SLOVENSKI STANDARD

SIST EN 14944-1:2006

01-oktober-2006

Vpliv cementnih proizvodov na pitno vodo ï Preskusne metode ï 1. del: Vpliv industrijsko izdelanih cementnih proizvodov na organoleptiļ ne parametre

Influence of cementitious products on water intended for human consumption - Test methods - Part 1: Influence of factory made cementitious products on organoleptic parameters

Einfluss von zementgebundenen Produkten auf Wasser für den menschlichen Gebrauch - Prüfverfahren - Teil 1: Einfluss fabrikmäßig hergestellter zementgebundener Produkte auf organoleptische Parameter

Influence des produits a base de ciment sur l'eau destinée a la consommation humaine - Méthode d'essai - Partie 1: Influence des produits a base de ciment fabriqués en usine sur les parametres organoleptiques

Ta slovenski standard je istoveten z: **EN 14944-1:2006**

ICS:

13.060.20	Pitna voda	Drinking water
67.250	Materiali in predmeti v stiku z živili	Materials and articles in contact with foodstuffs

SIST EN 14944-1:2006 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14944-1

April 2006

ICS 13.060.20; 67.250

English Version

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This European Standard was approved by CEN on 13 February 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Ref. No. EN 14944-1:2006: E

Contents

Foreword

This document (EN 14944-1:2006) has been prepared by Technical Committee CEN/TC 164 "Water supply", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

It describes a test method to determine the influence(s) of factory made cementitious products on the organoleptic parameters of water intended for human consumption.

Annex A, which is normative, describes additional procedures for testing factory made pipes (cement mortar lined and concrete).

Annex B, which is normative, describes additional procedures for testing factory made fittings (cement mortar lined and concrete).

Annex C, which is normative, describes additional procedures for testing factory made storage systems (cement mortar, cement mortar lined and concrete).

Annex D, which is informative, provides examples of typical test pieces and test conditions as a function of S/V ratio.

Annex E, which is informative, describes test arrangements for testing factory made cementitious products

Annex F, which is normative, describes additional procedures for testing factory made cementitious products at elevated temperature.

Annex G, which is informative, provides a means of discriminating between porous and non-porous coatings on factory made products.

Annex H, which is informative, provides a schematic description of the test (preconditioning and migration) procedure.

This European Standard provides a bibliography.

This European Standard will result in one of a series of standards that support appropriate standards.

This European Standard is Part 1 of a series dealing with the influence of cementitious and associated non-cementitious products/materials on water intended for human consumption, including:

— Part 1: Influence of factory made cementitious products on organoleptic parameters

— Part 2[1]: Influence of site-applied cementitious materials and associated non-cementitious products/materials on organoleptic parameters

— Part 3: Migration of substances from factory made cementitious products.

— Part 4[2]: Migration of substances from site-applied cementitious materials and associated non-cementitious products/materials.

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

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[1] The work on Part 2 of EN 14944 has not yet begun.

[2] The work on Part 4 of EN 14944 has not yet begun.

Introduction

With respect to any potential adverse effects of products and materials on the quality of water intended for human consumption, it should be understood that relevant national regulations remain in force until verifiable European acceptance criteria are adopted.

1 Scope

This European Standard specifies a method to determine the influence of factory made cementitious products on the odour, flavour, colour and turbidity of test waters after contact with the products.

This European Standard is applicable to factory made cementitious products, e.g. cement mortar linings to metallic pipes, tanks, concrete pipes etc. intended to be used for the transport and storage of water for human consumption, including raw water used for the production of drinking water.

2 Normative references

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

EN 196-1, *Methods of testing cement — Part 1: Determination of strength*

EN 1622:1997, *Water analysis — Method for the determination of threshold odour number (TON) and threshold flavour number (TFN)*

EN 1015-2, *Methods of test for mortar for masonry — Part 2: Bulk sampling of mortars and preparation of test mortars*

EN 1015-11, *Methods of test for mortar for masonry — Part 11: Determination of flexural and compressive strength of hardened mortar*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 12350-1, *Testing fresh concrete — Part 1: Sampling*

EN 12390-1, *Testing hardened concrete — Part 1: Shape, dimensions and other requirements for specimens and moulds*

EN 12390-2, *Testing hardened concrete — Part 2: Making and curing specimens for strength tests*

EN 27888, *Water quality — Determination of electrical conductivity (ISO 7888:1985)*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

EN ISO 7027:1999, *Water quality — Determination of turbidity (ISO 7027:1999)*

EN ISO 7887:1994, *Water quality — Examination and determination of colour (ISO 7887:1994)*

EN ISO 7393-1, *Water quality — Determination of free chlorine and total chlorine — Part 1: Titrimetric method using N, N-diethyl-1, 4-phenylenediamine (ISO 7393-1:1985)*

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

EN ISO 9963-2, *Water quality — Determination of alkalinity — Part 2: Determination of carbonate alkalinity (ISO 9963-2:1994)*

EN ISO 16264, *Water quality — Determination of soluble silicates by flow analysis (FIA and CFA) and photometric detection (ISO 16264:2002)*

ISO 6058, *Water quality — Determination of calcium content — EDTA titrimetric method*

ISO 10523, *Water quality — Determination of pH*

3 Terms and definitions

For the purpose of this European Standard, the following terms and definitions apply.

