



SLOVENSKI STANDARD

SIST EN 12672:2016

01-julij-2016

Nadomešča:
SIST EN 12672:2009

Kemikalije, ki se uporabljajo za pripravo pitne vode - Kalijev permanganat

Chemicals used for treatment of water intended for human consumption - Potassium permanganate

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Kaliumpermanganat

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Produits chimiques pour le traitement de l'eau destinée à la consommation humaine - Permanganate de potassium

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EUROPEAN STANDARD

EN 12672

NORME EUROPÉENNE

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May 2016

ICS 71.100.80

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English Version

Chemicals used for treatment of water intended for human consumption - Potassium permanganate

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Permanganate de potassium

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Kaliumpermanganat

This European Standard was approved by CEN on 18 March 2016.

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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 CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12672:2016) 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of an identical text or by endorsement, at the latest by November 2016 and conflicting national standards shall be withdrawn at the latest by November 2016.

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

This document supersedes EN 12672:2008.

The significant technical changes between this edition and EN 12672:2008 are as follows:

- deletion of reference to Directive 67/548/EEC of 27th June 1967 in order to take into account the latest Regulation in force (see [2]);
- amendment of subclause 6.2 according to [2].

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

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption caused by the product covered by this European Standard:

- a) this European Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;
- b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

NOTE Conformity with this European Standard does not confer or imply acceptance or approval of the product in any of the Member States of the EU or EFTA. The use of the product covered by this European Standard is subject to regulation or control by National Authorities.

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1 Scope

This European Standard is applicable to potassium permanganate used for treatment of water intended for human consumption. It describes the characteristics of potassium permanganate and specifies the requirements and the corresponding test methods for potassium permanganate. It gives information on its use in water treatment. It also provides general information on potassium permanganate (see Annex A) and determines the rules relating to its safe handling and use (see Annex B).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1233, *Water quality - Determination of chromium - Atomic absorption spectrometric methods*

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

EN ISO 11885, *Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885)*

EN ISO 12846, *Water quality - Determination of mercury - Method using atomic absorption spectrometry (AAS) with and without enrichment (ISO 12846)*

ISO 3165, *Sampling of chemical products for industrial use - Safety in sampling*
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ISO 3856-2, *Paints and varnishes - Determination of "soluble" metal content — Part 2: Determination of antimony content - Flame atomic absorption spectrometric method and Rhodamine B spectrophotometric method*

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ISO 6206, *Chemical products for industrial use - Sampling - Vocabulary*

ISO 8213, *Chemical products for industrial use - Sampling techniques - Solid chemical products in the form of particles varying from powders to coarse lumps*

ISO 8288:1986, *Water quality - Determination of cobalt, nickel, copper, zinc, cadmium and lead - Flame atomic absorption spectrometric methods*

ISO 17378-2, *Water quality - Determination of arsenic and antimony - Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS)*

ISO/TS 17379-2, *Water quality - Determination of selenium - Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS)*

3 Description

3.1 Identification

3.1.1 Chemical name

Potassium permanganate.

3.1.2 Synonym or common name

Permanganate of potash.

EN 12672:2016 (E)**3.1.3 Relative molecular mass**

158,04.

3.1.4 Empirical formulaKMnO₄.**3.1.5 Chemical formula**KMnO₄.**3.1.6 CAS Registry Number ¹⁾**

7722-64-7.

3.1.7 EINECS reference ²⁾

231-760-3.

3.2 Commercial forms

Solid product, consisting of rhombic crystals. For water treatment the commercial forms normally used are:

- technical grade to be dosed in liquid form, dissolved in water;
- free-flowing grade to be dosed either in solid form or dissolved in water.

3.3 Physical properties**3.3.1 Appearance**

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Crystals of a dark purple or bronze-like colour; almost opaque by transmitted light and of a blue metallic lustre by reflected light.

The free-flowing grade can present a different colour, usually greyish.

3.3.2 Density

The density of the product is 2,70 g/cm³ at 20 °C.

The bulk density is between 1,45 g/cm³ and 1,60 g/cm³.

3.3.3 Solubility (in water)

The product is soluble in water.

The solubility in water is given in Table 1.

Aqueous solubility:

$$\text{KMnO}_4 \text{ (g/l)} = 30.55 + 0.796 \times (T, \text{ }^\circ\text{C}) + 0.0392 \times (T, \text{ }^\circ\text{C})^2$$

where

T is the solution temperature (°C).

