	20
Hepart	L-isoleucine (R0043)	16000179	85347	60

- 10 754 spectra from a total of 306 batches from further 141 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 *L-isoleucine (R0043)*.

Supplier	Substance	Batch	Spectra
unbekannt	L-isoleucine (R0043)	15000638	1

[†]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*.

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-isoleucine (R0043)* 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 *L-isoleucine (R0043)* 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	90	0	9494
Type B	0	80	0	10 754
Type C	0	1	0	70

The substance/substance group *L-isoleucine (R0043)* 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 % (> 99.9118 %)	100.0000 % (> 93.3333 %)
Type B	100.0000 % (> 99.9030 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85076	85076	0.00	31.01
85272	85272	0.00	30.64

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe

von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-leucine (R0051)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85126-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-leucine (R0051)

Special notes

When selecting the *L-leucine (R0051)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-leucine (R0051)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-leucine (R0051)	110055M04C	85126	40	not required
Hepart	L-leucine (R0051)	14001122	85203	20	not required
Hepart	L-leucine (R0051)	15000636	85284	40	not required
Hepart	L-leucine (R0051)	16000180	85346	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 140 spectra of 4 reference samples from the substance/substance group *L-leucine (R0051)*. These samples are listed above in the [calibration samples](#) section.
- 9444 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 2 reference samples from the substance/substance group *L-leucine (R0051)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-leucine (R0051)	15000636	85284 [†]	20
Hepart	L-leucine (R0051)	16000180	85346 [†]	20

- 10 794 spectra from a total of 306 batches from further 141 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 *L-leucine (R0051)*.

Supplier	Substance	Batch	Spectra
unbekannt	L-leucine (R0051)	15000636	1

[†]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*.

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-leucine (R0051)* 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 *L-leucine (R0051)* 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	9444
Type B	0	40	0	10 794
Type C	0	1	0	70

The substance/substance group *L-leucine (R0051)* 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 % (> 99.9116 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9034 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85126	85126	0.00	39.51
85203	85203	0.00	39.58
85284	85284	0.00	47.45
85346	85346	0.00	46.04

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-lysine HCl (R0054)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85033-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-lysine HCl (R0054)

Special notes

When selecting the *L-lysine HCl (R0054)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-lysine HCl (R0054)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-lysine HCl (R0...	1007010	85106	40	not required
Hepart	L-lysine HCl (R0...	15000637	85294	40	not required
Hepart	L-lysine HCl (R0...	16000181	85344	40	not required

Validation samples

A total of 20 489 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 *L-lysine HCl (R0054)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 180 spectra of 5 reference samples from the substance/substance group *L-lysine HCl (R0054)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-lysine HCl (R0054)	1007010	85033	40
Hepart	L-lysine HCl (R0054)	14001829	85248	60
Hepart	L-lysine HCl (R0054)	15000637	85294 [†]	20
Hepart	L-lysine HCl (R0054)	16000181	85344 [†]	20
Hepart	L-lysine HCl (R0054)	17000480	85479	40

- 10 654 spectra from a total of 303 batches from further 141 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 *L-lysine HCl (R0054)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	L-lysine HCl (R0054)	16000181	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-lysine HCl (R0054)* 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 *L-lysine HCl (R0054)* 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	9464
Type B	0	140	40	10 654
Type C	0	1	0	70

The substance/substance group *L-lysine HCl (R0054)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9028 %)	77.7778 % (> 76.1111 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85106	85106	0.00	52.89
85294	85294	0.00	76.98
85344	85344	0.00	46.49

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-ornithine HCl (R0066)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85008-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-ornithine HCl (R0066)

Special notes

When selecting the *L-ornithine HCl (R0066)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-ornithine HCl (R0066)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-ornithine HCl ...	15000639	85276	40	not required
Hepart	L-ornithine HCl ...	15000998	85308	40	not required

Validation samples

A total of 20 489 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 *L-ornithine HCl (R0066)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 160 spectra of 5 reference samples from the substance/substance group *L-ornithine HCl (R0066)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-ornithine HCl (R0066)	1205006	85008	40
Hepart	L-ornithine HCl (R0066)	51501	85043	40
Hepart	L-ornithine HCl (R0066)	15000639	85276 [†]	20
Hepart	L-ornithine HCl (R0066)	15000998	85308 [†]	20
Hepart	L-ornithine HCl (R0066)	16000871	85416	40

- 10 674 spectra from a total of 303 batches from further 141 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 *L-ornithine HCl (R0066)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *L-ornithine HCl (R0066)* 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 *L-ornithine HCl (R0066)* 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	9504
Type B	0	119	41	10 674
Type C	0	0	0	71

The substance/substance group *L-ornithine HCl (R0066)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9028 %)	74.3750 % (> 72.5000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85276	85276	0.00	104.92
85308	85308	0.00	84.98

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-phenylalanine (R0067)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85045-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-phenylalanine (R0067)

Special notes

When selecting the *L-phenylalanine (R0067)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-phenylalanine (R0067)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-phenylalanine ...	14000033	85169	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group L-phenylalanine (R0067). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group L-phenylalanine (R0067).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-phenylalanine (R0067)	51301	85045	40
Hepart	L-phenylalanine (R0067)	16001699	85470	40

- 10 754 spectra from a total of 306 batches from further 141 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 L-phenylalanine (R0067).

Supplier	Substance	Batch	Spectra
unbekannt	L-phenylalanine (R0067)	15000569	1

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-phenylalanine (R0067)* 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 *L-phenylalanine (R0067)* 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	40	0	9544
Type B	0	80	0	10 754
Type C	0	0	1	70

The substance/substance group *L-phenylalanine (R0067)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9030 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85169	85169	0.00	47.00

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-proline (R0070)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85217-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-proline (R0070)

Special notes

When selecting the *L-proline (R0070)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-proline (R0070)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-proline (R0070)	14001322	85217	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group L-proline (R0070). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group L-proline (R0070).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-proline (R0070)	14001322	85217 [†]	20
Hepart	L-proline (R0070)	14001322	85220	60

- 10 754 spectra from a total of 307 batches from further 141 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 1 batches from the substance/substance group L-proline (R0070).

Supplier	Substance	Batch	Spectra
unbekannt	L-proline (R0070)	15001571	2

[†]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*.

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-proline (R0070)* 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 *L-proline (R0070)* 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	40	0	9544
Type B	0	65	15	10 754
Type C	0	1	1	69

The substance/substance group *L-proline (R0070)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9030 %)	81.2500 % (> 77.5000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85217	85217	0.00	71.87

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR

bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-threonine (R0080)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85006-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-threonine (R0080)

Special notes

When selecting the *L-threonine (R0080)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-threonine (R0080)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-threonine (R00...	1209013	85093	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group L-threonine (R0080). These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 2 reference samples from the substance/substance group L-threonine (R0080).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-threonine (R0080)	120504	85006	40
Hepart	L-threonine (R0080)	51401	85041	40

- 10 754 spectra from a total of 306 batches from further 141 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 L-threonine (R0080).

Supplier	Substance	Batch	Spectra
unbekannt	L-threonine (R0080)	15001826	1
unbekannt	L-threonine (R0080)	15001828	1

- 69 spectra from 1 *Apo-Ident* customers from a total of 41 batches from a further 26 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 *L-threonine (R0080)* 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 *L-threonine (R0080)* 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	40	0	9544
Type B	0	40	40	10 754
Type C	0	2	0	69

The substance/substance group *L-threonine (R0080)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9030 %)	50.0000 % (> 46.2500 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85093	85093	0.00	84.71

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-tryptophan (R0085)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85068-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-tryptophan (R0085)

Special notes

When selecting the *L-tryptophan (R0085)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-tryptophan (R0085)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-tryptophan (R0...	060801	85068	60	not required
Hepart	L-tryptophan (R0...	15000417	85260	40	not required
Hepart	L-tryptophan (R0...	16000183	85342	40	not required

Validation samples

A total of 20 489 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 *L-tryptophan (R0085)*. These samples are listed above in the [calibration samples](#) section.
- 9444 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 3 reference samples from the substance/substance group *L-tryptophan (R0085)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-tryptophan (R0085)	15000417	85260 [†]	20
Hepart	L-tryptophan (R0085)	16000183	85342 [†]	20
Hepart	L-tryptophan (R0085)	16000876	85407	40

- 10 754 spectra from a total of 305 batches from further 141 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 *L-tryptophan (R0085)*.