3.1
appropriate body
certification body, inspection body or test laboratory, as relevant to a particular requirement

3.2
cementitious product
factory made product containing a cementitious material supplied in the hardened state with a formed surface prior to its incorporation into the construction works

3.3
cementitious material
material that contains a hydraulic cement in sufficient proportion to act as the main binder by forming a hydrate structure which governs the performance of the material

3.4
associated non-cementitious product
product which is applied to the surface of a cementitious product, directly or indirectly, during manufacture (or construction) and which either provides a porous seal to the product or which remains as a residue in contact with water e.g. porous seal coats, formwork release agents and curing compounds

3.5
porous seal coat

polymeric (usually organic) materials applied in a thin (25µm - 200µm thickness) surface layer to a cement mortar lining in order to restrict (but not prevent) interactions between the mortar and conveyed water (ISO 16132 [1])

3.6

proxy sample
sample of fresh mortar or fresh concrete taken from material to be used for the production of a factory made product, either spray-applied to a laboratory test plate (mortar only) or cast into a mould (mortar or concrete) of appropriate dimensions (e.g. standard cube, cylinder or prism etc.) and compacted (where appropriate), cured and hardened under conditions representative of those intended for the product

3.7
fresh concrete
concrete that is fully mixed and still in a condition capable of being compacted by the chosen method

3.8
fresh mortar
cement mortar that is fully mixed and still in a condition of being applied to a substrate by the chosen method

3.9
odour
organoleptic attribute perceptible by olfactory organ on sniffing certain volatile substances (ISO 5492 [2])

3.10
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 [2])

3.11
colour
optical property that causes the changing of the spectral composition of transmitted visible light measured at three wavelengths (see section 3 of EN ISO 7887:1994)

3.12
turbidity
reduction of transparency of a water due to the presence of undissolved matter (see 3.1 of EN ISO 7027:1999)

3.13
threshold odour number (TON)
dilution ratio of the migration water with the reference water at the same temperature, beyond which this diluted sample does not have any perceptible odour (see EN 1622)

3.14
threshold flavour number (TFN)
dilution ratio of the migration water with the reference water at the same temperature, beyond which this diluted sample does not have any perceptible flavour (see EN 1622)

3.15
testing panel:
group of people meeting the relevant requirements of EN 1622

3.16
test
technical operation that consists of the determination of one or more characteristics of a given product

3.17
test procedure
specified technical method for performing a test

3.18
sample
one or more units, or a specified quantity, drawn from a batch or lot, selected at random for inspection, e.g. at the factory or in a laboratory

3.19
test piece
the sample or portion which is to be conditioned, treated or otherwise prepared to be tested to obtain a single test result

3.20
nominal diameter (DN/ID) or (DN/OD)
numerical designation of the size of a component, which is a whole number approximately equal to the actual dimensions in millimetres. This applies to either the internal diameter (DN/ID) or the external diameter (DN/OD).

3.21
preconditioning
succession of contact periods of a test piece with the preconditioning water (3.22) before contact with the test water

3.22
preconditioning water
water used for preconditioning prepared as described in 5.4.1

3.23
reference water
water described as without odour, flavour, colour and turbidity conforming to the requirements in 5.4.2

3.24
test water
water used for testing purposes prepared as described in 5.4.3 and 5.4.4

3.25
migration water:
test water which has been in contact with a test piece under specified conditions

3.26
blank water
test water which has been kept at the same specified conditions as migration water but without contact with the test piece

3.27
disinfection treatment water
preconditioning water containing chlorine as described in 5.3.2

3.28
tap water
drinking water distributed by a public supplier

NOTE Tap water is used as a lubricant/coolant for the sawing and coring operations used to obtain test pieces generally from products of large dimensions. See normative Annexes A, B and C.

3.29
demineralised water
water conforming to the requirements in EN ISO 3696 for Grade 3.

4 Principle

Each test piece is subjected to a specified preconditioning procedure where the surface which is exposed in practice to water intended for human consumption is brought into contact with preconditioning water during five sequential periods: three periods of 24 h, 1 period of 72 h and a final period of 24 h {with 50 mg/l Cl_2 (5.3.2) if requested to simulate chlorine disinfection treatment}.

