SLOVENSKI STANDARD
SIST EN 1622:1998

01-maj-1998

Kakovost vode - Določanje praga vonja in praga arome

Water analysis - Determination of the threshold odour number (TON) and threshold flavour number (TFN)

Wasserbeschaffenheit - Bestimmung des Geruchsschwellenwerts (TON) und des Geschmacksschwellenwerts (TFN)

Analyse de l'eau - Détermination du seuil d'odeur (TON) et du seuil de flaveur (TFN)

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English version

Water analysis - Determination of the threshold odour number (TON) and threshold flavour number (TFN)

Analyse de l'eau - Détermination du seuil d'odeur (TON) et du seuil de flaveur (TFN)

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This European Standard was approved by CEN on 4 September 1997.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1998, and conflicting national standards shall be withdrawn at the latest by April 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Annex A is normative. Annexes B, C, D and E are informative.

Introduction

This European Standard gives methods for the determination of the threshold odour number (TON) and the threshold flavour number (TFN).

The methods described in this European Standard are based on the standard methods for sensory analysis. However, some differences are noted, as compared with those methods, due to water specificity.

This European Standard is primarily intended to give a quantitative measure of odour and flavour of a water sample at a temperature of 25 °C.

NOTE : The method can be used to determine the odour and flavour of a water sample at other temperatures but there will be no correlation between results obtained at different temperatures.

1 Scope

This European Standard specifies methods for determining the TON and TFN of waters. It is essential that the safety remarks in clause 5 are taken into account.

Two methods are described :

- a short method applicable when either a sample has no odour and flavour or when the odour and flavour are to be compared with a specified threshold number ;
- a full method applicable when the threshold number for the sample is to be determined.

Both methods are applicable for quantifying the odour and flavour of drinking water and/or migration waters from materials in contact with waters.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 3591:1977
Sensory analysis – Apparatus – Wine-tasting glass

ISO 5492:1992
Sensory analysis – Vocabulary

ISO 8589:1988
Sensory Analysis – General guidance for the design of test rooms

ISO 7393-2:1985
Water quality – Determination of free chlorine and total chlorine – Part 2 : Colorimetric method using N,N-diethyl-1,4-phenylenediamine, for routine control purposes

3 Definitions

For the purposes of this Standard, the following definitions apply :

3.1 odour

Organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances [ISO 5492:1992].

3.2 flavour

Complex combination of the olfactory, gustatory and trigeminal sensations perceived during tasting. The flavour may be influenced by tactile, thermal, painful and/or kinaesthetic effects [ISO 5492:1992].

3.3 threshold odour number (TON)

Dilution ratio beyond which the diluted sample does not have any perceptible odour.

$$TON = \frac{A + B}{A}$$

where :

A is the volume of sample ;

B is the volume of reference water.

3.4 threshold flavour number (TFN)

Dilution ratio beyond which the diluted sample does not have any perceptible flavour.

$$TFN = \frac{A + B}{A}$$

where :

A is the volume of sample;

B is the volume of reference water.

3.5 reference water

Water described as without any odour and flavour.

NOTE : For guidance on reference waters, see annex B.

3.6 test panel

A group of selected assessors used to evaluate flavour and odour.

NOTE : For guidance on the selection of the test panel, see annexes C and E.

3.7 selected assessor

Assessor chosen for his/her ability to perform a sensory test [ISO 5492:1992].

4 Principle

The odour and flavour of a water sample are assessed by a test panel by comparing the sample and/or dilutions of the sample with a reference water.

5 Hazards

Care shall be taken to ensure that the samples are safe for selected assessors. If there is any suspicion of the presence of harmful microorganisms or of toxic substances at a toxic concentration, the samples shall not be tested without further precautions being taken.

Depending on the type of sample being tested, the selected assessors shall be instructed not to swallow any test sample.

6 Test environment

The room used for odour and flavour assessment shall be free from obtrusive draughts and noise. The general environment shall enable the selected assessor to perform his task unobserved so that he is not influenced by other selected assessors.

No air fresheners or room deodorisers shall be used in the room. The room shall be sited away from any activity that could generate interfering odours. The temperature of the room shall be (23 ± 2) °C. It is advisable that this room is only used for odour and flavour assessment. Suggestions on the design of suitable facilities are given in ISO 8589:1988.

7 Apparatus and reagents

7.1 Glassware

Glassware shall be reserved solely for TON and TFN assessment, shall be cleaned separately from other laboratory items and, when not in use, shall be stored in clean conditions in order to avoid accidental contamination.

Sample bottles, tasting glasses and volumetric glassware shall be cleaned before use so that they have no perceptible influence on the result of the assessment.

Tasting glasses can be as specified by ISO 3591:1977.