Supplier	Substance	Batch	Spectra
unbekannt	L-tryptophan (R0085)	15000417	4

[†]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*.

- 67 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-tryptophan (R0085)* 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 *L-tryptophan (R0085)* 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	9444
Type B	0	74	6	10 754
Type C	0	4	0	67

The substance/substance group *L-tryptophan (R0085)* 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 % (> 99.9116 %)	100.0000 % (> 95.7143 %)
Type B	100.0000 % (> 99.9030 %)	92.5000 % (> 88.7500 %)
Type C	100.0000 % (> 86.5266 %)	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.

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
85068	85068	0.00	136.58
85260	85260	0.00	125.38
85342	85342	0.00	143.09

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Labor-

prüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **L-tyrosine (R0086)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85215-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

L-tyrosine (R0086)

Special notes

When selecting the *L-tyrosine (R0086)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *L-tyrosine (R0086)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	L-tyrosine (R0086)	070801	85215	40	not required
Hepart	L-tyrosine (R0086)	14001321	85223	40	not required

Validation samples

A total of 20 489 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 *L-tyrosine (R0086)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 3 reference samples from the substance/substance group *L-tyrosine (R0086)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	L-tyrosine (R0086)	70801	85215 [†]	20
Hepart	L-tyrosine (R0086)	14001321	85223 [†]	20
Hepart	L-tyrosine (R0086)	16000877	85411	40

- 10 754 spectra from a total of 305 batches from further 141 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 1 batches from the substance/substance group *L-tyrosine (R0086)*.

Supplier	Substance	Batch	Spectra
unbekannt	L-tyrosine (R0086)	15001574	2

[†]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*.

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *L-tyrosine (R0086)* 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 *L-tyrosine (R0086)* 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	9504
Type B	0	80	0	10 754
Type C	0	2	0	69

The substance/substance group *L-tyrosine (R0086)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9030 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85215	85215	0.00	84.86
85223	85223	0.00	87.96

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das

alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Lycopene 5% extract (R0053)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85098-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Lycopene 5% extract (R0053)

Special notes

When selecting the *Lycopene 5% extract (R0053)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Lycopene 5% extract (R0053)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Lycopene 5% extr...	050901	85098	40	not required
Hepart	Lycopene 5% extr...	14000658	85181	40	not required

Validation samples

A total of 20 489 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 *Lycopene 5% extract (R0053)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *Lycopene 5% extract (R0053)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Lycopene 5% extract (R0053)	1102-016	85180	40

- 10 794 spectra from a total of 307 batches from further 141 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 *Lycopene 5% extract (R0053)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Lycopene 5% extract (R0053)* 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 *Lycopene 5% extract (R0053)* 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	9504
Type B	0	35	5	10 794
Type C	0	0	0	71

The substance/substance group *Lycopene 5% extract (R0053)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9034 %)	87.5000 % (> 80.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85098	85098	0.00	30.70
85181	85181	0.00	14.41

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Magnesium citrate nonahydrate (R0056)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85194-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Magnesium citrate nonahydrate (R0056)

Special notes

When selecting the *Magnesium citrate nonahydrate (R0056)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Magnesium citrate nonahydrate (R0056)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Magnesium citrat...	14000396	85340	40	not required
Hepart	Magnesium citrat...	14001234	85341	40	not required

Validation samples

A total of 20 489 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 *Magnesium citrate nonahydrate (R0056)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 4 reference samples from the substance/substance group *Magnesium citrate nonahydrate (R0056)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Magnesium citrate nonahydrat...	14000396	85340 [†]	20
Hepart	Magnesium citrate nonahydrat...	14001234	85341 [†]	20
Hepart	Magnesium citrate nonahydrat...	16001519	85447	40
Hepart	Magnesium citrate nonahydrat...	16001519	85468	40

- 10 714 spectra from a total of 305 batches from further 141 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 1 batches from the substance/substance group *Magnesium citrate nonahydrate (R0056)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	Magnesium citrate nonahydrat...	14000396	2

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Magnesium citrate nonahydrate (R0056)* 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 *Magnesium citrate nonahydrate (R0056)* 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	9504
Type B	0	120	0	10 714
Type C	0	2	0	69

The substance/substance group *Magnesium citrate nonahydrate (R0056)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85340	85340	0.00	61.78
85341	85341	0.00	62.43

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Magnesium stearate (R0140)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85149-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Magnesium stearate (R0140)

Special notes

When selecting the *Magnesium stearate (R0140)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Magnesium stearate (R0140)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Magnesium steara...	130503-MS1	85149	30	not required
Hepart	Magnesium steara...	131120001	85156	40	not required
Hepart	Magnesium steara...	131129505	85160	40	not required
Hepart	Magnesium steara...	15001477	85324	40	not required
Hepart	Magnesium steara...	17000218	85460	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 190 spectra of 5 reference samples from the substance/substance group *Magnesium stearate (R0140)*. These samples are listed above in the [calibration samples](#) section.
- 9394 spectra from a total of 229 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Magnesium stearate (R0140)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Magnesium stearate (R0140)	15001477	85324 [†]	20
Hepart	Magnesium stearate (R0140)	16001231	85439	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Magnesium stearate (R0140)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Magnesium stearate (R0140)* 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 *Magnesium stearate (R0140)* 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	190	0	9394
Type B	0	59	1	10 774
Type C	0	0	0	71

The substance/substance group *Magnesium stearate (R0140)* 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 % (> 99.9115 %)	100.0000 % (> 96.8421 %)
Type B	100.0000 % (> 99.9031 %)	98.3333 % (> 93.3333 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85149	85149	0.00	147.00
85156	85156	0.00	149.00
85160	85160	0.00	161.41
85324	85324	0.00	157.90
85460	85460	0.00	154.10

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR

bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Marshmallow root extract (R0204) / Gentian extra...**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85275-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192); Gentian extract (R0200); Juniper extract (R0192); Marshmallow root extract (R0204)

Special notes

When selecting the *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Juniper extract ...	15000615	85275	40	not required
Hepart	Gentian extract ...	15000798	85299	40	not required
Hepart	Marshmallow root...	15000796	85301	40	not required

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Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Gentian extract ...	16000715	85373	40	not required
Hepart	Marshmallow root...	16000724	85377	40	not required
Hepart	Juniper extract ...	16000596	85383	40	not required

Validation samples

A total of 20 489 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 *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)*. These samples are listed above in the [calibration samples](#) section.
- 9344 spectra from a total of 228 batches from further 99 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 3 reference samples from the substance/substance group *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Juniper extract (R0192)	15000615	85275 [†]	20
Hepart	Gentian extract (R0200)	15000798	85299 [†]	20
Hepart	Marshmallow root extract (R0...	15000796	85301 [†]	20

- 10 774 spectra from a total of 305 batches from further 139 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

[†]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*.

provided by the customer regarding manufacturer and batch number.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)* 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 *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)* 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	9344
Type B	0	60	0	10 774
Type C	0	0	0	71

The substance/substance group *Marshmallow root extract (R0204) / Gentian extract (R0200) / Juniper extract (R0192)* 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 % (> 99.9114 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 90.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85275	85275	0.00	16.82
85299	85299	0.00	25.85

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Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
85301	85301	0.00	26.91
85373	85373	0.00	30.27
85377	85377	0.00	32.26
85383	85383	0.00	28.18

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Methionine (R0059)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85112-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Methionine (R0059)

