SLOVENSKI STANDARD
SIST EN 890:2000

01-november-2000

Kemikalije, ki se uporabljajo za pripravo pitne vode - Železov (III) sulfat

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

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

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

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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
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EN 890

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ICS 71.100.80

Descriptors: potable water, water treatment, chemical compounds, iron sulphates, description, physical properties, chemical properties, impurities, toxic substances, tests, labelling, storage, utilization

English version

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

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

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

This European Standard was approved by CEN on 24 July 1998.

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

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Contents

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by February 1999, and conflicting national standards shall be withdrawn at the latest by February 1999.

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.

Introduction

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

1) This 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 ;

2) 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.

1 Scope

This European Standard is applicable to iron(III) sulfate of various iron and/or acid contents (see 3.2) used for treatment of water intended for human consumption. It describes the characteristics of iron(III) sulfate and specifies the requirements and the corresponding analytical methods for iron(III) sulfate and gives information on its use in water treatment.

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.

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 6206	Chemical products for industrial use - Sampling - Vocabulary

3 Description

3.1 Identification

3.1.1 Chemical name

Iron(III) sulfate.

3.1.2 Synonym or common names

Ferric sulfate liquor, red iron liquor.

3.1.3 Relative molecular mass

399,87.

3.1.4 Empirical formula

$Fe_2(SO_4)_3$.

3.1.5 Chemical formula

$Fe_2(SO_4)_3$.

3.1.6 CAS Registry Number[1)]

10028-22-5.

3.1.7 EINECS reference[2)]

233-072-9.

3.2 Commercial forms

Different grades of solution exist varying in iron content and acidity as classified in table 1.

Table 1 : Different grades

Grade	Fe(III) % (*m*/*m*)	$Fe_2(SO_4)_3$ % (*m*/*m*)[3)]	Free H_2SO_4 % (*m*/*m*)	Density at 15 °C g/ml
Grade A	11,20 to 11,80	40,00 to 42,14	< 1,00	1,49 to 1,53
Grade B	11,20 to 11,80	36,10 to 39,24	0 [1)]	1,45 to 1,47
Grade C	8,40 to 8,80	30,00 to 31,43	10,00 to 11, 00	1,46 to 1,48
Grade D	12,50 to 12,80	44,60 to 45,70	< 1,00	1,57 to 1,60
Grade E	12,50 to 12,80	40,70 to 42,80	0 [1)]	1,52 to 1,56
Grade F	13,50 to 14,00	44,78 to 47,55	0 [2)]	1,58 to 1,63

1) Deficiency of SO_4^{2-}, expressed as H_2SO_4, is 3 % (*m*/*m*) to 4 % (*m*/*m*) of the product.
2) Deficiency of SO_4^{2-}, expressed as H_2SO_4, is 2,5 % (*m*/*m*) to 3,5 % (*m*/*m*) of the product.
3) $Fe_2(SO_4)_3$ by direct stoicheiometry with substraction of calculated SO_4^{2-} deficiency where appropriate on grades B, E and F.

3.3 Physical properties

3.3.1 Appearance

Red/brown solution.

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1) Chemical Abstract Service Registry Number.
2) European Inventory of Existing Commercial Chemical Substances.

3.3.2 Density

See table 1.

3.3.3 Solubility (in water)

Dilutable down to about 1 % (*m/m*) of $Fe_2(SO_4)_3$. Below this concentration, hydrolysis and formation of hydroxide will occur.

3.3.4 Vapour pressure

Not known.

3.3.5 Boiling point at 100 kPa[3)]

Higher than 100 °C.

3.3.6 Freezing point

Lower than - 15 °C.

3.3.7 Specific heat

Not known.

3.3.8 Viscosity (dynamic)

The viscosity of the commonly used solution varies in the range of 5 mPa.s to 130 mPa.s at 10 °C.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

[3)] 100 kPa = 1 bar.

3.4 Chemical properties

Iron(III) sulfate solutions are acidic.

4 Purity criteria

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

4.1 Composition of commercial product

The product shall contain not less than 30 % *(m/m)* of $Fe_2(SO_4)_3$.

4.2 Impurities and main by-products

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

The concentration limits refer to Fe(III).

Table 2 : Impurities

Impurity		Limit % *(m/m)* of Fe(III) content		
		Level 1	Level 2	Level 3
Manganese	max.	0,5	1	2
Iron(II) [1)]	max.	2,5	2,5	2,5
Insolubles [2)]	max.	0,3	0,3	0,3

1) 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.
2) An excess of insolubles indicates the presence of foreign matter.

4.3 Toxic substances

NOTE : For the purpose of this standard, "toxic substances" are those defined in the EU Directive 80/778/EEC of 15 July, 1980 (see F.1).

