STANDARDISERINGEN I SVERIGE
SWEDISH INSTITUTE FOR STANDARDS

SVENSK STANDARD SS-EN 888

Handläggande organ	Fastställd	Utgåva	Sida
Standardiseringsgruppen STG	1999-01-08	1	1 (1+16)

Chemicals used for treatment of water intended for human consumption – Iron(III) chloride

This Swedish standard consists of the English version of EN 888:1998, Chemicals used for treatment of water intended for human consumption – Iron(III) chloride.

According to The National Food Administrations Ordinance with regulations and general advice on drinking water, SLV FS 1993:35, iron(III) chloride is permitted as a process chemical for treatment of water intended for human consumption in Sweden.

Swedish Standards corresponding to documents referred to in this Standard are listed in ”Catalogue of Swedish Standards”, issued by SIS. The Catalogue lists, with reference number and year of Swedish approval, International and European Standards approved as Swedish Standards as well as other Swedish Standards.

Processkemikalier för beredning av dricksvatten – Järn(III)klorid

Denna standard utgörs av den engelska versionen av EN 888:1998, Chemicals used for treatment of water intended for human consumption – Iron(III) chloride.

I enlighet med Livsmedelsverkets kungörelse om dricksvatten, SLV FS 1993:35, är järn(III)klorid tillåten som processkemikalie för beredning av dricksvatten i Sverige.

Motsvarigheten och aktualiteten i svensk standard till de publikationer som omnämns i denna standard framgår av ”Katalog över svensk standard”, som ges ut av SIS. I katalogen redovisas internationella och europeiska standarder som fastställts som svenska standarder och övriga gällande svenska standarder.

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 888

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Descriptors: potable water, water treatment, chemical compounds, iron chloride, 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) chloride

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch – Eisen(III) chlorid

This European Standard was approved by CEN on 22 July 1998.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 BRUSSELS

Ref. No. EN 888:1998 E

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.

Contents

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) chloride (a), iron(III) chloride hexahydrate (b) and iron(III) chloride solution (c) used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements and the corresponding test methods for iron(III) chlorides (a), (b) and (c) 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.*

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

3.1 Identification

3.1.1 *Chemical name*

a) Iron(III) chloride ($FeCl_3$).

b) Iron(III) chloride hexahydrate ($FeCl_3.6\ H_2O$).

c) Iron(III) chloride solution.

3.1.2 *Synonym or common names*

a) Ferric chloride, water free ferric chloride.

b) Ferric chloride hexahydrate.

c) Ferric chloride solution.

3.1.3 *Relative molecular mass*

a) 162,21

b) 270,31

3.1.4 *Empirical formula*

a) $FeCl_3$

b) $FeCl_3.6\ H_2O$

3.1.5 *Chemical formula*

a) $FeCl_3$

b) $FeCl_3.6\ H_2O$

3.1.6 *CAS Registry Number*[1)]

a) and c) 7705-08-0

b) 10025-77-1

3.1.7 *EINECS reference*[2)]

231-729-4

3.2 Commercial forms

a) Crystalline powder.

b) Crystalline granules.

c) Aqueous solutions.

3.3 Physical properties

3.3.1 *Appearance*

a) Hygroscopic, dark grey crystalline powder with a greenish sheen.

b) Hygroscopic, yellow deliquescent crystalline granules.

c) Dark brown liquids.

3.3.2 *Density*

a) 2,89 g/cm^3 at 20 °C.

b) 1,8 g/cm^3 at 20 °C.

c) 1,43 g/ml at 20 °C for a concentration of 40 % (*m/m*) of $FeCl_3$.

The bulk density of (a) and (b) is about 1,0 kg/dm^3.

3.3.3 *Solubility (in water)*

At 20 °C:

a) and b) approximately up to 47 % (*m/m*) of $FeCl_3$.

a), b) and c) dilutable down to about 1 % (*m/m*) of $FeCl_3$. Below this concentration, hydrolysis and formation of iron hydroxide will occur.

3.3.4 *Vapour pressure*

a) 0,1 kPa at 20 °C.

[1)] Chemical Abstracts Service Registry Number.

[2)] European Inventory of Existing Commercial Chemical Substances.

3.3.5 *Boiling point at 100 kPa*[3)]

a) Decomposition occurs at 315 °C.

b) Decomposition starts at 160 °C.

