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Sensory analysis — Methodology — Duo-trio test

Analyse sensorielle — Méthodologie — Essai duo-trio

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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.

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.

International Standard ISO 10399 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Sub-Committee SC 12, *Sensory analysis*.

Annexes A, B and C of this International Standard are for information only.

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Sensory analysis — Methodology — Duo-trio test

1 Scope

This International Standard specifies a method for determining whether there is a difference between two product samples, as perceived by a panel. This difference may relate to one specific organoleptic attribute or to a combination of organoleptic attributes.

This test is not applicable for the determination of preference, nor for the evaluation of the character or intensity of the perceived difference.

Two forms of this test are described

— the balanced-reference technique, and
— the constant-reference technique.

The constant-reference technique is used in particular as a tool for quality control where a trained panel and reference products well known to the assessors are available.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5492:—[1], *Sensory analysis — Vocabulary.*

ISO 6658:1985, *Sensory analysis — Methodology — General guidance.*

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

ISO 8589:1988, *Sensory analysis — General guidance for the design of test rooms.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5492 apply.

4 Principle

Simultaneous or consecutive presentation to an assessor of three samples, two of which are identical.

In the case of simultaneous presentation, the assessor is instructed to examine the samples in a specific order so that the sample identified as the control is examined first. In the case of consecutive presentation, the samples are presented by the supervisor such that the sample identified as the control is examined first.

Identification by the assessor of the sample which is perceived to be different from the control.

NOTE 1 The duo-trio test is a forced-choice test and always requires an answer to the question asked.

5 Apparatus

The apparatus shall be selected by the test supervisor according to the nature of the product to be analysed, the number of samples, etc., and shall have no influence on the test results.

If standard apparatus meets the requirements of the test, it shall be used.

6 Sampling

See the relevant International Standards on sampling for the purpose of sensory analysis of the product or products to be analysed.

1) To be published.

If no such International Standards exist, agreement shall be reached on this subject between the parties concerned.

7 General test conditions

7.1 Test room

See ISO 8589.

7.2 Assessors

7.2.1 Qualification, selection and aptitude

For requirements applicable to the assessors, see ISO 6658 and ISO 8586-1.

It is desirable that all the assessors on the panel should have the same sensory experience of the products tested. The level of experience should be related to the aim of the test.

7.2.2 Number of assessors

It is recommended to have about 20 assessors, but the number required depends on the purpose of the test and on the significance level chosen. The minimum number of assessors (replies) for a given significance level shall be as given in table 1.

NOTE 2 For example, it is possible to carry out the test with a minimum of seven assessors at significance levels of 5 % or 1 %, but a minimum of ten is required for a significance level of 0,1 %.

7.2.3 Discussion and preliminary tests

It is desirable that a preliminary discussion be held between the assessors and the test supervisor on the problem posed and the nature of the samples, provided that this discussion can have no influence on future judgements.

8 Procedure

8.1 Preparation of the test samples

8.1.1 Quantity

A representative quantity of the bulk sample of each of the products shall be provided; this quantity shall be sufficient to provide an adequate number of samples for the panel.

8.1.2 Presentation

It shall not be possible for the assessors to draw any conclusions on the nature of the samples from the way in which they are presented to them.

All samples shall be prepared in exactly the same way (identical containers and laboratory ware, same amounts of products).

Table 1

Number of replies	Minimum number of correct replies for a significance level of		
	5 % ($\alpha \leqslant 0,05$)	1 % ($\alpha \leqslant 0,01$)	0,1 % ($\alpha \leqslant 0,001$)
7	7	7	—
8	7	8	—
9	8	9	—
10	9	10	10
11	9	10	11
12	10	11	12
13	10	12	13
14	11	12	13
15	12	13	14
16	12	14	15
17	13	14	16
18	13	15	16
19	14	15	17
20	15	16	18
21	15	17	18
22	16	17	19
23	16	18	20
24	17	19	20
25	18	19	21
30	20	22	24
35	23	25	27
40	26	28	31
45	29	31	34
50	32	34	37
60	37	40	43
70	43	46	49
80	48	51	55
90	54	57	61
100	59	63	66

NOTES

1 The values given were calculated from the exact formula of the binomial distribution for parameter $P = 0,50$ with n repetitions (replies).

2 When the number of replies is greater than 100 ($n > 100$), it is necessary to use the following formula, based on the normal approximation of the binomial distribution, to give the minimum number of correct replies.

The minimum number of correct replies is equal to the nearest integer

$$\frac{n+1}{2} + k\sqrt{n}$$

where

$k = 0,82$ for $\alpha \leqslant 0,05$
$k = 1,16$ for $\alpha \leqslant 0,01$
$k = 1,55$ for $\alpha \leqslant 0,001$

8.1.3 Temperature of the samples

The temperature of the samples shall be specified and recorded in the test report. It shall be identical for all the samples in the test.