Special notes

When selecting the *Methionine (R0059)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Methionine (R0059)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Methionine (R0059)	1209010	85112	40	not required
Hepart	Methionine (R0059)	14001123	85212	40	not required
Hepart	Methionine (R0059)	15000268	85245	40	not required
Hepart	Methionine (R0059)	14001830	85246	40	not required

Validation samples

A total of 20 489 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 *Methionine (R0059)*. These samples are listed above in the [calibration samples](#) section.
- 9424 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 80 spectra of 3 reference samples from the substance/substance group *Methionine (R0059)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Methionine (R0059)	15000268	85245 [†]	20
Hepart	Methionine (R0059)	14001830	85246 [†]	20
Hepart	Methionine (R0059)	16000869	85421	40

- 10 754 spectra from a total of 305 batches from further 141 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 1 *Apo-Ident* customers from 3 batches from the substance/substance group *Methionine (R0059)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	Methionine (R0059)	15000330	1
unbekannt	Methionine (R0059)	16000869	1
unbekannt	Methionine (R0059)	14001123	1

- 68 spectra from 1 *Apo-Ident* customers from a total of 40 batches from a further 26 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 *Methionine (R0059)* 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 *Methionine (R0059)* 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	9424
Type B	0	80	0	10 754
Type C	0	2	1	68

The substance/substance group *Methionine (R0059)* 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 % (> 99.9115 %)	100.0000 % (> 96.2500 %)
Type B	100.0000 % (> 99.9030 %)	100.0000 % (> 92.5000 %)
Type C	100.0000 % (> 86.5978 %)	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.

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
85112	85112	0.00	53.63
85212	85212	0.00	47.72
85245	85245	0.00	52.24
85246	85246	0.00	54.57

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Methylcobalamin (R0190)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85302-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Methylcobalamin (R0190)

Special notes

When selecting the *Methylcobalamin (R0190)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Methylcobalamin (R0190)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Methylcobalamin ...	15000620	85302	40	not required
Hepart	Methylcobalamin ...	16000704	85362	40	not required

Validation samples

A total of 20 489 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 *Methylcobalamin (R0190)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Methylcobalamin (R0190)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Methylcobalamin (R0190)	15000620	85302 [†]	20
Hepart	Methylcobalamin (R0190)	16001701	85465	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Methylcobalamin (R0190)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Methylcobalamin (R0190)* 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 *Methylcobalamin (R0190)* 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	9504
Type B	0	48	12	10 774
Type C	0	0	0	71

The substance/substance group *Methylcobalamin (R0190)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9031 %)	80.0000 % (> 75.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85302	85302	0.00	60.59
85362	85362	0.00	82.93

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Methylsulfonylmethane (R0060)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85240-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Methylsulfonylmethane (R0060)

Special notes

When selecting the *Methylsulfonylmethane (R0060)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Methylsulfonylmethane (R0060)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Methylsulfonylme...	14001831	85240	40	not required
Hepart	Methylsulfonylme...	15000635	85282	40	not required
Hepart	Methylsulfonylme...	15001758	85334	40	not required
Hepart	Methylsulfonylme...	15001811	85335	40	not required
Hepart	Methylsulfonylme...	16000697	85388	40	not required

Validation samples

A total of 20 489 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 *Methylsulfonylmethane (R0060)*. These samples are listed above in the [calibration samples](#) section.
- 9384 spectra from a total of 229 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 180 spectra of 6 reference samples from the substance/substance group *Methylsulfonylmethane (R0060)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Methylsulfonylmethane (R0060)	14001831	85240 [†]	20
Hepart	Methylsulfonylmethane (R0060)	15000635	85282 [†]	20
Hepart	Methylsulfonylmethane (R0060)	15001758	85334 [†]	20
Hepart	Methylsulfonylmethane (R0060)	15001811	85335 [†]	20
Hepart	Methylsulfonylmethane (R0060)	16000184	85355	60
Hepart	Methylsulfonylmethane (R0060)	16001669	85451	40

- 10 654 spectra from a total of 302 batches from further 141 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 1 *Apo-Ident* customers from 4 batches from the substance/substance group *Methylsulfonylmethane (R0060)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	Methylsulfonylmethane (R0060)	14001831	1
unbekannt	Methylsulfonylmethane (R0060)	15001758	4
Chemacon	Methylsulfonylmethane (R0060)	15001811	1
unbekannt	Methylsulfonylmethane (R0060)	16000697	2

- 63 spectra from 1 *Apo-Ident* customers from a total of 39 batches from a further 26 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 *Methylsulfonylmethane (R0060)* 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 *Methylsulfonylmethane (R0060)* 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	9384
Type B	0	175	5	10 654
Type C	0	8	0	63

The substance/substance group *Methylsulfonylmethane (R0060)* 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 % (> 99.9114 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9028 %)	97.2222 % (> 95.5556 %)
Type C	100.0000 % (> 86.4198 %)	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.

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
85240	85240	0.00	148.88

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Sample ID	Reference sample ID	Distance to reference sample	Distance to next foreign sample
85282	85282	0.00	143.51
85334	85334	0.00	137.68
85335	85335	0.00	141.26
85388	85388	0.00	146.91

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **N-acetyl-L-cysteine (R0002)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85057-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

N-acetyl-L-cysteine (R0002)

Special notes

When selecting the *N-acetyl-L-cysteine (R0002)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *N-acetyl-L-cysteine (R0002)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	N-acetyl-L-cyste...	1007-013	85057	60	not required
Hepart	N-acetyl-L-cyste...	14001825	85250	40	not required
Hepart	N-acetyl-L-cyste...	15000267	85251	40	not required
Hepart	N-acetyl-L-cyste...	15000640	85279	40	not required

Validation samples

A total of 20 489 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 *N-acetyl-L-cysteine* (R0002). These samples are listed above in the [calibration samples](#) section.
- 9404 spectra from a total of 230 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 5 reference samples from the substance/substance group *N-acetyl-L-cysteine* (R0002).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	N-acetyl-L-cysteine (R0002)	14001118	85199	40
Hepart	N-acetyl-L-cysteine (R0002)	14001825	85250 [†]	20
Hepart	N-acetyl-L-cysteine (R0002)	15000267	85251 [†]	20
Hepart	N-acetyl-L-cysteine (R0002)	15000640	85279 [†]	20
Hepart	N-acetyl-L-cysteine (R0002)	16000863	85410	40

- 10 694 spectra from a total of 303 batches from further 141 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 *N-acetyl-L-cysteine* (R0002).

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	N-acetyl-L-cysteine (R0002)	15000640	4

- 67 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *N-acetyl-L-cysteine (R0002)* 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 *N-acetyl-L-cysteine (R0002)* 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	9404
Type B	0	140	0	10 694
Type C	0	4	0	67

The substance/substance group *N-acetyl-L-cysteine (R0002)* 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 % (> 99.9115 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 86.5266 %)	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.