3.3.6 *Melting point*

a) 304 °C (point of sublimation).

b) 37 °C.

c) The melting and crystallization points depending on concentration are given in Table 1.

Table 1 — Melting point

Solution concentration % (*m/m*) $FeCl_3$	Melting, crystallization point °C
34	−52
40	−12
45	+10

3.3.7 *Specific heat*

a) 600 kJ/kg·K.

b) Not known.

c) Not applicable.

3.3.8 *Viscosity (dynamic)*

a) and b) not applicable.

c) about 10 mPa·s for a solution of 40 % (*m/m*) of $FeCl_3$ at 20 °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

Solutions of (a) and of (b), and solution (c), are acidic and highly corrosive.

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 products shall conform to the following minimum requirements for (a) and (b):

expressed as $FeCl_3$: — (a) 99 % (*m/m*);
— (b) 59 % (*m/m*);

expressed as Fe(III): — (a) 34 % (*m/m*);
— (b) 20,3 % (*m/m*).

The concentration of the solution (c) shall be within the manufacturer's specifications. The common concentration is:

— expressed as $FeCl_3$: 40 % *(m/m)*;

— expressed as Fe(III): 13,7 % *(m/m)*.

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).

4.3 Toxic substances

NOTE For the purpose of this standard, "toxic substances" are those defined in the EU Directive 80/778/EEC of July 15, 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 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.	0,2	0,2	0,2

[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.

[3)] 100 kPa = 1 bar.

Table 3 — Toxic substances

Parameter		Limit mg/kg of Fe(III)		
		Type 1	Type 2	Type 3
Arsenic (As)	max.	20	20	50
Cadmium (Cd)	max.	1	25	50
Chromium (Cr)	max.	50	350	500
Mercury (Hg)	max.	0,3	5	10
Nickel (Ni)	max.	60	350	500
Lead (Pb)	max.	35	100	400
Antimony (Sb)	max.	10	20	60
Selenium (Se)	max.	10	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.

5.1.1 *Solid*

Prepare the laboratory sample(s) required by the relevant procedure described in ISO 8213.

5.1.2 *Liquid*

5.1.2.1 *Sampling from drums and bottles*

5.1.2.1.1 *General*

5.1.2.1.1.1 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.

5.1.2.1.1.2 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 **5.1.2.1.1.3**.

5.1.2.1.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in **5.1.2.1.2**. Otherwise, take samples as described in **5.1.2.1.3**.

5.1.2.1.2 *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.

5.1.2.1.3 *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.

5.1.2.2 *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 **5.1.2.1.2**;

b) from the bottom of the tank or tanker, using a sampling tube as described in **5.1.2.1.3** 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) chloride 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)*

The iron(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**.

5.2.3 ***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 to 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.4**).

5.2.3.4 *Cadmium*

The cadmium content shall be determined by atomic absorption spectrometry graphite furnace technique (see **B.6**).

5.2.3.5 *Chromium*

The chromium content shall be determined by atomic absorption spectrometry graphite furnace technique (see **B.6**).

5.2.3.6 *Mercury*

The mercury content shall be determined by atomic absorption spectrometry cold vapour technique (see **B.5**).

5.2.3.7 *Nickel*

The nickel content shall be determined by atomic absorption spectrometry graphite furnace technique (see **B.6**).

5.2.3.8 *Lead*

The lead content shall be determined by atomic absorption spectrometry graphite furnace technique (see **B.6**).

5.2.3.9 *Antimony*

The antimony content shall be determined by atomic absorption spectrometry hydride technique (see **B.4**).

5.2.3.10 *Selenium*

The selenium content shall be determined by atomic absorption spectrometry hydride technique (see **B.4**).

6 Labelling — Transportation — Storage

6.1 Means of delivery

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)]

Iron(III) chloride is not subject to labelling regulations.

6.3 Transportation regulations and labelling

Iron(III) chloride is listed as UN Numbers[5)]: a) 1773; c) 2582.

RID[6)] ADR[7)]:	a) class 8, 22 °C;
	b) class 8, 5 °C.
IMDG[8)]:	a) class 8; c) class 8.
IATA[9)]:	a) class 8, 1773; c) class 8, 2582.

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4) See **F.2**.

5) United Nations Number.

6) Regulations concerning international carriage of dangerous goods by rail.

7) European Agreement concerning the international carriage of dangerous goods by road.

8) International Maritime transport of dangerous goods.

9) International Air Transport Association.