NOTE : Sample bottles should be of glass and of a suitable capacity. Stoppers should be of glass or polytetrafluoroethene (PTFE) and capable of yielding no headspace in the sample.

7.2 Water bath or incubator

Capable of maintaining an homogeneous temperature of (25 ± 1) °C.

7.3 Reference Water

Odour and flavour free water used for rinsing, dilution and reference, preferably appropriate to the area and where possible similar in mineral character to the type of water being tested. See annex B.

7.4 Cleaning Liquids

Use one of the following cleaning liquids for glassware :

7.4.1 Non-perfumed biodegradable laboratory detergent

7.4.2 Hydrochloric acid, c(HCl) ≈ 2 mol/l.

7.4.3 Hydrogen peroxide, w(H_2O_2) approximately 3 %.

8 Sampling and sample preservation

Collect the samples (with no headspace) in the clean, well stoppered sample bottles (see 7.1). Keep the samples cool and in the absence of light during transportation and storage. If storage is necessary, store in a refrigerator at (4 ± 2) °C. Storage time shall be as short as possible, in no case longer than 72 h, and be specified with the result.

9 Test panel and selected assessors

A test panel shall consist of at least three selected assessors (see 3.7) for unforced choice (see clause 10) and eight selected assessors (see 3.7) for forced choice (see clause 10).

Selected assessors shall be trained and have known sensitivities to specific substances (descriptors) describing odours and flavours such as earthy, musty, aromatic or plasticizer.

NOTE : When a new test panel is started, the selected assessors should be untrained but should undergo training with flavours and odours to increase their precision. It is accepted that after a period of training and experience, the test panel will become both more selective and more precise than the general population.

New selected assessors shall be introduced to the odour and flavour test method by an experienced selected assessor or consultant. Selected assessors shall have gained experience in the method before being integrated into regular test panel sessions.

Selected assessors shall be willing to serve, and shall be disqualified if they suffer from allergy or of unusual sensitivity. It is desirable that the sensitivities in a test panel to odour and flavour do not differ widely.

The performance of individual selected assessors and test panels shall be monitored. This shall be done by recording the results of each selected assessor during regular work and by interlaboratory tests.

The precision of the result is dependent on the test panel size.

See annexes C and E for information.

10 Procedure

10.1 General

The principle of the method is to quantify the odour and flavour of a sample by the use of a test panel, comparing dilutions of the sample with the reference water. A coordinator organizes the activities of the test panel.

Before testing, samples of chlorinated water shall be dechlorinated according to the procedure indicated in annex A.

10.2 Short Method

10.2.1 Applicability

This short method is applicable when either a sample has no odour and flavour or for compliance of odour and flavour with a specified level. Only one dilution is prepared.

10.2.2 Type of test

10.2.2.1 The triangle test

Three test samples, two of which are reference water (see 7.3) and the third the sample or a dilution of it are presented simultaneously to the selected assessors. The selected assessors shall select the sample perceived as different.

10.2.2.2 The paired test

Two test samples are presented simultaneously to the selected assessors. One is the sample or a dilution of it and the other is the reference water (see 7.3). The selected assessors shall select the sample perceived to have the greater odour and flavour.

10.2.3 Type of choice

10.2.3.1 Evaluation by forced choice

Even if the selected assessor is unable to perceive a difference between the two or three samples, the selected assessor shall choose one sample as having the greater flavour or odour. The individual result is incorporated into a statistical evaluation with results of the other selected assessors (see annex E).

10.2.3.2 Evaluation by unforced choice

If the selected assessor is unable to perceive one of the samples or a dilution of it as different, the selected assessor shall note it. This individual TON or TFN is less than the dilution proposed.

10.2.4 Test procedure

10.2.4.1 General

Prepare a dilution of the water to be evaluated using reference water (see 7.3), according to the threshold of interest. Adjust the temperature of all the dilutions and reference water (see 7.3) in a temperature controlled water bath or incubator (see 7.2)

10.2.4.2 Assessment of samples

Ensure that each selected assessor assesses the samples independently and without knowledge of the results obtained by other selected assessors.

Remove the sample or sample dilution and the reference water from the water bath or incubator.

For TON assessment, transfer 100 ml of each sample or sample dilution and the reference water to clean, coded 250 ml flasks with a neck diameter of at least 45 mm, stopper the flasks and, if necessary, re-adjust the temperature to (25 ± 1) °C.

Supply each selected assessor with their own coded flask(s) in batches of two (paired test) or three (triangle test) in order of ascending concentration. The selected assessor will not know which flask(s) contains the reference water. Ask the selected assessor to shake each flask thoroughly, remove the stopper, smell and record his/her decision.

For TFN assessment, transfer 50 ml of each sample or sample dilution and the reference water to clean, coded tasting glasses.