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
85057	85057	0.00	44.80
85250	85250	0.00	36.78
85251	85251	0.00	42.55
85279	85279	0.00	42.70

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Nicotinamide (R0064)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85020-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Nicotinamide (R0064)

Special notes

When selecting the *Nicotinamide (R0064)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Nicotinamide (R0064)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Nicotinamide (R0...	14001124	85204	40	not required
Hepart	Nicotinamide (R0...	15000235	85254	40	not required

Validation samples

A total of 20 489 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 *Nicotinamide (R0064)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 4 reference samples from the substance/substance group *Nicotinamide (R0064)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Nicotinamide (R0064)	1206003	85020	40
Hepart	Nicotinamide (R0064)	15000235	85254 [†]	20
Hepart	Nicotinamide (R0064)	16000870	85415	40
Hepart	Nicotinamide (R0064)	16001700	85442	40

- 10 694 spectra from a total of 305 batches from further 141 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 *Nicotinamide (R0064)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Nicotinamide (R0064)* 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 *Nicotinamide (R0064)* 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	9504
Type B	0	140	0	10 694
Type C	0	0	0	71

The substance/substance group *Nicotinamide (R0064)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85204	85204	0.00	85.12
85254	85254	0.00	86.81

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Olive leaf extract (R0202)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85298-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Olive leaf extract (R0202)

Special notes

When selecting the *Olive leaf extract (R0202)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Olive leaf extract (R0202)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Olive leaf extra...	15000789	85298	40	not required
Hepart	Olive leaf extra...	16000717	85364	40	not required

Validation samples

A total of 20 489 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 *Olive leaf extract (R0202)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Olive leaf extract (R0202)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Olive leaf extract (R0202)	15000789	85298 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Olive leaf extract (R0202)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Olive leaf extract (R0202)* 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 *Olive leaf extract (R0202)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Olive leaf extract (R0202)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85298	85298	0.00	32.01
85364	85364	0.00	24.68

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **OPC (grape seed) extract (R0065)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85034-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

OPC (grape seed) extract (R0065)

Special notes

When selecting the *OPC (grape seed) extract (R0065)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *OPC (grape seed) extract (R0065)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	OPC (grape seed)...	059601	85121	40	not required
Hepart	OPC (grape seed)...	130430-TE13	85230	40	not required

Validation samples

A total of 20 489 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 *OPC (grape seed) extract (R0065)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *OPC (grape seed) extract (R0065)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	OPC (grape seed) extract (R0...	1208016	85034	40
Hepart	OPC (grape seed) extract (R0...	130430-TE13	85230 [†]	20

- 10 774 spectra from a total of 306 batches from further 141 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 *OPC (grape seed) extract (R0065)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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

[†]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*.

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 *OPC (grape seed) extract (R0065)* 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 *OPC (grape seed) extract (R0065)* 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	9504
Type B	0	60	0	10 774
Type C	0	0	0	71

The substance/substance group *OPC (grape seed) extract (R0065)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 90.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85121	85121	0.00	18.67
85230	85230	0.00	36.65

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Oregano extract (R0206)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85293-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Oregano extract (R0206)

Special notes

When selecting the *Oregano extract (R0206)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 extract (R0206)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Oregano extract ...	15000790	85293	40	not required
Hepart	Oregano extract ...	16000720	85365	40	not required

Validation samples

A total of 20 489 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 *Oregano extract (R0206)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Oregano extract (R0206)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Oregano extract (R0206)	15000790	85293 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 extract (R0206)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Oregano extract (R0206)* 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 extract (R0206)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Oregano extract (R0206)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85293	85293	0.00	19.29
85365	85365	0.00	19.59

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Osha root extract (R0220)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85314-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Osha root extract (R0220)

Special notes

When selecting the *Osha root extract (R0220)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Osha root extract (R0220)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Osha root extrac...	15000939	85314	40	not required
Hepart	Osha root extrac...	16000546	85393	40	not required

Validation samples

A total of 20 489 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 *Osha root extract (R0220)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Osha root extract (R0220)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Osha root extract (R0220)	15000939	85314 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Osha root extract (R0220)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Osha root extract (R0220)* 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 *Osha root extract (R0220)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Osha root extract (R0220)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85314	85314	0.00	25.39
85393	85393	0.00	20.07

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **p-aminobenzoic acid (R0004)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85065-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

p-aminobenzoic acid (R0004)

Special notes

When selecting the *p-aminobenzoic acid (R0004)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *p-aminobenzoic acid (R0004)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	p-aminobenzoic a...	0912-11	85065	60	not required
Hepart	p-aminobenzoic a...	14001832	85247	40	not required
Hepart	p-aminobenzoic a...	15000235	85257	40	not required
Hepart	p-aminobenzoic a...	15001755	85333	40	not required

Validation samples

A total of 20 489 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 *p-aminobenzoic acid* (R0004). These samples are listed above in the [calibration samples](#) section.
- 9404 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 5 reference samples from the substance/substance group *p-aminobenzoic acid* (R0004).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	p-aminobenzoic acid (R0004)	14001832	85247 [†]	20
Hepart	p-aminobenzoic acid (R0004)	15000235	85257 [†]	20
Hepart	p-aminobenzoic acid (R0004)	15001755	85333 [†]	20
Hepart	p-aminobenzoic acid (R0004)	16000864	85412	40
Hepart	p-aminobenzoic acid (R0004)	16001691	85467	40

- 10 694 spectra from a total of 304 batches from further 141 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 *p-aminobenzoic acid* (R0004).

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *p-aminobenzoic acid (R0004)* 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 *p-aminobenzoic acid (R0004)* 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	9404
Type B	0	140	0	10 694
Type C	0	0	0	71

The substance/substance group *p-aminobenzoic acid (R0004)* 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 % (> 99.9115 %)	100.0000 % (> 96.6667 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 95.7143 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85065	85065	0.00	135.48
85247	85247	0.00	126.66
85257	85257	0.00	133.51
85333	85333	0.00	130.30

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das

alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Piperine 95% extract (R0069)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85189-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Piperine 95% extract (R0069)

Special notes

When selecting the *Piperine 95% extract (R0069)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Piperine 95% extract (R0069)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Piperine 95% ext...	130816502	85189	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Piperine 95% extract (R0069)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *Piperine 95% extract (R0069)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Piperine 95% extract (R0069)	16000742	85403	40

- 10 794 spectra from a total of 307 batches from further 141 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 *Piperine 95% extract (R0069)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Piperine 95% extract (R0069)* 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 *Piperine 95% extract (R0069)* 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	40	0	9544
Type B	0	32	8	10 794
Type C	0	0	0	71

The substance/substance group *Piperine 95% extract (R0069)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9034 %)	80.0000 % (> 72.5000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85189	85189	0.00	111.85

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Potato starch, pregelatinized (R0047)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85231-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Potato starch, pregelatinized (R0047)

Special notes

When selecting the *Potato starch, pregelatinized (R0047)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Potato starch, pregelatinized (R0047)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Potato starch, p...	14001694	85231	40	not required
Hepart	Potato starch, p...	16000526	85392	40	not required

Validation samples

A total of 20 489 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 *Potato starch, pregelatinized (R0047)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Potato starch, pregelatinized (R0047)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Potato starch, pregelatinize...	14001694	85231 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Potato starch, pregelatinized (R0047)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Potato starch, pregelatinized (R0047)* 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 *Potato starch, pregelatinized (R0047)* 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	9504
Type B	0	20	0	10814
Type C	0	0	0	71

The substance/substance group *Potato starch, pregelatinized (R0047)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85231	85231	0.00	12.34
85392	85392	0.00	11.02

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Progesterone, micronized (R0108)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85021-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Progesterone, micronized (R0108)

Special notes

When selecting the *Progesterone, micronized (R0108)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Progesterone, micronized (R0108)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Progesterone, mi...	11177211	85079	50	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 50 spectra of 1 reference samples from the substance/substance group *Progesterone, micronized (R0108)*. These samples are listed above in the [calibration samples](#) section.
- 9534 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *Progesterone, micronized (R0108)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Progesterone, micronized (R0...	11177206	85021	40

- 10 794 spectra from a total of 307 batches from further 141 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 *Progesterone, micronized (R0108)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Progesterone, micronized (R0108)* 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 *Progesterone, micronized (R0108)* 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	50	0	9534
Type B	0	17	23	10 794
Type C	0	0	0	71

The substance/substance group *Progesterone, micronized (R0108)* 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 % (> 99.9124 %)	100.0000 % (> 88.0000 %)
Type B	100.0000 % (> 99.9034 %)	42.5000 % (> 35.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85079	85079	0.00	36.19

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Pyridoxal-5-phosphate (R0195)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85269-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Pyridoxal-5-phosphate (R0195)

Special notes

When selecting the *Pyridoxal-5-phosphate (R0195)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Pyridoxal-5-phosphate (R0195)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Pyridoxal-5-phos...	15000618	85269	40	not required
Hepart	Pyridoxal-5-phos...	16000705	85400	40	not required

