



SLOVENSKI STANDARD SIST ISO 8587:2011

01-junij-2011

Nadomešča:
SIST ISO 8587:1997

Senzorična analiza - Metodologija - Razvrščanje

Sensory analysis -- Methodology -- Ranking

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Analyse sensorielle -- Méthodologie -- Classement par rangs
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Ta slovenski standard je istoveten z: ISO 8587:2006

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ICS:

67.240

Senzorična analiza

Sensory analysis

SIST ISO 8587:2011

en,fr

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INTERNATIONAL STANDARD

**ISO
8587**

Second edition
2006-11-01

Sensory analysis — Methodology — Ranking

Analyse sensorielle — Méthodologie — Classement par rangs

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Reference number
ISO 8587:2006(E)

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8587 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 12, *Sensory analysis*.

This second edition cancels and replaces the first edition (ISO 8587:1988), which has been technically revised.

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Sensory analysis — Methodology — Ranking

1 Scope

This International Standard describes a method for sensory evaluation with the aim of placing a series of test samples in rank order.

This method allows for assessing differences among several samples based on the intensity of a single attribute, of several attributes¹⁾ or of an overall impression. It is used to find if differences exist, but cannot determine the degree of difference that exists between samples.

The method is suited for the following cases:

- a) evaluation of assessors' performance
 - 1) training assessors,
 - 2) determining perception thresholds of individuals or groups;
- b) product assessment
 - 1) pre-sorting of samples
 - i) on a descriptive criterion
 - ii) on hedonic preference;
 - 2) determination of the influence on intensity levels of one or more parameters (e.g. order of dilution, influence of raw materials, of production, packaging or storage methods)
 - i) on a descriptive criterion,
 - ii) on hedonic preference;
 - 3) determination of the order of preference in a global hedonic test.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5492, *Sensory analysis — Vocabulary*

ISO 6658, *Sensory analysis — Methodology — General guidance*

1) In this case, each attribute is tested through a different test in which the same products have different codes and are served in different orders to the same assessor.

ISO 8587:2006(E)

ISO 8586-1, *Sensory analysis — General guidance for the selection, training and monitoring of assessors — Part 1: Selected assessors*

ISO 8586-2, *Sensory analysis — General guidance for the selection, training and monitoring of assessors — Part 2: Experts*

ISO 8589, *Sensory analysis — General guidance for the design of test rooms*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 11035, *Sensory analysis — Identification and selection of descriptors for establishing a sensory profile by a multidimensional approach*

ISO 11036, *Sensory analysis — Methodology — Texture profile*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-1 and ISO 5492 apply.

4 Principle

The assessors receive simultaneously three or more samples in random order.

NOTE Although it is possible to rank two samples, the paired comparison method, as described in ISO 5495^[1], usually is preferred.

The assessors are asked to rank the samples according to a specified criterion: either a unidimensional criterion (i.e. particular attribute or specific characteristic of an attribute) or a global intensity (e.g. overall impression).

The rank sums are determined and statistical comparisons are made.

5 General test conditions

Refer, where available, to the standards (see ISO 6658) describing the sampling methods, the room in which tests are conducted (see ISO 8589) and the apparatus.

When preparing the test samples, the important points to be taken into consideration are as follows:

- a) preparation, coding and presentation of the test samples;
- b) number of samples to be compared that can be compared reliably (to be determined based on the nature of the test product (saturation sensitivity effects) and the design chosen; the number of samples shall be adapted based on
 - 1) the type of product [e.g. up to 15 samples can be assessed by selected assessors (ISO 8586-1) or experts (ISO 8586-2) on mild samples, while three can be a real maximum for harsh, spicy or high fat products assessed by consumers], and
 - 2) the criterion to be assessed (e.g. sweet is less saturating than bitter);
- c) possible illumination of the samples.

6 Assessors

6.1 Qualification

The qualification of assessors depends on the aim of the test (see Annex A).

All assessors should preferably have the same level of qualification, this level being chosen according to the purpose of the test:

- a) selected assessors or experts, for
 - 1) training assessors,
 - 2) assessment on a descriptive criterion, for instance determining the influence of intensity levels of one or more parameters (e.g. order of dilution, influence of raw materials, of production, packaging or storage methods),
 - 3) determination of perception thresholds of individuals or groups;
- b) untrained assessors or consumers, already trained on the method
 - 1) for hedonic preference,
 - 2) when pre-sorting samples (to select a few products from a large number, as a preliminary test).

For the conditions with which assessors shall comply, see ISO 6658, ISO 8586-1 and ISO 8586-2. They shall all be specially trained on the ranking procedure and on the selected descriptors being used.

6.2 Number of assessors

The number of assessors depends on the aim of the test (see Annex A).

When testing assessors' performance, training assessors or determining perception thresholds of individuals or groups, no minimum or maximum number is required.

For descriptive product assessment, the minimum number of assessors is determined by the levels of statistical risks accepted and shall comply with ISO 11035 or ISO 11036, i.e. preferably around 12 to 15 selected assessors.