NOTE 3 It is customary to present the samples at the temperature at which the product is normally consumed.

8.1.4 Coding

The vessels containing the samples shall be coded, preferably using three digit numerals chosen at random.

8.2 Test method

8.2.1 Balanced reference technique

Make up series comprising four sets of samples in the following four combinations:

A_RAB
A_RBA
B_RAB
B_RBA

The first two sets in the series contain A_R as control; the last two contain B_R as control.

Make up a sufficient number of series to provide each assessor with one set.

NOTE 4 For example, if there are 22 assessors, make up six series of samples (i.e. 24 sets).

If the total number of sets made up is greater than the number of assessors, proceed as follows. If there is one superfluous set, discard at random one set. If there are two superfluous sets, discard at random one set containing A_R as control and one set containing B_R as control. If there are three superfluous sets, discard at random one set containing A_R as control and one set containing B_R as control, and then discard at random one further set.

Randomly distribute the sets among the assessors.

Present the sets either simultaneously or consecutively. In the case of simultaneous presentation, instruct the assessor to examine the samples in a specific order, e.g. from left to right, such that the sample identified as control is examined first. In the case of consecutive presentation, the supervisor shall present the samples to the assessors such that the sample identified as control is examined first.

In accordance with the forced-choice technique, instruct each assessor to indicate which of the two samples is different from the control.

8.2.2 Constant-reference technique

This technique is used in particular when one of the samples is a familiar or routinely assessed product.

The possible combinations of samples are thus restricted to A_RAB and A_RBA, A_R being the control product. In all other aspects, the procedure is identical to that of the balanced-reference technique (8.2.1).

9 Expression of results

Count the number of correct replies and refer to table 1 to determine whether the panel has significantly perceived a difference between the samples.

The final decision is based on the previously chosen α-risk and does not take into account the exact probability.

NOTE 5 A specimen answer form and examples of practical application of the two techniques are given in annexes A, B and C.

10 Test report

The test report shall give the following information:

a) the purpose of the test;

b) all information necessary for the complete identification of the samples;

c) the test parameters used, in particular the temperature of the samples or possible unique features of presentation or apparatus;

d) details of all test conditions differing from the specifications given in this International Standard, or from the principles and guidelines set out in ISO 6658;

e) details of any other instruction given during the test (e.g. regarding special foods);

f) the number of assessors and whether or not the panel is trained;

g) whether the test was carried out in accordance with the constant- or the balanced-reference technique;

h) the results obtained and the conclusion drawn at the chosen significance level;

i) reference to this International Standard;

j) the date of the test;

k) the name of the test supervisor.

Annex A
(informative)

Specimen answer form for the duo-trio test

Place:	Name: ..... Date: ..... Time: .....

Duo-trio test

Product: .....

You are provided with three samples. The left-hand sample is the control, one of the other two samples is different from the control.

Examine the samples, beginning with the control, and write below the numeral of the sample which you perceive to be different from the control.

Sample different from the control: .....

You must make a choice.

Annex B
(informative)

Example of the application of the balanced-reference technique

A manufacturer changes the formulation of a product and wishes to know whether the new product is perceived as different from the old product from a sensory point of view.

The manufacturer has available a panel of 24 assessors who are not familiar with the product. The manufacturer is willing to accept a risk of 1 % that the test will reveal a difference where there is none.

Two batches of product are prepared, one old formulation (batch A) and one new formulation (batch B).

It is necessary to prepare 36 samples (24 + 24/2) of each of A and B from these to make up six series comprising four sets of samples in the following four combinations (the controls are designated as A_R and B_R, according to which product is used as the control):

A_RAB
A_RBA
B_RAB
B_RBA

The number of correct responses obtained in the test is 20, i.e. 20 assessors correctly identified the sample which is different from the control. By reference to table 1, the products are perceived to be significantly different at the 1 % level.

Annex C
(informative)

Example of the application of the constant-reference technique

A manufacturer is testing a number of new raw materials and wishes to know whether they are perceived as different from the existing raw materials by the panel.

During this test, the existing raw materials continue to be used to make the usual product.

The usual product is identified as the control product A_R, and an experimental batch B is made up using the new raw materials.

The manufacturer has available a panel of 18 assessors who are familiar with the usual product. The manufacturer is willing to accept a risk of 5 % that the test will reveal a difference where there is none.

The appropriate number of sets (A_RAB and A_RBA) is distributed.

Ten correct replies are obtained. Reference to table 1 shows that the products are not perceived to be significantly different at the 5 % level.

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