



SLOVENSKI STANDARD

SIST EN 14664:2005

01-marec-2005

Kemikalije, ki se uporabljajo za pripravo pitne vode – Železov (III) sulfat, v trdnem stanju

Chemicals used for treatment of water intended for human consumption - Iron (III) sulfate, solid

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Eisen(III)sulfat, fest

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Produits chimiques utilisés pour le traitement de l'eau destinée a la consommation humaine - Sulfate de fer (III) solide

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ICS:

13.060.20	Pitna voda	Drinking water
71.100.80	Kemikalije za čiščenje vode	Chemicals for purification of water

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EUROPEAN STANDARD

EN 14664

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2004

ICS

English version

Chemicals used for treatment of water intended for human consumption - Iron (III) sulfate, solid

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Sulfate de fer (III) solide

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Eisen(III)sulfat, fest

This European Standard was approved by CEN on 30 September 2004.

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.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

This document (EN 14664:2004) 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 May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

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

- a) This document 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 document does not confer or imply acceptance or approval of the product in any or the Member States of the EU or EFTA. The use of the product covered by this document is subject to regulation or control by National Authorities.

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1 Scope

This standard is applicable to iron (III) sulfate solid used for treatment of water intended for human consumption. It describes the characteristics of iron (III) sulfate solid and specifies the requirements and the corresponding analytical methods for iron (III) sulfate solid (analytical methods are given in Annex C) and gives information on its use in water treatment. It also determines the rules relating to safe handling and use of iron (III) sulfate solid (see Annex B).

2 Normative references

The following referenced documents are indispensable for the application 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 ISO 3696, *Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)*

ISO 3165, *Sampling of chemical products for industrial use – Safety in sampling*

ISO 5790:1979, *Inorganic chemical products for industrial use – General method for the determination of chloride content - Mercurimetric method*

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*

3 Description

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3.1 Identification

3.1.1 Chemical name

Iron (III) sulfate solid.

3.1.2 Synonym or common names

Ferric sulfate solid.

3.1.3 Relative molecular mass

561,9.

3.1.4 Empirical formula

$\text{Fe}_2(\text{SO}_4)_3 \cdot x \text{H}_2\text{O}$ where x is approximately 5,5.

3.1.5 Chemical formula

$\text{Fe}_2(\text{SO}_4)_3 \cdot x \text{H}_2\text{O}$ where x is approximately 5,5.

EN 14664:2004 (E)**3.1.6 CAS Registry Number ¹⁾**

10028-22-5.

3.1.7 EINECS reference ²⁾

233-072-9.

3.2 Commercial form

The iron (III) sulfate solid is available as free flowing granules or powder, with a particle size range from 0,1 mm to 10 mm and 0,055 mm to 0,060 mm respectively and the angle of repose is approximately 37.

3.3 Physical properties**3.3.1 Appearance**

The iron (III) sulfate solid consists of greyish or yellowish granules.

3.3.2 Density

The bulk density is approximately equal to 1 300 kg/m³ for granules and 1 000 kg/m³ for powders at 20 °C.

3.3.3 Solubility (in water)

Iron (III) sulfate solid dissolves rapidly in water. The solubility is approximately 550 g/l, corresponding to approximately mass fraction 11 % of Fe at 20 °C. At concentrations lower than mass fraction of 0,3 % Fe, hydrolysis and formation of iron (III) hydroxide will occur.

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3.3.4 Vapour pressure

Not known.

3.3.5 Boiling point at 100 kPa ³⁾

Not applicable.

3.3.6 Melting point

Iron (III) sulfate solid decomposes when heated.

3.3.7 Specific heat

Not known.

3.3.8 Viscosity (dynamic)

Not applicable.

1) Chemical Abstract Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

The granule strength is higher than 50 N.

3.4 Chemical properties

Iron (III) sulfate solid is slightly hygroscopic at relative humidity higher than 50 %.

Iron (III) sulfate solutions are acidic.

4 Purity criteria

4.1 General

This document specifies the minimum purity requirements for iron (III) sulfate solid 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.

NOTE 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 this product standard.

Limits have been given for impurities and chemical 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 lead 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 product shall contain not less than mass fraction of 64 % of $\text{Fe}_2(\text{SO}_4)_3$ or not less than a mass fraction of 18 % of Fe and shall be within ± 3 % of the manufacturer's declared values.

4.3 Impurities and main by-products

The product shall conform to the requirements specified in Table 1.

The concentration limits refer to Fe (III).

Table 1 – Impurities

Impurity		Limit		
		Mass fraction in % of Fe (III) content		
		Grade 1	Grade 2	Grade 3
Manganese	max.	0,5	1	2
Iron(II) ^a	max.	3,5	3,5	3,5
H ₂ SO ₄ free	max.	8	8	8
Insoluble matters ^b	max.	10	10	10

^a Fe (II) has a lower coagulant efficiency compared to Fe (III).
Also hydrolysis of Fe (II) starts at pH value 8, and therefore Fe (II) can remain into the water at lower pH values

^b An excess of insoluble matters indicates the presence of foreign matter. Iron is a component of the product will usually be removed in the treatment process.

4.4 Chemical parameters

The product shall conform to the requirements specified in Table 2.

The concentration limits are specified in milligrams per kilogram of Fe (III).