Validation samples

A total of 20 489 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 *Pyridoxal-5-phosphate (R0195)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Pyridoxal-5-phosphate (R0195)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Pyridoxal-5-phosphate (R0195)	15000618	85269 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Pyridoxal-5-phosphate (R0195)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Pyridoxal-5-phosphate (R0195)* 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 *Pyridoxal-5-phosphate (R0195)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Pyridoxal-5-phosphate (R0195)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85269	85269	0.00	38.31
85400	85400	0.00	31.21

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Pyridoxine hydrochloride (vitamin B6) (R0071)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85022-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Pyridoxine hydrochloride (vitamin B6) (R0071)

Special notes

When selecting the *Pyridoxine hydrochloride (vitamin B6) (R0071)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Pyridoxine hydrochloride (vitamin B6) (R0071)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Pyridoxine hydro...	1209016	85111	40	not required
Hepart	Pyridoxine hydro...	15000236	85238	40	not required
Hepart	Pyridoxine hydro...	14001827	85249	40	not required

Validation samples

A total of 20 489 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 *Pyridoxine hydrochloride (vitamin B6) (R0071)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 200 spectra of 6 reference samples from the substance/substance group *Pyridoxine hydrochloride (vitamin B6) (R0071)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Pyridoxine hydrochloride (vi...	1208001	85022	40
Hepart	Pyridoxine hydrochloride (vi...	15000236	85238 [†]	20
Hepart	Pyridoxine hydrochloride (vi...	14001827	85249 [†]	20
Hepart	Pyridoxine hydrochloride (vi...	16000872	85409	40
Hepart	Pyridoxine hydrochloride (vi...	16001137	85429	40
Hepart	Pyridoxine hydrochloride (vi...	16001689	85471	40

- 10 634 spectra from a total of 302 batches from further 141 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 *Pyridoxine hydrochloride (vitamin B6) (R0071)*.

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Pyridoxine hydrochloride (vitamin B6) (R0071)* 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 *Pyridoxine hydrochloride (vitamin B6) (R0071)* 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	9464
Type B	0	159	41	10 634
Type C	0	0	0	71

The substance/substance group *Pyridoxine hydrochloride (vitamin B6) (R0071)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9028 %)	79.5000 % (> 78.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85111	85111	0.00	149.76
85238	85238	0.00	148.90
85249	85249	0.00	148.62

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das

alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Retinyl palmitate (vitamin A palmitate) (R0073)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85237-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Retinyl palmitate (vitamin A palmitate) (R0073)

Special notes

When selecting the *Retinyl palmitate (vitamin A palmitate) (R0073)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Retinyl palmitate (vitamin A palmitate) (R0073)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Retinyl palmitat...	14001530	85237	40	not required
Hepart	Retinyl palmitat...	16000747	85369	40	not required

Validation samples

A total of 20 489 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 *Retinyl palmitate (vitamin A palmitate)* (R0073). These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Retinyl palmitate (vitamin A palmitate)* (R0073).

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Retinyl palmitate (vitamin A...	14001530	85237 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Retinyl palmitate (vitamin A palmitate)* (R0073).
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Retinyl palmitate (vitamin A palmitate) (R0073)* 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 *Retinyl palmitate (vitamin A palmitate) (R0073)* 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	9504
Type B	0	20	0	10814
Type C	0	0	0	71

The substance/substance group *Retinyl palmitate (vitamin A palmitate) (R0073)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85237	85237	0.00	40.89
85369	85369	0.00	45.90

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Rhodiola rosea extract 3% (R0159)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85172-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Rhodiola rosea extract 3% (R0159)

Special notes

When selecting the *Rhodiola rosea extract 3% (R0159)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Rhodiola rosea extract 3% (R0159)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Rhodiola rosea e...	14000090	85172	40	not required
Hepart	Rhodiola rosea e...	16001514	85459	40	not required

Validation samples

A total of 20 489 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 *Rhodiola rosea extract 3% (R0159)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 40 spectra of 1 reference samples from the substance/substance group *Rhodiola rosea extract 3% (R0159)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Rhodiola rosea extract 3% (R...	16001514	85448	40

- 10 794 spectra from a total of 307 batches from further 141 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 *Rhodiola rosea extract 3% (R0159)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Rhodiola rosea extract 3% (R0159)* 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 *Rhodiola rosea extract 3% (R0159)* 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	9504
Type B	0	40	0	10 794
Type C	0	0	0	71

The substance/substance group *Rhodiola rosea extract 3% (R0159)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9034 %)	100.0000 % (> 85.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85172	85172	0.00	26.14
85459	85459	0.00	46.43

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Riboflavin (vit. B2) (R0074)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85013-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Riboflavin (vit. B2) (R0074)

Special notes

When selecting the *Riboflavin (vit. B2) (R0074)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Riboflavin (vit. B2) (R0074)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Riboflavin (vit....	1209014	85116	40	not required
Hepart	Riboflavin (vit....	14001828	85236	40	not required
Hepart	Riboflavin (vit....	15000237	85243	40	not required
Hepart	Riboflavin (vit....	15001035	85311	40	not required
Hepart	Riboflavin (vit....	16000523	85391	40	not required

Validation samples

A total of 20 489 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 *Riboflavin (vit. B2) (R0074)*. These samples are listed above in the [calibration samples](#) section.
- 9384 spectra from a total of 229 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 140 spectra of 5 reference samples from the substance/substance group *Riboflavin (vit. B2) (R0074)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Riboflavin (vit. B2) (R0074)	1205007	85013	40
Hepart	Riboflavin (vit. B2) (R0074)	14001828	85236 [†]	20
Hepart	Riboflavin (vit. B2) (R0074)	15000237	85243 [†]	20
Hepart	Riboflavin (vit. B2) (R0074)	15001035	85311 [†]	20
Hepart	Riboflavin (vit. B2) (R0074)	16000873	85404	40

- 10 694 spectra from a total of 303 batches from further 141 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 *Riboflavin (vit. B2) (R0074)*.

[†]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*.

- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Riboflavin (vit. B2) (R0074)* 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 *Riboflavin (vit. B2) (R0074)* 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	9384
Type B	0	110	30	10 694
Type C	0	0	0	71

The substance/substance group *Riboflavin (vit. B2) (R0074)* 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 % (> 99.9114 %)	100.0000 % (> 97.0000 %)
Type B	100.0000 % (> 99.9028 %)	78.5714 % (> 76.4286 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85116	85116	0.00	54.14
85236	85236	0.00	69.49
85243	85243	0.00	73.42
85311	85311	0.00	71.56
85391	85391	0.00	61.84

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe

mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Silymarine 80% extract (R0077)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85159-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Silymarine 80% extract (R0077)

Special notes

When selecting the *Silymarine 80% extract (R0077)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Silymarine 80% extract (R0077)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Silymarine 80% e...	131121500	85159	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Silymarine 80% extract (R0077)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 1 reference samples from the substance/substance group *Silymarine 80% extract (R0077)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Silymarine 80% extract (R0077)	14001401	85213	60

- 10 774 spectra from a total of 307 batches from further 141 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 *Silymarine 80% extract (R0077)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Silymarine 80% extract (R0077)* 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 *Silymarine 80% extract (R0077)* 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	40	0	9544
Type B	0	0	60	10 774
Type C	0	0	0	71

The substance/substance group *Silymarine 80% extract (R0077)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9031 %)	0.0000 % (≥ 0.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85159	85159	0.00	97.59

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Skimmed milk powder (SMP SI medium-high heat) (R...
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85397-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Skimmed milk powder (SMP SI medium-high heat) (R0234)

