

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

The European Standard EN 890:1998 has the status of a
British Standard

ICS 71.100.80

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National foreword

This British Standard is the English language version of EN 890:1998.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

The United Kingdom did not support this standard at the CEN Enquiry stage and voted against its acceptance at the Formal Vote Stage. The principle UK objections were as follows.

- a) The limits for manganese, iron(II) and insoluble matter in Table 2 are expressed as percentages of the iron(III) content whereas the analytical methods described in annex B give the results as mg/kg of the product for manganese and a percentage by mass of the product for the other impurities. Similarly, the limits for toxic substances in Table 3 are expressed as mg/kg of iron(III) but the calculations described in **B.5.5.4**, **B.6.5.4**, and **B.7.5.4** give the results as mg/kg of the product.
- b) The method for the determination of total iron, described in **B.1.1**, requires the use of mercury(II) chloride, which is classified as “acutely toxic”.
- c) Specifying deionised water in **B.3.3.1** and **B.4.4.1** is inappropriate: the water should conform to grade 3 in EN ISO 3696.
- d) No instructions are given in **B.5** for the preparation of the calibration curve for the determinations of arsenic, antimony and selenium. The standard additions technique, to which reference is made, is not relevant because any matrix interference is removed by conversion of the elements to gaseous hydrides.

Additional information

Article 8 of the council of the European Community Directive 80/778/EEC relating to the quality of water intended for human consumption requires Member states to ensure that substances used in the preparation of drinking water do not cause any contravention of the maximum admissible concentrations prescribed in annex 1 to the Directive.

This requirement is given effect in England and Wales by regulation 25 of the Water Supply (Water Quality) Regulations 1989 (similar provisions apply in Scotland and Northern Ireland). Regulation 25 makes provision for attaching conditions of use to chemicals which are authorized for use in public water supplies.

Details of conditions of use are contained in the Secretary of State’s list of Approved Products published by the Drinking Water Inspectorate, Floor 2/A1, Ashdown House, 123 Victoria Street, London SW1E 6DE.

Cross references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 16, an inside back cover and a back cover.

Amendments issued since publication

Amd. No.	Date	Text affected

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 February 1999

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ISBN 0 580 30640 2

ICS 71.100.80

Descriptors: potable water, water treatment, chemical compounds, iron sulfates, 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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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.

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CEN

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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.

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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 standard:

- a) 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;
- 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.

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

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

3.1.5 Chemical formula

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

3.1.6 CAS Registry Number¹⁾

10028-22-5.

3.1.7 EINECS reference²⁾

233-072-9.

3.2 Commercial forms

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

3.3 Physical properties

3.3.1 Appearance

Red/brown solution.

3.3.2 Density

See Table 1.

3.3.3 Solubility (in water)

Dilutable down to about 1 % (m/m) of $\text{Fe}_2(\text{SO}_4)_3$. Below this concentration, hydrolysis and formation of hydroxide will occur.

3.3.4 Vapour pressure

Not known.

3.3.5 Boiling point at 100 kPa³⁾

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.

3.4 Chemical properties

Iron(III) sulfate solutions are acidic.

¹⁾ Chemical Abstract Service Registry Number.

²⁾ European Inventory of Existing Commercial Chemical Substances.

³⁾ 100 kPa = 1 bar.

Table 1 — Different grades

Grade	Fe(III) % (m/m)	Fe ₂ (SO ₄) ₃ % (m/m) ³⁾	Free H ₂ SO 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 SO₄²⁻, expressed as H₂SO₄, is 3 % (m/m) to 4 % (m/m) of the product.
2) Deficiency of SO₄²⁻, expressed as H₂SO₄, is 2,5 % (m/m) to 3,5 % (m/m) of the product.
3) Fe₂(SO₄)₃ by direct stoichiometry with subtraction of calculated SO₄²⁻ deficiency where appropriate on grades B, E and F.

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 Fe₂(SO₄)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 in the water at lower pH values.
2) An excess of insolubles indicates the presence of foreign matter.

4.3 Toxic substances

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