



**SLOVENSKI STANDARD**  
**SIST EN 14944-1:2023**

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**Vpliv cementnih proizvodov na pitno vodo – Preskusne metode – 1. del: Vpliv industrijsko izdelanih cementnih proizvodov na organoleptične 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 à base de ciment sur l'eau destinée à la consommation humaine - Méthode d'essai - Partie 1: Influence des produits à base de ciment fabriqués en usine sur les paramètres organoleptiques

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English Version

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

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

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

This European Standard was approved by CEN on 2 July 2023.

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**EN 14944-1:2023(E)****European foreword**

This document (EN 14944-1:2023) 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of an identical text or by endorsement, at the latest by April 2024, and conflicting national standards shall be withdrawn at the latest by April 2024.

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

This document supersedes EN 14944-1:2006.

In comparison with EN 14944-1:2006, the following changes have been made:

- provisions for testing the influence of materials on the migration of organic substances (TOC) have been added;
- the test method for TON /TFN according to EN 1622 has been specified according to the revised EN 1420;
- requirements for disinfection (preconditioning with 50 mg/L chlorine) have been removed;
- a procedure for extending the number of migration periods has been included.

This document describes a test method to determine the influence(s) of factory-made cement based products on organoleptic parameters and the migration of organic substances (TOC) in water intended for human consumption.

This document will result in one of a series of standards that support standards for the approval of products and materials in contact with water intended for human consumption.

This document is part of a series dealing with the influence of cement based and associated non-cement based products/materials on water intended for human consumption, including:

- *Part 1: Influence of factory-made cement based products on organoleptic parameters and migration of organic substances (TOC)*
- *Part 2: Influence of site-applied cement based materials and associated non-cement based products/materials on organoleptic parameters and migration of organic substances (TOC)*
- *Part 3: Migration of substances from factory-made cement based products*
- *Part 4: Migration of substances from site-applied cement based materials and associated non-cement based products/materials*

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

## 1 Scope

This document specifies a method to determine the influence of factory-made cement based products on the odour, flavour, colour, turbidity and total organic carbon (TOC) of test waters after contact with the products.

This document is applicable to factory-made cement based 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.

NOTE Tests with the specified test water will not necessarily be representative of materials used in different kinds of waters and especially very soft waters.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

EN 1420:2016, *Influence of organic materials on water intended for human consumption - Determination of odour and flavour assessment of water in piping systems*

EN 1484, *Water analysis - Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)*

EN 1622:2006, *Water quality - Determination of the 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 10088-1:2014, *Stainless steels - Part 1: List of stainless steels*

EN 12350-1, *Testing fresh concrete - Part 1: Sampling and common apparatus*

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)*

EN ISO 3696:1995, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987)*

EN ISO 7027-1:2016, *Water quality - Determination of turbidity - Part 1: Quantitative methods (ISO 7027-1:2016)*

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)*

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

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EN ISO 7887:2011, *Water quality - Examination and determination of colour (ISO 7887:2011)*

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

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

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

EN ISO 10523, *Water quality - Determination of pH (ISO 10523)*

**3 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

**3.1****appropriate body**

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

**3.2****associated non-cement based product**

product which is applied to the surface of a cement based 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

**3.3****blank water**

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

**3.4****cement based 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

**3.5****cement based product**

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



**3.6****colour of water**

optical property that causes the changing of the spectral composition of transmitted visible light measured at three wavelengths

[SOURCE: EN ISO 7887:2011, 3.2]

**3.7****demineralized water**

water of which the mineral matter or salts have been removed by deionization

[SOURCE ISO 23321:2019, 3.1]

**3.8****flavour**

complex combination of the olfactory, gustatory, and trigeminal sensations perceived during tasting

Note 1 to entry: The flavour may be influenced by tactile, thermal, painful and/or kinaesthetic effects.

[SOURCE: ISO 5492:2008, 3.20[2]]

**3.9****fresh concrete**

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

**3.10****fresh mortar**

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

**3.11****migration water**

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

[SOURCE: EN 1622:2006, 3.13]

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**3.12****nominal diameter****DN/ID****DN/OD**

numerical designation of the size of a component, which is a whole number approximately equal to the actual dimensions in millimetres

Note 1 to entry: This applies to either the internal diameter (DN/ID) or the external diameter (DN/OD).

**3.13****odour**

sensation perceived by means of the olfactory organ in sniffing certain volatile substances

[SOURCE: ISO 5492:2008, 3.18]

**EN 14944-1:2023(E)****3.14****porous seal coat**

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

Note 1 to entry: See ISO 16132:2016, 3.6 [1].

**3.15****preconditioning**

succession of contact periods of a test piece with the preconditioning water (3.16) before contact with the test water

**3.16****preconditioning water**

water used for preconditioning, prepared as described in 5.3.1

**3.17****proxy sample**

sample of fresh mortar or fresh concrete taken from material to be used for the production of a factory-made product, either applied to one face of a stainless steel plate (6.2.1.1) using the same process of application used in the factory (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

**3.18****reference water**

water described as without odour, flavour, colour and turbidity conforming to the requirements in 5.3.2

**3.19****sample**

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

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**3.20****tap water**

drinking water distributed by a public supplier

Note 1 to entry: 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 Annexes A, B and C.