Special notes

When selecting the *Skimmed milk powder (SMP SI medium-high heat) (R0234)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Skimmed milk powder (SMP SI medium-high heat) (R0234)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Skimmed milk pow...	16000734	85397	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Skimmed milk powder (SMP SI medium-high heat) (R0234)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Skimmed milk powder (SMP SI medium-high heat) (R0234)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Skimmed milk powder (SMP SI medium-high heat) (R0234)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Skimmed milk powder (SMP SI medium-high heat) (R0234)* 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 *Skimmed milk powder (SMP SI medium-high heat) (R0234)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Skimmed milk powder (SMP SI medium-high heat) (R0234)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85397	85397	0.00	23.86

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Sodium borate (R0191)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85271-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Sodium borate (R0191)

Special notes

When selecting the *Sodium borate (R0191)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Sodium borate (R0191)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Sodium borate (R...	15000621	85271	40	not required
Hepart	Sodium borate (R...	15000999	85306	40	not required

Validation samples

A total of 20 489 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 *Sodium borate (R0191)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 120 spectra of 4 reference samples from the substance/substance group *Sodium borate (R0191)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Sodium borate (R0191)	15000621	85271 [†]	20
Hepart	Sodium borate (R0191)	15000999	85306 [†]	20
Hepart	Sodium borate (R0191)	16000597	85381	40
Hepart	Sodium borate (R0191)	16000597	85426	40

- 10 714 spectra from a total of 305 batches from further 141 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 *Sodium borate (R0191)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Sodium borate (R0191)* 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 *Sodium borate (R0191)* 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	9504
Type B	0	120	0	10 714
Type C	0	0	0	71

The substance/substance group *Sodium borate (R0191)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 95.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85271	85271	0.00	94.92
85306	85306	0.00	78.68

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group	Sodium chondroitin sulfate (R0061)
Substance class	Hepart raw materials
Report date	08/09/2017
Report number	85002-2017-09-08
Executing company	HiperScan GmbH Weißeritzstraße 3 01067 Dresden Germany

Relevant substance names

Sodium chondroitin sulfate (R0061)

Special notes

When selecting the *Sodium chondroitin sulfate (R0061)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7	<i>European Pharmacopoeia 8th Edition, Basic Version 2014</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>
Anhang F	Zusatz zu den Modellen der zweiten Stufe

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.

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 *Sodium chondroitin sulfate (R0061)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Sodium chondroit...	16000186	85338	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Sodium chondroitin sulfate (R0061)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 100 spectra of 3 reference samples from the substance/substance group *Sodium chondroitin sulfate (R0061)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Sodium chondroitin sulfate (...)	1203008	85002	40
Hepart	Sodium chondroitin sulfate (...)	1205001	85007	40
Hepart	Sodium chondroitin sulfate (...)	16000186	85338 [†]	20

- 10 734 spectra from a total of 305 batches from further 141 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 *Sodium chondroitin sulfate (R0061)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Sodium chondroitin sulfate (R0061)* 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 *Sodium chondroitin sulfate (R0061)* 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	40	0	9544
Type B	0	51	49	10 734
Type C	0	0	0	71

The substance/substance group *Sodium chondroitin sulfate (R0061)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9029 %)	51.0000 % (> 48.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85338	85338	0.00	70.86

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Sweet whey powder S Instant (R0144)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85399-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Sweet whey powder S Instant (R0144)

Special notes

When selecting the *Sweet whey powder S Instant (R0144)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Sweet whey powder S Instant (R0144)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Sweet whey powde...	16000686	85399	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Sweet whey powder S Instant (R0144)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 0 spectra of 0 reference samples from the substance/substance group *Sweet whey powder S Instant (R0144)*.
- 10 834 spectra from a total of 308 batches from further 142 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 *Sweet whey powder S Instant (R0144)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Sweet whey powder S Instant (R0144)* 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 *Sweet whey powder S Instant (R0144)* 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	40	0	9544
Type B	0	0	0	10 834
Type C	0	0	0	71

The substance/substance group *Sweet whey powder S Instant (R0144)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9026 %)	n/a (n/a)
Type C	100.0000 % (> 86.3129 %)	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.

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
85399	85399	0.00	51.33

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Taurine (R0078)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85018-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Taurine (R0078)

Special notes

When selecting the *Taurine (R0078)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Taurine (R0078)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Taurine (R0078)	1209008	85102	40	not required
Hepart	Taurine (R0078)	15000276	85252	40	not required

Validation samples

A total of 20 489 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 *Taurine (R0078)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 200 spectra of 5 reference samples from the substance/substance group *Taurine (R0078)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Taurine (R0078)	1206005	85018	40
Hepart	Taurine (R0078)	15000276	85252 [†]	20
Hepart	Taurine (R0078)	16000182	85357	60
Hepart	Taurine (R0078)	16000874	85402	40
Hepart	Taurine (R0078)	16001668	85440	40

- 10 634 spectra from a total of 303 batches from further 141 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 1 batches from the substance/substance group *Taurine (R0078)*.

[†]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*.

Supplier	Substance	Batch	Spectra
unbekannt	Taurine (R0078)	15000276	2

- 69 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Taurine (R0078)* 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 *Taurine (R0078)* 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	9504
Type B	0	200	0	10 634
Type C	0	2	0	69

The substance/substance group *Taurine (R0078)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9028 %)	100.0000 % (> 97.0000 %)
Type C	100.0000 % (> 86.7403 %)	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.

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
85102	85102	0.00	23.96
85252	85252	0.00	25.69

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Thiamine HCl (Vitamin B1) (R0079)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85015-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Thiamine HCl (Vitamin B1) (R0079)

Special notes

When selecting the *Thiamine HCl (Vitamin B1) (R0079)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Thiamine HCl (Vitamin B1) (R0079)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Thiamine HCl (Vi...	1209015	85113	40	not required
Hepart	Thiamine HCl (Vi...	131203001	85157	40	not required
Hepart	Thiamine HCl (Vi...	14001197	85222	40	not required
Hepart	Thiamine HCl (Vi...	14001826	85239	40	not required
Hepart	Thiamine HCl (Vi...	15000419	85262	40	not required
Hepart	Thiamine HCl (Vi...	15001037	85313	40	not required

Validation samples

A total of 20 489 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 *Thiamine HCl (Vitamin B1) (R0079)*. These samples are listed above in the [calibration samples](#) section.
- 9344 spectra from a total of 228 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 200 spectra of 7 reference samples from the substance/substance group *Thiamine HCl (Vitamin B1) (R0079)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Thiamine HCl (Vitamin B1) (R...	1205008	85015	40
Hepart	Thiamine HCl (Vitamin B1) (R...	14001197	85222 [†]	20
Hepart	Thiamine HCl (Vitamin B1) (R...	14001826	85239 [†]	20
Hepart	Thiamine HCl (Vitamin B1) (R...	15000419	85262 [†]	20
Hepart	Thiamine HCl (Vitamin B1) (R...	15001037	85313 [†]	20
Hepart	Thiamine HCl (Vitamin B1) (R...	16000875	85423	40
Hepart	Thiamine HCl (Vitamin B1) (R...	16001534	85446	40

- 10634 spectra from a total of 301 batches from further 141 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.

[†]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*.

