SLOVENSKI STANDARD
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Senzorična analiza - Metodologija - Preskus "triangel"

Sensory analysis -- Methodology -- Triangular test

Analyse sensorielle -- Méthodologie -- Essai triangulaire

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67.240	Senzorična analiza	Sensory analysis

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International Standard 4120

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Sensory analysis — Methodology — Triangular test

Analyse sensorielle — Méthodologie — Essai triangulaire

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4120 was developed by Technical Committee ISO/TC 34, *Agricultural food products*, and was circulated to the member bodies in December 1982.

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No member body expressed disapproval of the document.

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Sensory analysis — Methodology — Triangular test

1 Scope

This International Standard specifies a method of sensory analysis for detecting differences between samples of two products by means of triangular comparison.

The method described is the simple triangular test. Information on possible extensions of the test is given in annex A.

2 Field of application

The method is applicable for revealing slight differences between samples of products. The differences may concern either all attributes or one attribute of the samples.

It may be used in the selection and training of assessors and for monitoring the performance of assessors.

The method is particularly convenient when :

a) the number of assessors available is not very large;

b) there is no problem of sensory fatigue.

3 References

ISO 3534, *Statistics — Vocabulary and symbols.*

ISO 5492, *Sensory analysis — Vocabulary.*

ISO 6658, *Sensory analysis — Methodology — General guidance.*[1)]

4 Definitions

For definitions of terms relating to sensory analysis, see ISO 5492, and for those referring to statistics, see ISO 3534.

5 Principle

Simultaneous presentation to the assessors of a set of three test samples, two of which are identical, for identification of the odd sample.

Following testing, written response by the assessors, and interpretation of the replies obtained.

6 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 in no way affect the test results.

If standardized apparatus corresponds to the needs of this test, it shall be used.

7 Sampling

Refer to the International Standards relating to sampling, for sensory analysis, of the product or products to be examined.

The method of sampling shall take account of the test objectives and, if there is no International Standard for the product concerned, shall be agreed between the parties concerned.

8 General test requirements

8.1 Room

For the conditions in the room in which tests are to be conducted, see ISO 6658.

8.2 Assessors

8.2.1 Qualification, selection, aptitude

For the conditions which the assessors shall fulfil, see ISO 6658.

All the assessors shall have the same level of qualification, this being chosen according to the purpose of the test.

1) At present at the stage of draft.

8.2.2 Number of assessors

The minimum number of assessors required depends on the purpose of the test. Thus, for the strict use of the statistical table (see clause 10), and according to the significance level adopted, it will be possible, for example, to carry out this test with a minimum of 5 assessors at significance levels of 5 % or 1 %, and with a minimum of 7 assessors at a significance level of 0,1 %.

8.2.3 Participation by test supervisor

Normally the test supervisor shall not take part in the test. If he participates he shall not be informed of the codes.

8.3 Preliminaries

It may be desirable for the test supervisor to organize a preliminary presentation on the problem concerned and the nature of the samples, provided that this presentation does not bias subsequent judgements.

If the test in question concerns the detection of particular taints, this preliminary presentation shall when possible be supplemented by an examination of a sample free from the taint concerned and of the taint to be detected.

9 Procedure

9.1 Preparation of test samples

(distribution, dilution, cooking, etc.)

9.1.1 Make provision for sufficient quantities of products A and B, for the desired number of sets of three test samples.

9.1.2 Prepare equal numbers of sets (as far as possible), from the laboratory samples, of the six possible sequences for testing, as follows :

ABB	BAA
AAB	BBA
ABA	BAB

9.1.3 The assessors shall not be able to draw conclusions as to the nature of the test samples from the way in which they are presented.

The various sets of test samples shall be prepared in an identical fashion [same apparatus, same vessels, same quantities of products and same arrangements (in a triangle, in a line, etc.)].

9.1.4 The temperature of the test samples in any given set shall be the same and, if possible, the same as that of all other samples in a given test series.

9.1.5 The vessels containing the test samples shall be coded, preferably using three figure numbers chosen at random. The coding shall be different for each test.

9.2 Test technique

9.2.1 The assessors shall be informed of the purpose of the test, but only to the extent that this does not risk introducing bias in their replies (see 8.3).

9.2.2 The sets prepared in 9.1.2 shall be distributed at random to the assessors. Thus, certain assessors will receive two containers of sample A and one container of sample B and others will receive two containers of sample B and one container of sample A.

9.2.3 The assessors shall examine the test samples making up each set in a predetermined order which shall be specified to them, and which shall always be the same for a series of sets of test samples (for example, by always beginning with the sample on the left, or that on the right, etc.).

The assessors shall, however, have the opportunity of making repeated tests of each test sample during evaluation of the same set of three test samples.

If necessary, the assessors may be advised of the quantity or volume of each test portion.

If the number of assessors is not a multiple of six, it is possible

a) not to use the supplementary set (or supplementary sets) (this alternative may be sufficient for a first approach of the problem);

b) to use some of the assessors a second time (in this case, the results cannot be analysed statistically);

c) to present the six sets to each assessor in several sittings.