Table 2 – Chemical parameters

Parameter		Limit in mg/kg of Fe (III)		
		Type 1	Type 2	Type 3
Arsenic (As)	max.	1	20	50
Cadmium (Cd)	max.	1	25	50
Chromium (Cr)	max.	100	350	500
Mercury (Hg)	max.	2,5	5	10
Nickel (Ni)	max.	300	350	500
Lead (Pb)	max.	2,5	100	400
Antimony (Sb)	max.	10	20	60
Selenium (Se)	max.	5	20	60

NOTE Cyanide (CN⁻) is usually not relevant because of the acidity of the product. Pesticides and polycyclic aromatic hydrocarbons are not relevant since the raw materials used in the manufacturing process are free of them.

For maximum impact of iron (III) sulfate on trace metal content in drinking water see A.2.

5 Test methods

5.1 Sampling

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

5.2 Analyses

5.2.1 Main product

Iron (III) sulfate is determined as Fe (III) contents in the test sample. Fe (III) content is determined as the difference between total iron content and Fe (II) content (see C.1).

5.2.2 Impurities

5.2.2.1 Manganese

The manganese content shall be determined by flame atomic absorption spectrometry (FAAS) (see C.2).

5.2.2.2 Iron (II) (Fe (II))

The Fe (II) content is expressed as $C_{(II)}$ (see C.1.2.5.3).

5.2.2.3 Insoluble matter

The mass fraction in % of the insoluble matter shall be determined in accordance with the method described in C.3.

5.2.2.4 Free acid

The free acid shall be determined in accordance with the method described in C.4.

5.2.3 Chemical parameters

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5.2.3.1 Preparation of sample solution [SIST EN 14664:2005](#)

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5.2.3.1.1 General

Oxidation and wet digestion is used to bring the samples into a stable solution.

5.2.3.1.2 Principle

Oxidation with hydrogen peroxide (H_2O_2) followed by digestion with hydrochloric acid (HCl).

5.2.3.1.3 Reagents

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

5.2.3.1.3.2 Hydrochloric acid (HCl), solution, mass fraction 30 %.

5.2.3.1.3.3 Hydrogen peroxide (H_2O_2), solution, mass fraction 30 %.

5.2.3.1.4 Apparatus

5.2.3.1.4.1 Ordinary laboratory apparatus and glassware together with the following

5.2.3.1.4.2 Analytical balance.

5.2.3.1.4.3 Graduated cylinder, 50 ml.

5.2.3.1.4.4 Round flask with reflux condenser.

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5.2.3.1.4.5 Hot plate.

5.2.3.1.4.6 Volumetric flask, 200 ml.

5.2.3.1.5 Procedure

Dissolve with 20 ml of water 20,0 g of the iron salt. Filter and wash the filter cake with hot water. Add to the mixed filtrate and wash water 5 ml hydrogen peroxide solution (5.2.3.1.3.3) to iron (III)-samples. After adding 50 ml hydrochloric acid (5.2.3.1.3.2) boil the solution for 15 min by using a reflux condenser (5.2.3.1.4.4). Cool down the solution, transfer to a 200 ml volumetric flask (5.2.3.1.4.6) and fill up to the mark with water. This is the sample solution.

5.2.3.2 Arsenic

The arsenic content shall be determined by hydride generation atomic absorption spectrometry (see C.5).

5.2.3.3 Cadmium

The cadmium content shall be determined by graphite furnace atomic absorption spectrometry (see C.7).

5.2.3.4 Chromium

The chromium content shall be determined by graphite furnace atomic absorption spectrometry (see C.7).

5.2.3.5 Mercury

The mercury content shall be determined by cold vapour atomic absorption spectrometry (see C.6).

5.2.3.6 Nickel

The nickel content shall be determined by graphite furnace atomic absorption spectrometry (see C.7).

5.2.3.7 Lead

The lead content shall be determined by graphite furnace atomic absorption spectrometry (see C.7).

5.2.3.8 Antimony

The antimony content shall be determined by hydride generation atomic absorption spectrometry (see C.5).

5.2.3.9 Selenium

The selenium content shall be determined by hydride generation atomic absorption spectrometry (see C.5).

6 Labelling - Transportation - Storage**6.1 Means of delivery**

The product shall be delivered in suitable packages, paper or plastics bags, or by rubber-lined or plastics-lined bulk truck.

In order that the purity of the product is not affected, the means of delivery shall not have been used previously for any different product or it shall have been specially cleaned and prepared before use.

6.2 Risk and safety labelling according to the EU Directives ⁴⁾

The following labelling requirements shall apply to iron (III) sulfate solid at the date of the publication of this document.

- symbols and indications of danger :
 - X_i : Irritant;
 - X_n Harmful
- nature of special risks attributed to dangerous substances:
 - R 22: Harmful by ingestion;
 - R 36/37/38 : Irritating to eyes, respiratory system and skin;
- safety advice concerning dangerous substances:
 - S 26 : In case of contact with eyes, rinse immediately with plenty of water and seek medical advice;
 - S 28 : After contact with skin, wash immediately with plenty of water;
 - S 37/39 : Wear suitable gloves and eye/face protection.

NOTE Annex I of the Directive 67/548/EEC on Classification, packaging and labelling of dangerous substances and its amendments and adaptations in the European Union contains a list of substances classified by the EU. Substances not in this Annex 1 should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

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6.3 Transportation regulations and labelling

Iron (III) sulfate solid is not listed under a UN number ⁵⁾.

Iron (III) sulfate solid is not classified as a dangerous product for road, rail, sea and air transportation.

6.4 Marking

The marking shall include the following information:

- name "iron(III) sulfate solid", trade name, grade and type;
- net mass;
- name and the address of the supplier and/or manufacturer;
- statement "this product conforms to EN 14664".

6.5 Storage

6.5.1 General

Iron (III) sulfate solid is not corrosive.

⁴⁾ See [2].

⁵⁾ United Nations Number.