Supply each selected assessor with their own coded glass(es) in batches of two (paired test) or three (triangle test) in order of ascending concentration. The selected assessor will not know which glass(es) contains the reference water. Ask the selected assessor to take a suitable volume of water and to hold it in the mouth for several seconds before discharging it without swallowing, before recording his/her decision.

NOTE : Care should be taken to ensure that the length of the session does not fatigue the selected assessor and cause a lowering of sensitivity. It can be helpful between samples for the selected assessor to eat a water biscuit to recover sensitivity to flavour.

The precision of the result is dependent on the size of the test panel, the range of the individual results, the range of the dilutions chosen and the statistical assessment of the results.

Calculate the result in accordance with 10.4

10.2.4.3 Evaluation

If there is no perceived difference between the sample and the reference water at this dilution, describe the result as less than the threshold number. There shall be a minimum of three selected assessors contributing a score and with only three selected assessors, all shall agree. With four or more selected assessors, the agreement shall be higher than 70 %. If the required level of agreement among the selected assessors within the test panel is not met, then the test shall be repeated.

If the result obtained is less than the threshold of interest, the test is now complete.

If the result obtained is not less than the threshold of interest, it can be necessary to proceed with the full method (see 10.3).

10.3 Full method

10.3.1 Applicability

The full method is applicable when the threshold number for a sample is to be determined. A series of successive dilutions are prepared and assessed.

Make a preliminary evaluation of the threshold number and then prepare a minimum of five dilutions around this expected threshold number with reference water (see 7.3).

10.3.2 Type of test

10.3.2.1 The triangle test

Three test samples, two of which are reference water (see 7.3) and the third the sample or a dilution of it, are presented simultaneously to the selected assessors. The selected assessors shall select the sample perceived as different.

10.3.2.2 The paired test

Two test samples are presented simultaneously to the selected assessors. One is the sample or a dilution of it and the other is the reference water (see 7.3). The selected assessors shall select the sample perceived to have the greater odour and flavour.

10.3.3 Type of choice

10.3.3.1 Evaluation by forced choice

Even if the selected assessor is unable to perceive a difference between the two or three samples, the selected assessor shall choose one sample as having the greater flavour or odour. This individual result is incorporated into a statistical evaluation of the answers of all the selected assessors. See annex E.

10.3.3.2 Evaluation by unforced choice

If the selected assessor is unable to perceive a sample as different, the last dilution where a difference was perceived represents his/her individual TON or TFN for this sample.

10.3.4 Test procedure

10.3.4.1 Preparation of dilutions

Prepare a series of dilutions of the sample with reference water (see 7.3) in the series

$$x^{p}$$

where :

x is the ratio of the concentration of successive dilutions in the series ;

p is a series of whole numbers, 0,1,2, ... i.., indicating the position of each dilution in the test series.

The value of x shall be between 1,3 and 3 (see annex D).

NOTE : This test procedure gives a dilution series where the concentrations form a geometric progression, i.e. the ratio of the concentrations of each pair of successive dilutions is constant. The use of a geometric series ensures that the change in perceived level of odour or flavour is equal between successive dilutions.

Adjust the temperature of all the dilutions and reference water (see 7.3) in a temperature controlled water bath or incubator (see 7.2).

10.3.4.2 Assessment of samples

Ensure that each selected assessor assesses the samples independently and without knowledge of the results obtained by other selected assessors.

Remove the sample or sample dilution and the reference water from the water bath or incubator.

For TON assessment, transfer 100 ml of each sample or sample dilution and the reference water to clean, coded 250 ml flasks with a neck diameter of at least 45 mm, stopper the flasks and, if necessary, re-adjust the temperature to (25 ± 1) °C.

Supply each selected assessor with their own coded flask(s) in batches of two (paired test) or three (triangle test) in order of ascending concentration. The selected assessor will not know which flask(s) contains the reference water. Ask the selected assessor to shake each flask thoroughly, remove the stopper, smell and record his/her decision.

For TFN assessment, transfer 50 ml of each sample or sample dilution and the reference water to clean, coded tasting glasses.

Supply each selected assessor with their own coded glass(es) in batches of two (paired test) or three (triangle test) in order of ascending concentration. The selected assessor will not know which glass(es) contains the reference water. Ask the selected assessor to take a suitable volume of water and to hold it in the mouth for several seconds before discharging it without swallowing, before recording his/her decision.

NOTE : Care should be taken to ensure that the length of the session does not fatigue the selected assessor and cause a lowering of sensitivity. It can be helpful between samples for the selected assessor to eat a water biscuit to recover sensitivity to flavour.

The precision of the result is dependent on the size of the test panel, the range of the individual results, the range of the dilutions chosen and the statistical assessment of the results.

Calculate the result in accordance with 10.4