- 0 spectra from 0 *Apo-Ident* customers from 0 batches from the substance/substance group *Thiamine HCl (Vitamin B1) (R0079)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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 *Thiamine HCl (Vitamin B1) (R0079)* 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 *Thiamine HCl (Vitamin B1) (R0079)* 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	9344
Type B	0	160	40	10 634
Type C	0	0	0	71

The substance/substance group *Thiamine HCl (Vitamin B1) (R0079)* 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 % (> 99.9114 %)	100.0000 % (> 97.5000 %)
Type B	100.0000 % (> 99.9028 %)	80.0000 % (> 78.5000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85113	85113	0.00	96.88
85157	85157	0.00	88.57
85222	85222	0.00	123.57
85239	85239	0.00	88.28
85262	85262	0.00	80.43
85313	85313	0.00	114.46

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Thiamine mononitrate (R0212)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85305-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Thiamine mononitrate (R0212)

Special notes

When selecting the *Thiamine mononitrate (R0212)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Thiamine mononitrate (R0212)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Thiamine mononit...	15000748	85305	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 40 spectra of 1 reference samples from the substance/substance group *Thiamine mononitrate (R0212)*. These samples are listed above in the [calibration samples](#) section.
- 9544 spectra from a total of 233 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Thiamine mononitrate (R0212)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Thiamine mononitrate (R0212)	15000748	85305 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Thiamine mononitrate (R0212)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Thiamine mononitrate (R0212)* 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 *Thiamine mononitrate (R0212)* 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	40	0	9544
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Thiamine mononitrate (R0212)* 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 % (> 99.9127 %)	100.0000 % (> 85.0000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85305	85305	0.00	73.96

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Tripotassium citrate monohydrate (R0117)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85268-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Tripotassium citrate monohydrate (R0117)

Special notes

When selecting the *Tripotassium citrate monohydrate (R0117)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Tripotassium citrate monohydrate (R0117)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Tripotassium cit...	15000230	85268	40	not required
Hepart	Tripotassium cit...	16000736	85374	40	not required

Validation samples

A total of 20 489 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 *Tripotassium citrate monohydrate (R0117)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Tripotassium citrate monohydrate (R0117)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Tripotassium citrate monohyd...	15000230	85268 [†]	20
Hepart	Tripotassium citrate monohyd...	17000186	85462	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Tripotassium citrate monohydrate (R0117)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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

[†]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*.

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 *Tripotassium citrate monohydrate (R0117)* 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 *Tripotassium citrate monohydrate (R0117)* 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	9504
Type B	0	60	0	10 774
Type C	0	0	0	71

The substance/substance group *Tripotassium citrate monohydrate (R0117)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 90.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85268	85268	0.00	35.34
85374	85374	0.00	34.81

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Valine (R0087)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85069-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Valine (R0087)

Special notes

When selecting the *Valine (R0087)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Valine (R0087)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Valine (R0087)	057601	85069	60	not required
Hepart	Valine (R0087)	057701	85075	50	not required
Hepart	Valine (R0087)	14000230	85221	40	not required

Validation samples

A total of 20 489 spectra were provided for validation. The results were evaluated separately according to the following sample categories:

Type A All calibration spectra.

- 150 spectra of 3 reference samples from the substance/substance group *Valine (R0087)*. These samples are listed above in the [calibration samples](#) section.
- 9434 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 60 spectra of 2 reference samples from the substance/substance group *Valine (R0087)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Valine (R0087)	14000230	85221 [†]	20
Hepart	Valine (R0087)	16001533	85443	40

- 10 774 spectra from a total of 306 batches from further 141 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 *Valine (R0087)*.

Supplier	Substance	Batch	Spectra
unbekannt	Valine (R0087)	15000580	1

[†]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*.

- 70 spectra from 1 *Apo-Ident* customers from a total of 42 batches from a further 26 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 *Valine (R0087)* 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 *Valine (R0087)* 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	9434
Type B	0	60	0	10 774
Type C	0	0	1	70

The substance/substance group *Valine (R0087)* 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 % (> 99.9115 %)	100.0000 % (> 96.0000 %)
Type B	100.0000 % (> 99.9031 %)	100.0000 % (> 90.0000 %)
Type C	100.0000 % (> 87.1676 %)	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.

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
85069	85069	0.00	57.43
85075	85075	0.00	74.04
85221	85221	0.00	44.48

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das

alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Walnut leaf extract (R0197)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85296-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Walnut leaf extract (R0197)

Special notes

When selecting the *Walnut leaf extract (R0197)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Walnut leaf extract (R0197)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Walnut leaf extr...	15000791	85296	40	not required
Hepart	Walnut leaf extr...	16000712	85376	40	not required

Validation samples

A total of 20 489 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 *Walnut leaf extract (R0197)*. These samples are listed above in the [calibration samples](#) section.
- 9504 spectra from a total of 232 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 20 spectra of 1 reference samples from the substance/substance group *Walnut leaf extract (R0197)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Walnut leaf extract (R0197)	15000791	85296 [†]	20

- 10 814 spectra from a total of 307 batches from further 141 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 *Walnut leaf extract (R0197)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 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](#).

[†]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*.

Validation results

The validation runs checked whether the substance/substance group *Walnut leaf extract (R0197)* 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 *Walnut leaf extract (R0197)* 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	9504
Type B	0	20	0	10 814
Type C	0	0	0	71

The substance/substance group *Walnut leaf extract (R0197)* 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 % (> 99.9119 %)	100.0000 % (> 92.5000 %)
Type B	100.0000 % (> 99.9042 %)	100.0000 % (> 70.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85296	85296	0.00	24.61
85376	85376	0.00	36.80

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

VALIDATION REPORT

IdentModul 1.3-2017-05

Validated substance/substance group **Zinc citrate trihydrate (R0089)**
Substance class Hepart raw materials
Report date 08/09/2017
Report number 85178-2017-09-08
Executing company HiperScan GmbH
Weißeritzstraße 3
01067 Dresden
Germany

Relevant substance names

Zinc citrate trihydrate (R0089)

Special notes

When selecting the *Zinc citrate trihydrate (R0089)* substance/substance group, the following information is displayed to the user:

no information

Applicable documents

978-3-7692-5416-7 *European Pharmacopoeia 8th Edition, Basic Version 2014* [3]
Komm2.2.40 *Erfüllung von Ph. Eur. 2.2.40 durch Apo-Ident* [4]
AA004 *Erstellung und Validierung eines IdentModul-Updates*
Anhang F [Zusatz zu den Modellen der zweiten Stufe](#)

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.

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 *Zinc citrate trihydrate (R0089)*:

Supplier	Substance	Batch	Sample ID	Spectra	Certificate
Hepart	Zinc citrate tri...	14000662	85178	40	not required
Hepart	Zinc citrate tri...	14001807	85233	40	not required
Hepart	Zinc citrate tri...	15000315	85267	40	not required

Validation samples

A total of 20 489 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 *Zinc citrate trihydrate (R0089)*. These samples are listed above in the [calibration samples](#) section.
- 9464 spectra from a total of 231 batches from further 101 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*.

These samples are allowed to originate from the same batch as calibration samples (*Type A*) as long as the package differs. In the following table spectra recorded from the same package as the corresponding calibration samples (*Type A*) are highlighted by [†].

- 100 spectra of 3 reference samples from the substance/substance group *Zinc citrate trihydrate (R0089)*.

Supplier	Substance	Batch	Sample ID	Spectra
Hepart	Zinc citrate trihydrate (R00...	14001807	85233 [†]	20
Hepart	Zinc citrate trihydrate (R00...	15000315	85267 [†]	20
Hepart	Zinc citrate trihydrate (R00...	15001427	85321	60

- 10 734 spectra from a total of 305 batches from further 141 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 *Zinc citrate trihydrate (R0089)*.
- 71 spectra from 1 *Apo-Ident* customers from a total of 43 batches from a further 27 substances. These spectra were recorded by *Apo-Ident* customers. *Type C* samples are documented within

[†]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*.

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 *Zinc citrate trihydrate (R0089)* 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 *Zinc citrate trihydrate (R0089)* 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	9464
Type B	0	100	0	10 734
Type C	0	0	0	71

The substance/substance group *Zinc citrate trihydrate (R0089)* 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 % (> 99.9116 %)	100.0000 % (> 95.0000 %)
Type B	100.0000 % (> 99.9029 %)	100.0000 % (> 94.0000 %)
Type C	100.0000 % (> 86.3129 %)	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.