For determining the order of preference in a hedonic test, the minimum number of assessors is determined by the levels of statistical risks accepted, e.g. a minimum of 60 assessors per group of consumer type.

For statistical analysis of the results, other things being equal (for example, test conditions, qualification of assessors), the larger the number of assessors, the greater the probability of revealing any systematic difference in rank among products.

6.3 Preliminary discussion

The assessors shall be informed of the purpose of the test, i.e. ranking of test samples.

If necessary, a demonstration of a ranking procedure can be given. It is essential in this test to ensure common understanding by all assessors of the criterion under test. The preliminary discussion shall not influence assessors' expectations.

7 Procedure

7.1 Presentation of the samples

The assessors shall not be able to draw conclusions about the samples from the way in which they are presented.

Prepare samples out of sight of the assessors and in an identical manner: same apparatus, vessels, same quantity of products, same temperature, same presentation. All irrelevant differences in samples shall be masked to avoid influencing the ranking. It is preferable to present the samples at the temperature at which the product is generally consumed.

The vessels are identified by 3-digit numbers, chosen at *random*, and different from one sample to another within one session (and preferably from one assessor to another).

The presentation takes into account the design chosen. In a “complete block” design, each assessor ranks all the samples. It is the preferred procedure. But, if the number of samples or their nature makes it impracticable to rank all the samples, a “balanced incomplete block” design may be used. In either case, it is necessary to ensure that all assessors complete their part of the design and do not omit any assessment.

For balanced incomplete block designs, each assessor is presented a specific subset of the samples in a randomized order (see Annex C for an example).

NOTE The use of a certain Balanced Incomplete Block is only possible when such a block variation exists in reality. So it is necessary to look for a predefined block from literature, e.g. Reference [5] in the Bibliography.

Each assessor is presented with k of the p samples ($k < p$). The subset of k samples is determined such that, in a single pass through the balanced incomplete block design, each sample is evaluated by n of the j assessors ($n < j$) and each pair of samples is evaluated by g assessors. It may be necessary to repeat the entire balanced incomplete block design several times in order to achieve an adequate level of sensitivity in the study. The number of repeats is denoted by r . In total, every sample is evaluated by $r \times n$ assessors and every pair of samples is evaluated by $r \times g$ assessors.

7.2 Reference samples

Reference samples may be included. If so, they are introduced unidentified into the series of samples.

7.3 Test technique

All assessors shall work under the same test conditions.

The assessors evaluate the samples presented in random order and place them in rank order on the designated attribute.

Instruct the assessors to avoid tied ranks²⁾. If an assessor cannot differentiate two or more of the samples, instruct the assessor to place the samples in a rank order and record which samples they were unable to differentiate in the comment section of the answer form.

Provided there is no danger of sensory adaptation, and the products are sufficiently stable, it may be helpful to instruct each assessor to conduct an initial provisional ranking and then verify it by re-evaluating the samples in the rank order.

A single attribute shall be evaluated per test. If information about the ranking of more than one attribute is desired, each shall be evaluated by a separate test.

2) Tied ranks (identical ranks) are to be avoided and only used when assessors are really unable to differentiate between samples.

7.4 Answer form

An example of an answer form is shown in Annex D.

Sample codes should not initially appear on the blank answer form in case their positions influence assessors' expectations about their rank order. The ranks assigned to the individual samples shall be recorded by the assessors on the answer form.

Depending on the purpose of the test and on the test samples, it may be helpful to record additional information through a specific answer form.

8 Expression and interpretation of results

8.1 Summary of the results and calculation of the rank sums

Table 1 illustrates how rankings of one attribute by seven assessors for four samples are tabulated. If ranking is performed with respect to more than one attribute, a separate table is required for each attribute.

If there are tied ranks, record the mean rank of the samples that are tied. In Table 1, assessor 2 has assigned the same rank to samples B and C. Assessor 3 has assigned the same rank to samples B, C and D.

If there is no missing data and if tied ranks are correctly calculated, all rows will have the same total. The rank sum for each sample is obtained by adding up the ranks in each column. The rank sums indicate the consistency of the ranks assigned by the whole group of assessors. If they are consistent, the rank sums will be very different, but if they are inconsistent the rank sums will be similar.

8.2 Statistical analysis and interpretation

The statistical test to be chosen depends on the purpose of the test (see Annex A).

8.2.1 Determination of individual performance: Spearman correlation coefficient

To study the agreement between two rank orders (for example, rankings by two assessors or an assessor's rank order and an order predicted by information about the samples), the Spearman correlation coefficient, r_s , can be calculated:

$$r_s = 1 - \frac{6 \sum d_i^2}{p(p^2 - 1)}$$

where

p is the number of products ranked;

d_i is the difference between the two rankings for sample i .

If the value of the Spearman correlation coefficient approaches +1, there is high agreement between the two rank orders. If it is close to 0, the rank orders are unrelated.

If it approaches -1, there is strong disagreement between the rankings. Consideration should be given to the possibility that an assessor has misinterpreted the instructions and has arranged the samples in the opposite order to that intended.

Critical values of r_s to determine if the observed correlation is significant are given in Table 2.