

SLOVENSKI STANDARD

SIST EN 890:2012

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Nadomešča:
SIST EN 890:2005

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

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

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

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

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 890

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ICS 71.100.80

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

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

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

This European Standard was approved by CEN on 24 May 2012.

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EN 890:2012 (E)

Foreword

This document (EN 890:2012) 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of an identical text or by endorsement, at the latest by January 2013, and conflicting national standards shall be withdrawn at the latest by January 2013.

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 890:2004.

Significant technical differences between EN 890:2012 and EN 890:2004 are as follows:

- a) change of the maximum allowed percentage of mass fraction of insoluble matter in the product from 0,3 % to 0,5 % (see Table 2);
- b) update of the information of risk and safety labelling of the product to comply with the new regulations (see 6.2 and [2]);
- c) change of the method for determination of iron (III) sulfate in order to avoid the use of hazardous potassium dichromate (see B.1).

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, 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 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 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 document is subject to regulation or control by National Authorities.

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EN 890:2012 (E)

1 Scope

This European Standard is applicable to iron (III) sulfate solution 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 solution and specifies the requirements and the corresponding analytical methods for iron (III) sulfate solution (analytical methods are given in Annex B) and gives information on its use in water treatment. It also determines the rules relating to safe handling and use of iron (III) sulfate solution (see Annex E).

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 10028-7, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

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

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

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

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

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

3 Description

3.1 Identification

<https://standards.iteh.ai/catalog/standards/sist/401d2738-278e-4e7e-bfda-d25efc76d1c8/sist-en-890-2012>

3.1.1 Chemical name

Iron (III) sulfate, solution.

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

$\text{Fe}_2(\text{SO}_4)_3$.

3.1.5 Chemical formula

$\text{Fe}_2(\text{SO}_4)_3$.

3.1.6 CAS Registry Number ¹⁾

10028-22-5.

1) Chemical Abstract Service Registry Number.

3.1.7 EINECS reference ²⁾

233-072-9.

3.2 Commercial forms

Different classes of solution exist varying in iron content and acidity. Examples are given in Table 1.

Table 1 — Different classes

Classes	Fe (III) Mass fraction in %	Fe ₂ (SO ₄) ₃ Mass fraction ^c in %	Free H ₂ SO ₄ Mass fraction in %	Density at 15 °C g/ml
Class A	11,20 to 11,80	40,00 to 42,14	< 1,00	1,49 to 1,53
Class B	11,20 to 11,80	36,10 to 39,24	0 ^a	1,45 to 1,47
Class C	8,40 to 8,80	30,00 to 31,43	10,00 to 11,00	1,46 to 1,48
Class D	12,50 to 12,80	44,60 to 45,70	< 1,00	1,57 to 1,60
Class E	12,50 to 12,80	40,70 to 42,80	0 ^a	1,52 to 1,56
Class F	13,50 to 14,00	44,78 to 47,55	0 ^b	1,58 to 1,63
^a Deficiency of SO ₄ ²⁻ , expressed as H ₂ SO ₄ , is a mass fraction of 3 % to 4 % of the product. ^b Deficiency of SO ₄ ²⁻ , expressed as H ₂ SO ₄ , is a mass fraction of 2,5 % to 3,5 % of the product. ^c Fe ₂ (SO ₄) ₃ by direct stoichiometry with subtraction of calculated SO ₄ ²⁻ deficiency where appropriate on classes B, E and F.				

3.3 Physical properties

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3.3.1 Appearance

The iron (III) sulfate solution is a red/brown solution.

3.3.2 Density

See Table 1.

3.3.3 Solubility (in water)

The iron (III) sulfate solution is dilutable down to about a mass fraction of 1 % of Fe₂(SO₄)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.

²⁾ European Inventory of Existing Commercial Chemical Substances.

³⁾ 100 kPa = 1 bar.

EN 890:2012 (E)**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.

3.4 Chemical properties

The solutions of iron (III) sulfate are acidic.

4 Purity criteria

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4.1 General

This document specifies the minimum purity requirements for iron (III) sulfate solution 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 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 a mass fraction of 30 % of $\text{Fe}_2(\text{SO}_4)_3$ 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 2.

The concentration limits refer to Fe (III).

Table 2 — Impurities

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

^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 (see A.2). Iron is a component of the product that will usually be removed in the treatment process.

4.4 Chemical parameters

The product shall conform to the requirements specified in Table 3.

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

Table 3 — 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.	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 Cyanide (CN⁻), 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

5.1.1 General

Observe the general recommendations in ISO 3165 and take into account ISO 6206. Prepare the laboratory sample required by the relevant procedure described in 5.1.2 and 5.1.3.

EN 890:2012 (E)**5.1.2 Sampling from drums and bottles****5.1.2.1 General**

5.1.2.1.1 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.

5.1.2.1.2 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 5.1.2.3.

5.1.2.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.2.2. Otherwise, take samples as described in 5.1.2.3.

5.1.2.2 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.

5.1.2.3 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.

5.1.3 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 5.1.2.2;
- b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.2.3 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 matters

The percentage mass fraction of the insoluble matters 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 Chemical parameters

5.2.3.1 Preparation of sample solution

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

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

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

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

5.2.3.1.4 Apparatus

Ordinary laboratory apparatus and glassware together with the following.

5.2.3.1.4.1 Analytical balance.

5.2.3.1.4.2 Graduated cylinder, capacity 50 ml.

5.2.3.1.4.3 Round flask with reflux condenser.

5.2.3.1.4.4 Hot plate.

5.2.3.1.4.5 Volumetric flask, capacity 200 ml.

5.2.3.1.5 Procedure

Dissolve with 20 ml of water 20,0 g of the iron solution. Add 5 ml hydrogen peroxide solution (5.2.3.1.3.2) to iron (III)-samples. After adding 50 ml hydrochloric acid (5.2.3.1.3.1) boil the solution for 15 min by using a reflux condenser (5.2.3.1.4.3). Cool down the solution, transfer to a 200 ml volumetric flask (5.2.3.1.4.5) 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 B.5).