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
85178	85178	0.00	54.00
85233	85233	0.00	55.29
85267	85267	0.00	56.68

Die Identität einer Probe wird mittels NIR bestätigt, wenn der Abstand zur nächsten Fremdprobe mindestens 50 % größer ist, als der Abstand zu einer Referenzprobe, deren Identität mittels Laborprüfung belegt wurde. Dieses Kriterium wird immer in dem chemometrischen Modell betrachtet, das alle Substanzen der Substanzklasse enthält, selbst dann wenn eine Zweite Stufe eine Untergruppe von ähnlichen Substanzen auflöst und dabei die Abstände untereinander vergrößert. Die mittels NIR bestätigten Proben untermauern die statistische Streuung der originalen Referenzsubstanz, können aber keine neuen Aspekte bzw. Ausprägungsformen der Substanz hinzufügen.

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 72 batches. From these 3134 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
Hepart	5-grain flakes (...)	1209001	40	not required
Hepart	Anhyrous sodium ...	15000383	13	not required
Hepart	Apple powder (R0...	1209017	60	not required
Hepart	Apple powder (R0...	130508-AP2	40	not required
Hepart	Apple powder (R0...	130508-AP1	40	not required
Hepart	Apple powder (R0...	051001	40	not required
Hepart	Banana frappé	180414/866	50	not required
Hepart	Banana frappé	250914/268	40	not required
Hepart	Barley flour (R0...	L70860	40	not required
Hepart	Base powder	749001	50	not required
Hepart	Beta carotene 10...	16000748	40	not required
Hepart	Beta carotene 10...	16001028	40	not required
Hepart	Chlorophyllin 97...	16001000	40	not required
Hepart	Chocolate concen...	1208012	40	not required
Hepart	Chocolate frappé	120914/222	40	not required
Hepart	Chocolate muesli	060301	50	not required
Hepart	Chocolate muesli	060201	50	not required
Hepart	Chocolate muesli	052501	50	not required
Hepart	Chromium(III) ch...	14000606	40	not required
Hepart	Dipotassium phos...	15000146	60	not required
Hepart	Healthy tea	12006132	60	not required
Hepart	Iron sulfate hep...	14000045	40	not required
Hepart	Lactalbumin, hyd...	14011001	40	not required
Hepart	Linseed, brown (...)	L3065-44060	40	not required
Hepart	Lupine proteins ...	1207001	40	not required
Hepart	Lupine proteins ...	1208004	40	not required
Hepart	Lupine proteins ...	130411-LP3	40	not required
Hepart	Magnesium glycer...	1211005	60	not required
Hepart	Magnesium glycer...	16000888	40	not required
Hepart	Milk protein pow...	131129001	40	not required
Hepart	Millet flakes, g...	L77149	40	not required
Hepart	Neutral concentr...	1208010	40	not required
Hepart	Neutral muesli	061701	60	not required
Hepart	Neutral muesli	058201	50	not required
Hepart	Neutral muesli	054701	60	not required
Hepart	Orange concentrate	1208005	40	not required
Hepart	Pea protein (R0...	1208015	40	not required
Hepart	Peta 11 (R0128)	1204050	40	not required
Hepart	Phosphatidylseri...	060601	60	not required
Hepart	Potassium chlori...	15000147	31	not required
Hepart	Potassium chlori...	16001518	40	not required
Hepart	Potato flour (R0...	130429005	40	not required
Hepart	Potato flour (R0...	130429004	40	not required
Hepart	Raspberry whey	746402	60	not required
Hepart	Raspberry whey	130604101	40	not required
Hepart	Regiovit mixture	055901	40	not required
Hepart	Rye sourdough (R...	131129505	40	not required
Hepart	Saccharin sodium...	16000830	40	not required

continued on the next page

continued from previous page

Supplier	Substance	Batch	Spectra	Certificate
Hepart	Seaweed ascophyl...	130408-SA1	40	not required
Hepart	Sodium cyclamate...	16000829	40	not required
Hepart	Soup asparagus	039602	40	not required
Hepart	Soup asparagus	140914/226	40	not required
Hepart	Soup curry	140914/227	40	not required
Hepart	Soup pea	030812/77	40	not required
Hepart	Soup potato	150414/848	40	not required
Hepart	Soup potato	150914/231	40	not required
Hepart	Soup tomato	070614	50	not required
Hepart	Soup tomato	150914/232	40	not required
Hepart	Soup tomato	20121116/2	50	not required
Hepart	Soy flakes (R0101)	1209003	40	not required
Hepart	Soy shells, fine...	L73242	40	not required
Hepart	Soya lecithin	061912P	40	not required
Hepart	Soya lecithin	1208013	40	not required
Hepart	Spelt flour (R01...	L70833	40	not required
Hepart	Stabipan bread f...	746601	60	not required
Hepart	Strawberry conce...	060901	50	not required
Hepart	Strawberry frappê	260914/271	40	not required
Hepart	Strawberry muesli	061601	50	not required
Hepart	Strawberry muesli	061601	50	not required
Hepart	Strawberry powde...	131126001	40	not required
Hepart	Strawberry whey	131016003	40	not required
Hepart	Vanilla frappê	30914/303	40	not required

Appendix C: Additional validation samples (Type C)

Not required.

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).

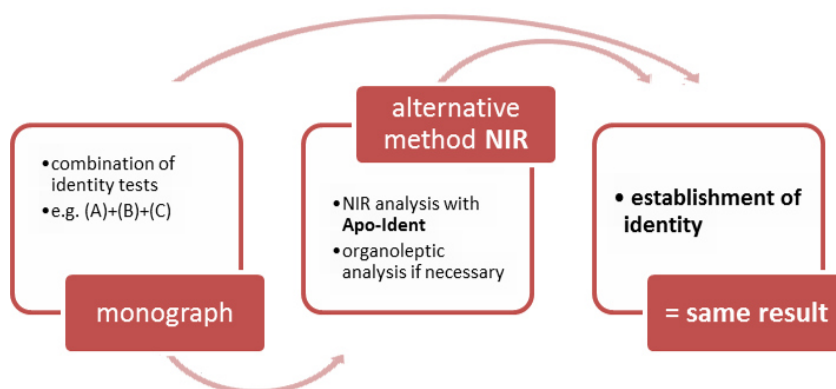


Figure 2: The combination of tests of the monograph is replaced by the alternative method NIR spectroscopy using *Apo-Ident*. This is permissible because both test procedures result in the establishment of the identity of the raw material.

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].

Anhang F: Zusatz zu den Modellen der zweiten Stufe

Wie im allgemeinen Teil der Validierungsdokumentation des *Apo-Ident* im Abschnitt [Ablauf von Modellerstellung und Validierungsläufen](#) unter 2. *Generieren der chemometrischen Modelle (Kalibrierung)* in f) beschrieben, besteht die Möglichkeit für bestimmte Substanzen ein weiteres *chemometrisches Modell* zu erstellen (Zweite-Stufe-Modell) und die Bewertung in mehreren Stufen vorzunehmen.

Substanzen in Stufe-Zwei-Modellen

Im *Apo-Ident Update 2017-05* werden folgende Substanzen in den aufgeführten Stufe-Zwei-Modellen differenziert:

Submodell 1

Betamethason, mikronisiert
Betamethasonvalerat
Budesonid, mikronisiert
Dexamethason
Erythromycin
Hydrocortisonbutyrat
Norethisteronacetat
Prednicarbat, mikronisiert
Prednisolon, mikronisiert
Triamcinolonacetonid

Submodell 2

Beclometasondipropionat, wasserfreies
Betamethasondipropionat, mikronisiert
Clobetasolpropionat
Diphenylcyclopropenon
Gentamicinsulfat
Natriumbenzoat
Natriumcitrat
Oxybutyninhydrochlorid

Submodell 3

Alfatradiol
Chininhydrochlorid
Chininsulfat Dihydrat
Estriol
Pregnenolon
Progesteron, mikronisiert
Spironolacton
Testosteronpropionat

Submodell flüssig

2-Ethylhexyllaurat
Basiscreme DAC
Hydrophile Creme, nichtionisch DAB
Lanette®-Salbe (konserviert)
Squalan
Wollwachsalkoholcreme DAB/SR

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