The preconditioned test piece is then brought into contact with test water, chlorinated and/or chlorine-free during three sequential migration periods. A migration period is either:

a) 72 h at (23 ± 2) °C for products intended to come into contact with chlorinated or chlorine-free cold water;

b) 24 h at a specified elevated temperature for products intended to come into contact with warm or hot chlorine-free water.

After each contact period, each migration water is assessed for odour, flavour, colour and turbidity.

NOTE The selection of:

a) the appropriate test water, chlorinated and/or chlorine-free, from those made available in this European Standard;
b) the temperature of the test water;
c) the need for chlorination during preconditioning;

is specified in product or system standards or in national or European regulations, as appropriate.

5 Reagents

5.1 General requirements

Use only reagents of analytical quality unless otherwise stated.

5.2 Chlorine neutralisation reagents

5.2.1 Ascorbic acid solution, prepared by dissolving (4,0 ± 0,1) g of ascorbic acid in one litre of reference water (5.4.2).

This ascorbic acid solution shall be replaced on a monthly basis.

5.2.2 Sodium thiosulfate solution, comprising a solution of 3,5 g/l of sodium thiosulfate pentahydrate ($Na_2S_2O_3 .5H_2O$) and stored in the absence of light at a temperature below 10°C, for a maximum of 4 months.

5.3 Disinfection reagents

5.3.1 Sodium hypochlorite solution, prepared from a commercial solution of sodium hypochlorite (NaOCl) and have a known concentration of about 0,1 % by mass of free chlorine determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2.

This sodium hypochlorite solution is unstable and shall be prepared on the day of use.

5.3.2 Disinfection treatment water, consisting of a batch of preconditioning water (5.4.1) with a free chlorine content of (50 ± 5) mg/l as Cl_2, determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2, after addition of sodium hypochlorite solution (5.3.1).

5.4 Waters to be used for testing

5.4.1 Preconditioning water prepared by dissolving (222 ± 2) mg anhydrous calcium chloride ($CaCl_2$) and (336 ± 2) mg sodium hydrogen-carbonate ($NaHCO_3$) in one litre of demineralised water (3.29). The pH is determined in accordance with ISO 10523 and adjusted to 7,4 ± 0,1 by bubbling air and/or CO_2 into the solution.

NOTE The target total hardness is 200 mg/l as $CaCO_3$ and the target alkalinity is 244 mg/l as HCO_3.

5.4.2 Reference water, a natural water without gas and with parameters that conform to the requirements given in Table 1.

When a reference water is chlorinated to 1,0 mg/l free chlorine and then dechlorinated after 72 h with either the ascorbic acid solution (5.2.1) or the sodium thiosulfate solution (5.2.2), its organoleptic parameters, odour, flavour colour and turbidity shall conform to the requirements given in Table 1.

Table 1 — Reference water

Parameter	Test method [a]	Requirement	Unit
Conductivity	EN 27888	500 ± 50	µS/cm
pH	ISO 10523	7,3 ± 0,2	pH unit
Calcium	ISO 6058	80 ± 10	mg Ca/l
Alkalinity	EN ISO 9963-2	350 ± 50	mg HCO_3^-/l
Silica	EN ISO 16264	15 ± 5	mg SiO_2/l
Odour	EN 1622	< 2	TON
Flavour	EN 1622	< 2	TFN
Colour	EN ISO 7887:1994 [b]	< 0,1	m^{-1}
Turbidity	EN ISO 7027:1999 [c]	< 0,1	FNU

[a] Alternative methods, either calibrated against the reference methods or which have proven comparable analytical performance, may be used.

[b] Section 3

[c] Clause 6

5.4.3 Test water without chlorine content (chlorine-free), shall consist of a batch of reference water (5.4.2) used for contact with test pieces and preparation of the blank water (3.26).

5.4.4 Test water with chlorine content (chlorinated), consisting of reference water (5.4.2) with a free chlorine content of (1,0 ± 0,2) mg/l as Cl_2, determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2, after addition of sodium hypochlorite solution (5.3.1)

5.5 Cleaning liquids for apparatus

Use one of the following cleaning liquids:

— non-perfumed biodegradable detergent;

— hydrochloric acid, 2 mol/l;

— nitric acid, 10 % or 1,5 mol/l.

6 Apparatus

6.1 General

For cleaning the glassware, and appropriate apparatus, before use, the following general requirements apply:

a) Clean the glassware to be used, using detergent (5.5). Rinse the glassware in demineralised water (3.29);

b) Clean the inner surface of the glassware with hydrochloric acid (5.5) and rinse it with demineralised water. For stainless steel, clean with nitric acid (5.5) and then rinse with demineralised water;

c) Before use, rinse the glassware, and appropriate apparatus, at least three times using preconditioning water before preconditioning (8.3) or reference water before the test procedure (Clause 9).