1) Chemicals Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

Table 1 — Solubility in water

Temperature °C	KMnO ₄ g/l
5	35,51
10	42,43
15	51,31
20	62,15
25	74,95
30	89,71

3.3.4 Vapour pressure

Not applicable.

3.3.5 Boiling point at 100 kPa³⁾

Not applicable.

3.3.6 Melting point

Product decomposes at 240 °C with emission of oxygen.

3.3.7 Specific heat

744,2 kJ/kg.K at 20 °C.

3.3.8 Viscosity (dynamic)

Not applicable.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Potassium permanganate is a very strong oxidizing agent.

It is soluble in water and also dissolves in various organic solvents (e.g. methanol, ethanol).

It decomposes at high temperature and also in the presence of concentrated acids, hydrogen peroxide and organic compounds in general.

It hydrolyzes in contact with air, reducing to manganese dioxide (MnO₂), a solid, brown to black colour product.

3) 100 kPa = 1 bar.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for potassium permanganate used for the treatment of water intended for human consumption. Limits are given for impurities commonly present in the product. Depending on the raw material and the manufacturing process other impurities may be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

Users of this product should check the national regulations in order to clarify whether it is of appropriate purity for treatment of water intended for human consumption, taking into account raw water quality, required dosage, contents of other impurities and additives used in the product not stated in the product standard.

Limits have been given for impurities and chemicals parameters where these are likely to be present in significant quantities from the current production process and raw materials. If the production process or raw materials leads to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of commercial product

The potassium permanganate content shall not be less than a mass fraction of 98,5 % in the technical grade, and a mass fraction of 97,5 % in the free-flowing grade.

4.3 Impurities and main by-products

MnO₂ (water insolubles): less than a mass fraction of 1,00 %.

Moisture (H₂O): less than a mass fraction of 0,50 %.

4.4 Chemical parameters

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NOTE For the purpose of this standard, "chemical parameters" are those defined in the EU Directive 98/83/EC of 3 November 1998 (see [1]).

The content of chemical parameters shall conform to the requirements specified in Table 2.

Table 2 — Chemical parameters

Parameter		Limit mg/kg of product
Arsenic (As)	max.	20
Cadmium (Cd)	max.	50
Chromium (Cr)	max.	50
Mercury (Hg)	max.	10
Nickel (Ni)	max.	50
Lead (Pb)	max.	50
Antimony (Sb)	max.	50
Selenium (Se)	max.	50
NOTE Cyanide, which does not exist in a strong oxidizing medium such as potassium permanganate, is not a relevant chemical parameter. Pesticides and polycyclic aromatic hydrocarbons are not by-products of the manufacturing process.		

4.5 Flowability of free-flowing grade

The free-flowing grade shall pass the flowability test.

5 Test methods

5.1 Sampling

Observe the general recommendations of ISO 3165 and take account of ISO 6206. Prepare the laboratory sample(s) required by the relevant procedure described in ISO 8213.

5.2 Analysis

5.2.1 Determination of potassium permanganate (main product)

5.2.1.1 Principle

Reduction of potassium permanganate Mn(VII) to Mn(II) with sodium oxalate under acidic conditions. The excess of sodium oxalate is titrated with a standard volumetric solution of potassium permanganate.

5.2.1.2 Reagents

All reagents shall be of a recognized analytical grade and the water used shall conform to grade 3 in accordance with EN ISO 3696.

5.2.1.2.1 Potassium permanganate.

5.2.1.2.2 Sodium oxalate.

5.2.1.2.3 Sulfuric acid solution, 20 % (m/m)

5.2.1.2.4 Potassium permanganate standard volumetric solution $c(\text{KMnO}_4) = 1,000 \text{ g/l}$.

- Weigh 1,000 g of the potassium permanganate (5.2.1.2.1), transfer to a 1 l volumetric flask and dilute to volume with water. Allow to stand with occasional mixing for 15 min.

Standardize the solution as follows:

- Weigh 2,120 g of the sodium oxalate (5.2.1.2.2) and transfer to a 1 l volumetric flask. Add 20 ml of 20 % (m/m) H_2SO_4 (5.2.1.2.3) to the 1 l volumetric flask containing the oxalate, dissolve and allow to stand for 5 min.

Transfer 40 ml of the sodium oxalate solution by pipette into a small conical flask, heat to 70 °C to 80 °C and titrate with the potassium permanganate standard volumetric solution to a faint pink end-point that persists for 20 s to 30 s.

The standardization factor (F) is calculated as follows:

$$F = \frac{40}{V} \quad (1)$$

where

V is the volume, in millilitres, of potassium permanganate standard volumetric solution used in titration.