The content of toxic substances shall conform to the requirements specified in table 3.

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

Table 3 : Toxic substances

Element		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.	0,1	5	10
Nickel (Ni)	max.	300	350	500
Lead (Pb)	max.	10	100	400
Antimony (Sb)	max.	10	20	60
Selenium (Se)	max.	1	20	60
NOTE : Cyanides, pesticides and polycyclic aromatic hydrocarbons are not relevant toxic substances as listed in EU Directive 80/778/EEC because they are not likely to be found in the raw materials.				

5 Test methods

5.1 Sampling

Observe the general recommandations in ISO 3165 and take account of ISO 6206. Prepare the laboratory sample(s) required by the relevant procedure described in 5.1.1.

5.1.1 Liquid

5.1.1.1 Sampling from drums and bottles

5.1.1.1.1 General

5.1.1.1.1.1 Mix the contents of each container to be sampled by shaking the container, by rolling it or by rocking it from side to side, taking care not to damage the container or spill any of the liquid.

5.1.1.1.1.2 If the design of the container is such (for example, a narrow-necked bottle) that it is impracticable to use a sampling implement, take a sample by pouring after the contents have been thoroughly mixed. Otherwise, proceed as described in 5.1.1.1.3.

5.1.1.1.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.1.1.2. Otherwise, take samples as described in 5.1.1.1.3.

5.1.1.1.2 Surface sampling

Take a sample using a suitable ladle. Lower the ladle into the liquid until the rim is just below the surface, so that the surface layer runs into it. Withdraw the ladle just before it fills completely and allow any liquid adhering to the ladle to drain off. If necessary, repeat this operation so that, when the other selected containers have been sampled in a similar manner, the total volume of sample required for subsequent analysis is obtained.

5.1.1.1.3 Bottom sampling

Take a sample using an open sampling tube, or a bottom-valve sampling tube, suited to the size of container and the viscosity of the liquid.

When using an open sampling tube, close it at the top and then lower the bottom end to the bottom of the container. Open the tube and move it rapidly so that the bottom of the tube traverses the bottom of the container before the tube is filled. Close the tube, withdraw it from the container and allow any liquid adhering at the outside of the tube to drain off.

When using a bottom-valve sampling tube, close the valve before lowering the tube into the container and then proceed in a similar manner to that when using an open sampling tube.

5.1.1.2 Sampling from tanks and tankers

From each access point, take samples as follows :

a) from the surface of the liquid, using a ladle as described in 5.1.1.1.2,

b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.1.1.3 or using specially designed bottom-sampling apparatus,

c) from one or more positions, depending on the overall depth, between the bottom and the surface using a weighted sampling can.

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 B.1).

5.2.2 Impurities

5.2.2.1 Manganese

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

5.2.2.2 Iron (II) : Fe(II)

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

5.2.2.3 Insoluble matter

The percentage by mass % (*m*/*m*) of the insoluble matter shall be determined in accordance with the method described in B.3.

5.2.2.4 Free acid

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

5.2.3 Toxic substances

5.2.3.1 General

The contents of toxic substances shall be determined by atomic absorption spectrometry (AAS).

5.2.3.2 Preparation of sample solution

5.2.3.2.1 General

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

5.2.3.2.2 Principle

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

5.2.3.2.3 Reagents

5.2.3.2.3.1 Hydrochloric acid (HCl) solution, 30 % (*m*/*m*).

5.2.3.2.3.2 Hydrogen peroxide (H_2O_2) solution, 30 % (*m*/*m*).

5.2.3.2.4 Apparatus

Ordinary laboratory apparatus and glassware together with the following

5.2.3.2.4.1 Analytical balance.

5.2.3.2.4.2 Graduated cylinder, 50 ml.

5.2.3.2.4.3 Round flask with reflux condenser.

5.2.3.2.4.4 Hot plate.

5.2.3.2.4.5 Volumetric flask, 200 ml.

5.2.3.2.5 Procedure

Dissolve with 20 ml of distilled water 20,0 g of the iron salt or iron solution. Add 5 ml hydrogen peroxide solution (5.2.3.2.3.2) to iron(III)-samples. After adding 50 ml hydrochloric acid (5.2.3.2.3.1) boil the solution for 15 min by using a reflux condenser (5.2.3.2.4.3). Cool down the solution, transfer to a 200 ml volumetric flask (5.2.3.2.4.5) and fill up to the mark with water. This is the sample solution.

5.2.3.3 Arsenic

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

5.2.3.4 Cadmium

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

5.2.3.5 Chromium

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

5.2.3.6 Mercury

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

5.2.3.7 Nickel

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

5.2.3.8 Lead

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

5.2.3.9 Antimony

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