6.2 Apparatus and materials for test piece preparation (see normative Annexes A, B and C)

6.2.1 Stainless steel plates and cylinders

6.2.1.1 Stainless steel

Stainless steel shall be austenitic, super austenitic or duplex grades in accordance with the corresponding numerical designations, 1.4301, 1.4436, 1.4429, 1.4259 or 1.4462 in EN 10088-1 for stainless steels.

NOTE The grades above are specified for the use of stainless steel as reinforcement in concrete. Therefore they are considered to be inert when used in contact with cementitious proxy samples (see normative Annexes A, B and C of this European Standard).

6.2.1.2 Plates

In order to provide a sufficient volume of migration water for assessment, the surface area of one face of a plate should be between 10 000 mm^2 and 90 000 mm^2. The length/width of the plates should be selected to be consistent with the dimensions of the test container and the volume of test water in which they will be immersed.

6.2.1.3 Cylinders

The diameter and length of a cylinder should be consistent with the dimensions of the test piece (see normative Annexes A, B or C and informative Annexes D and E) and the volume of test water appropriate to the specified S/V ratio given in 7.3.

6.2.2 Glass cylinders

The diameter and length of a glass cylinder should be consistent with the dimensions of the test piece (see normative Annexes A, B or C and informative Annexes D and E) and the volume of test water appropriate to the specified S/V ratio given in 7.3. Glass cylinders should be provided with suitable external (opaque) shielding for use during migration procedures (test pieces and blanks), in order to minimize exposure of migration waters to ambient light.

6.2.3 Moulds for forming test pieces

Moulds for forming prisms of mortar shall conform to the requirements of EN 196-1, as specified for use in EN 1015-11, or to EN 12390-1 for forming cubes/cylinders of concrete, with modifications to materials and dimensional tolerances as specified by the appropriate normative Annex A, B or C of this European Standard.

Clean moulds and any filling frame used with a mould, by thoroughly washing with non-perfumed detergent (5.5) and tap water (3.28), rinsing with copious amounts of tap water, followed by a final rinse with demineralised water (3.29) and dry before use.

Where a factory made cementitious product has been formed in a process where its entire contact surface has been in contact with a release agent then where proxy samples (3.6) are used, the same release agent shall be applied to the internal surfaces of the mould, otherwise the use of release agents is not permitted by this European Standard.

6.3 Apparatus and materials for preconditioning and migration procedure

6.3.1 vessels, containers, covers, connectors and stoppers, made of materials which do not affect the odour, flavour, colour and turbidity assessment under the specified test conditions such as glass, polytetrafluoroethylene (PTFE) or stainless steel.

NOTE The material PTFE should only be used when there is a small contact area with the test water. Thus PTFE is unsuitable for containers.

6.3.2 equipment, capable of maintaining the test temperature within ± 2°C for the duration of the test.

6.3.3 where required, **sealants** that do not affect the odour, flavour, colour and turbidity assessments under the specified test conditions.

6.4 Apparatus for odour and flavour assessment

6.4.1 erlenmeyer and volumetric flasks, beakers, measuring cylinders, immersion tanks, volumetric pipettes, funnels and stoppers made of glass, PTFE or stainless steel.

NOTE The material PTFE should only be used when there is a small contact area with the test water. Thus PTFE is unsuitable for containers.

6.4.2 testing vessels, comprising the following glassware (which shall be reserved for odour and flavour assessment only and cleaned separately from other items): testing bottles for odour assessment and testing glasses for flavour assessment conforming to the requirements given in EN 1622.

6.4.3 waterbath or incubator, conforming to the requirements of EN 1622.

6.5 Apparatus for colour and turbidity assessment

6.5.1 Apparatus for the determination of colour, conforming to the requirements of section 3 of EN ISO 7887:1994.

6.5.2 Apparatus for the determination of turbidity, conforming to the requirements of 6.3.1 of EN ISO 7027:1999.

7 Samples and test pieces

7.1 Sampling, transport and storage of samples

Carry out sampling of factory made products in accordance with the relevant product standard, system standard or the national or European regulations, or the relevant normative Annex to this European Standard, as appropriate.

Take care that the transport conditions do not influence the test results.

If it is necessary to store samples or test pieces before testing, ensure that they are protected from contamination taking into account any written instructions that are provided.

Where appropriate, clean storage containers using the same procedures as are used for the test containers.

Ensure that the surfaces of the test pieces intended to come into contact with the test water are free from any contamination e.g. adhesive tape, labels, ink or pencil marks.

7.2 Preparation of test pieces

7.2.1 General

Prepare the test pieces in such a way that only the surface intended to come into contact with drinking water is exposed to the test water except as given in normative Annex C (see C.1.2.3.2.1) where stainless steel plates are coated with cement mortar on one face only prior to complete immersion during testing.