9.2.4 The person supervising the test shall opt for one of the following possibilities :

a) according to the "forced choice" option, oblige the assessors to indicate which test sample is different from the other two, even if the assessors claim not to detect the difference;

b) allow the answer "no difference" when they cannot detect a difference.

The "forced choice" option shall be used if strict statistical validity of the analysis of results by means of the table is required.

Specimen answer forms are reproduced in annex B.

10 Expression and interpretation of results

10.1 "Forced choice" option

Count the number of correct answers and refer to the table to determine whether there is a significant difference between the samples.

NOTE — See annex C for a practical example of application.

10.2 "No difference" replies

According to the purpose of the test, it is possible to treat "no difference" replies in different ways, for example

a) ignore them, i.e. subtract them from the total number of replies from the panel;

b) consider them in the following possible ways :

- allocate one third of the "no difference" replies to the category of correct replies;
- allocate them to the incorrect replies;
- consider them separately.

A large proportion of "no difference" replies provides an interesting piece of information and may be useful during subsequent tests. It could indicate, in particular, that the difference between the samples is below the detection threshold of the assessors. This may equally reveal an imperfect experimental technique, reflect the existence of an important physiological variation in the assessors making up the panel, or even a lack of motivation of certain assessors for the tests in which they are participating.

10.3 Use of the sequential approach

This approach can be used only if the "forced choice" option is used.

With the sequential approach, results are checked as the test proceeds and the test is stopped as soon as a decision can be reached. Decisions to accept or reject the presence of a difference are usually made by reference to a graph with either sloping or horizontal boundaries (see the figure).

The progress of the test is plotted by adding a new point to the graph each time a result is obtained. When the plotted point falls outside either of the boundaries a decision is made and the test is stopped.[1)]

The positions of the boundaries are calculated from such information as

a) the probability of a correct result by chance;

b) the level of significance required;

c) the ability required for detecting difference of a given magnitude.

11 Test report

The test report shall make reference to this International Standard and shall give the following information :

a) all information allowing complete identification of the sample (quantity, shape, temperature);

b) the test parameters which were adopted, and in particular the number of presentations of sets of three test samples;

c) any other recommendations given during the test;

d) the number of tests and the number of assessors per test and their qualifications;

e) all the test conditions, in particular whether the "forced choice" option was used;

f) the results obtained, the conclusion drawn, and the significance level chosen;

g) the date, time and conditions of the tests;

h) name of the person supervising the tests.

1) Refer to the specialized literature for a precise description of the method of establishing this type of graph.

Table — Minimum numbers of correct replies to establish a difference at various significance levels for the triangular test

Number of replies	Minimum number of correct replies for a significance level of			Number of replies	Minimum number of correct replies for a significance level of			Number of replies	Minimum number of correct replies for a significance level of		
	5 %	1 %	0,1 %		5 %	1 %	0,1 %		5 %	1 %	0,1 %
5	4	5	—	37	18	20	22	69	31	33	36
6	5	6	—	38	19	21	23	70	31	34	37
7	5	6	7	39	19	21	23	71	31	34	37
8	6	7	8	40	19	21	24	72	32	34	38
9	6	7	8	41	20	22	24	73	32	35	38
10	7	8	9	42	20	22	25	74	32	35	39
11	7	8	10	43	20	23	25	75	33	36	39
12	8	9	10	44	21	23	26	76	33	36	39
13	8	9	11	45	21	24	26	77	34	36	40
14	9	10	11	46	22	24	27	78	34	37	40
15	9	10	12	47	22	24	27	79	34	37	41
16	9	11	12	48	22	25	27	80	35	38	41
17	10	11	13	49	23	25	28	81	35	38	41
18	10	12	13	50	23	26	28	82	35	38	42
19	11	12	14	51	24	26	29	83	36	39	42
20	11	13	14	52	24	26	29	84	36	39	43
21	12	13	15	53	24	27	30	85	37	40	43
22	12	14	15	54	25	27	30	86	37	40	44
23	12	14	16	55	25	28	30	87	37	40	44
24	13	15	16	56	26	28	31	88	38	41	44
25	13	15	17	57	26	28	31	89	38	41	45
26	14	15	17	58	26	29	32	90	38	42	45
27	14	16	18	59	27	29	32	91	39	42	46
28	15	16	18	60	27	30	33	92	39	42	46
29	15	17	19	61	27	30	33	93	40	43	46
30	15	17	19	62	28	30	33	94	40	43	47
31	16	18	20	63	28	31	34	95	40	44	47
32	16	18	20	64	29	31	34	96	41	44	48
33	17	18	21	65	29	32	35	97	41	44	48
34	17	19	21	66	29	32	35	98	41	45	48
35	17	19	22	67	30	33	36	99	42	45	49
36	18	20	22	68	30	33	36	100	42	46	49

NOTES

1 The values in this table were calculated from the exact binomial law formula for parameter $p = 1/3$ with n repetitions (replies).