**3.21****test**

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

**3.22****test piece**

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

**3.23****test procedure**

specified technical method for performing a test

**3.24****test water**

water used for testing purposes

**3.25****testing panel**

group of people meeting relevant requirements

Note 1 to entry: This group of people meet the requirements of EN 1622

**3.26****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

Note 1 to entry: See EN 1622.

**3.27****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

Note 1 to entry: See EN 1622.

**3.28****total organic carbon****TOC**

quantity of carbon present in the organic matter which is dissolved or suspended in water, including cyanate, elemental carbon and thiocyanate

**3.29****turbidity**

reduction of transparency of a water due to the presence of undissolved matter

Note 1 to entry: See EN ISO EN-1:2016

**4 Principle**

Each test piece is subjected to a specified preconditioning procedure where the surface which, in practice will be exposed 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.

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  $(23 \pm 2)$  °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.

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

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,

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

## 5 Reagents

### 5.1 Chlorine neutralization reagents.

**5.1.1 Ascorbic acid solution**, prepared by dissolving  $(4,0 \pm 0,1)$  g of ascorbic acid in one litre of reference water (5.3.2).

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

**5.1.2 Sodium thiosulfate solution**, prepared by dissolving  $(3,5 \pm 0,1)$  g of sodium thiosulfate pentahydrate ( $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5 \cdot \text{H}_2\text{O}$ ) in one litre of demineralized water and stored in the absence of light at a temperature below  $10^\circ\text{C}$ , for a maximum of 4 months.

**5.2 Sodium hypochlorite solution**, prepared from a commercial solution of sodium hypochlorite ( $\text{NaOCl}$ ) 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 Waters** to be used for testing

**5.3.1 Preconditioning water** shall be unchlorinated test water (s. 5.3.3).

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

When the reference water is prepared from demineralized water, dissolve  $(222 \pm 2)$  mg anhydrous calcium chloride ( $\text{CaCl}_2$ ),  $(482 \pm 2)$  mg sodium hydrogencarbonate ( $\text{NaHCO}_3$ ) and  $(71 \pm 1)$  mg sodium silicate nonahydrate ( $\text{Na}_2\text{SiO}_3 \cdot 9 \cdot \text{H}_2\text{O}$ ) in 1 l of demineralized water (3.29). The pH is determined in accordance with EN ISO 10523 and adjusted to  $7,4 \pm 0,1$  by bubbling air and/or  $\text{CO}_2$  into the solution.

Table 1 — Reference water

Parameter	Test method <sup>a</sup>	Requirement	Unit
Conductivity	EN 27888	500 ± 50	µS/cm
pH	EN ISO 10523	7,3 ± 0,2	pH unit
Calcium	ISO 6058	80 ± 10	mg/l
Alkalinity	EN ISO 9963-2	5,7 ± 0,8	mmol/l
Silica	EN ISO 16264	15 ± 5	mg/l
Odour	EN 1622	< 2	TON
Flavour	EN 1622	< 2	TFN
Colour	EN ISO 7887 <sup>b</sup>	< 0,1	m <sup>-1</sup>
Turbidity	EN ISO 7027-1 <sup>c</sup>	< 0,1	FNU
TOC	EN 1484	< 0,2	mg/l
<sup>a</sup> Alternative methods, either calibrated against the reference methods or which have proven comparable analytical performance, may be used. <sup>b</sup> See Clause 5. <sup>c</sup> See Clause 6.			

**5.3.3 Test water without chlorine content (chlorine-free)**, shall consist of a batch of reference water (5.3.2) used for contact with test pieces and preparation of the blank water (3.27).

**5.3.4 Test water with chlorine content (chlorinated)**, consisting of reference water (see 5.3.2) with a free chlorine content of (1,0 ± 0,2) mg/l as Cl<sub>2</sub>, determined in accordance with either EN ISO 7393-1 or EN ISO 7393-2, after addition of sodium hypochlorite solution (5.2).

## 5.4 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 (5.4). Rinse the glassware with demineralized water (3.29);
- b) Clean the inner surface of the glassware with hydrochloric acid (5.4) and rinse it with demineralized water. For stainless steel, clean with nitric acid (5.4) and then rinse with demineralized water;

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- 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 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 10088-1:2014 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 Annexes A, B and C).

**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<sup>2</sup> and 90 000 mm<sup>2</sup>. 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 Annexes A, B, C, 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 Annexes A, B, C, 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 in Annex A, B or C, as appropriate.

Clean moulds and any filling frame used with a mould, by thoroughly washing with non-perfumed detergent (5.4) and tap water (3.20), rinsing with copious amounts of tap water, followed by a final rinse with demineralized water (3.29) and dry before use.

If a factory-made cement based product has been formed in a process where its entire contact surface has been in contact with a release agent and if proxy samples (3.17) 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.