2 When the number of replies is larger than 100 ($n > 100$), it is necessary to use the following formula based on the approximation to the binomial law by the normal law which gives the actual number of expressed assessments to be obtained, with a maximum error equal at most to 1 unit.

Minimum number of replies (X) = nearest whole number to

$$X = 0{,}471\,4\,z\sqrt{n} + \frac{(2n + 3)}{6}$$

where

$z = 1{,}64$ for $\alpha < 0{,}05$

$z = 2{,}33$ for $\alpha < 0{,}01$

$z = 3{,}10$ for $\alpha < 0{,}001$

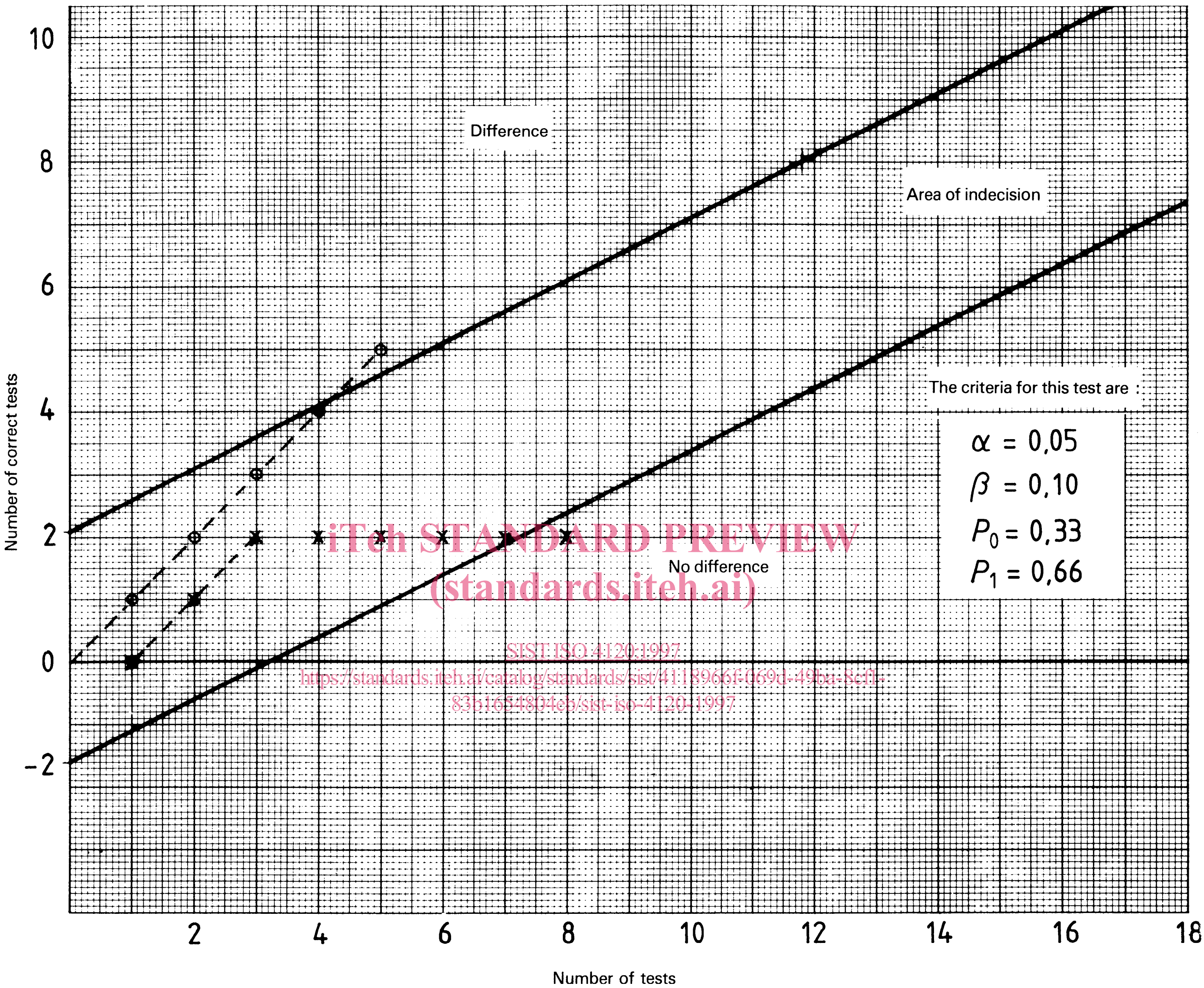

Figure — Sequential approach for triangular test
(from WALD A., *Sequential analysis* (1947), Wiley and Sons, New York, USA)

α is the probability of stating that a difference occurs when it does not.

β is the probability of stating that no difference occurs when it does.

P_0 is the expected proportion of correct decisions when the samples are identical.

P_1 is the expected proportion of correct decisions when the odd sample is detected (other than by guess) on half of the total number of occasions.