



SLOVENSKI STANDARD

SIST EN 878:2016

01-maj-2016

Nadomešča:
SIST EN 878:2004

Kemikalije, ki se uporabljajo za pripravo pitne vode - Aluminijev sulfat

Chemicals used for treatment of water intended for human consumption - Aluminium sulfate

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Aluminiumsulfat

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Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Sulfate d'aluminium

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EUROPEAN STANDARD

EN 878

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Chemicals used for treatment of water intended for human consumption - Aluminium sulfate

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Sulfate d'aluminium

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Aluminiumsulfat

This European Standard was approved by CEN on 18 January 2016.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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EN 878:2016 (E)**European foreword**

This document (EN 878:2016) 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of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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 878:2004.

Significant technical differences between this edition and EN 878:2004 are as follows:

- a) addition of CAS Registry Number for tetradecahydrate;
- b) information relating to the crystallization point added;
- c) replacement of warning and safety precautions notes by labelling according to Regulation (EC) No 1272/2008;
- d) modification of the concentration of the solutions used.

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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.

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 European Standard is subject to regulation or control by National Authorities.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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.

1 Scope

This European Standard is applicable to aluminium sulfate used for treatment of water intended for human consumption. It describes the characteristics of aluminium sulfate and specifies the requirements for aluminium sulfate and gives reference to the analytical methods. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use of aluminium sulfate (see Annex B).

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 1302, *Chemicals used for treatment of water intended for human consumption - Aluminium-based coagulants - Analytical methods*

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*

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3 Description

3.1 Identification

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3.1.1 Chemical name

Aluminium sulfate.

3.1.2 Synonym or common names

Aluminium sulfate, cake alum, alum.

NOTE In English the generic term “alum” is imprecise and is deprecated and in German the term “Alaun” is misleading.

3.1.3 Relative molecular mass

342,14 for $\text{Al}_2(\text{SO}_4)_3$.

3.1.4 Empirical formula

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

3.1.5 Chemical formula

$\text{Al}_2(\text{SO}_4)_3 \cdot n \text{H}_2\text{O}$.

3.1.6 CAS Registry Number ¹⁾

$\text{Al}_2(\text{SO}_4)_3$: 10043-01-3.

¹⁾ Chemical Abstracts Service Registry Number.

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$\text{Al}_2(\text{SO}_4)_3 \cdot 14 \text{H}_2\text{O}$: 16828-12-9.

$\text{Al}_2(\text{SO}_4)_3 \cdot 16 \text{H}_2\text{O}$: 16828-11-8.

$\text{Al}_2(\text{SO}_4)_3 \cdot 18 \text{H}_2\text{O}$: 7784-31-8

3.1.7 EINECS reference ²⁾

$\text{Al}_2(\text{SO}_4)_3$: 233-135-0.

3.2 Commercial forms

Aluminium sulfate is available in solid hydrated forms, with different particle sizes (slabs, kibbled, ground, granulated) and as aqueous solutions.

3.3 Physical properties**3.3.1 Appearance**

The product is a white solid or colourless to yellow, clear liquid.

3.3.2 Density

The density of a typical aluminium sulfate solution is given in Table 1 and varies depending on the concentration of the active matter (aluminium content), expressed in grams per kilogram of solution (Al g/kg).

Table 1 — Density of solution

Al g/kg of solution	Density at 15 °C g/ml
40,8	1,310
41,6	1,315
42,5	1,320
43,3	1,325
44,2	1,330
45,0	1,335

3.3.3 Solubility

The theoretical limit of active matter content for a typical solution is given in Table 2.

Table 2 — Solubility

Temperature °C	Active matter in Al g/kg of solution
- 1	44,7
24	44,8

The practical limit of solubility depends on the temperature and the device used for solubilization of the solid form (slabs, kibbled, ground or granulated).

²⁾ European Inventory of Existing Commercial Chemical Substances.

An indication of practical limits is given in Table 3.

Table 3 — Indication of practical limits of solubility

Temperature °C	Active matter Al g/kg of solution	Solubility in grams solid form (containing Al 90 g/kg of solid) per kilogram of solution
15	37	410

3.3.4 Vapour pressure at 20 °C

Not known.

3.3.5 Boiling point at 100 kPa ³⁾

Not known.

3.3.6 Crystallization point

The crystallization point of aluminium sulfate varies, depending on the concentration of the active matter.

For example:

- - 7 °C for a typical solution of aluminium content of 42,4 g/kg of solution.
- Solution stored at low temperatures (below 0°C) can spontaneously form a solid mass of crystal hydrate.

3.3.7 Specific heat

Not known.

3.3.8 Viscosity (dynamic)

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The viscosity of aluminium sulfate solution varies greatly, depending on the concentration of the active matter.

For a typical solution of aluminium content of 42,4 g/kg of solution, the viscosity is given in Table 4.

Table 4 — Viscosity

Temperature °C	Viscosity mPa.s
0	40,0
10	26,5
20	18,6
30	13,2
40	8,8

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

³⁾ 100 kPa = 1 bar.

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3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Aluminium sulfate is an acidic hydrated salt or solution. Very dilute solutions hydrolyse and form a precipitate of aluminium hydroxide.

NOTE Since aluminium compounds are amphoteric in nature, the solubility of aluminium depends on the pH value and it is advised to use the product within an appropriate pH range.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for aluminium sulfate 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 can be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

Users of the 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 the product standard, and other relevant factors.

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 a change in the production process or raw materials leads 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 concentration of active matter (aluminium content) in the product expressed as grams per kilogram of product shall be within $\pm 3\%$ of the manufacturer's declared values.

NOTE The concentration of water-soluble aluminium in commercial products varies. Typical values are given here below:

Commercial form	Al g/kg of product
Solid	72 to 91
Solution	32 to 44

4.3 Impurities and main by-products

The product shall conform to the requirements specified in Table 5.

Table 5 — Limits of impurities

Grade	Impurity	Limit g/kg of Al
Iron free	Iron (Fe) max.	1,60
Low iron	Iron (Fe) max.	$1,60 < Fe \leq 115$
All grades	Insoluble matter max.	23
NOTE The value quoted for iron is for both iron (II) and iron (III). Iron can be present as a component of the product and will usually be removed in the treatment process.		

4.4 Chemical parameters

The product shall conform to the requirements specified in Table 6.

Table 6 — Chemical parameters

Parameter		Limit mg/kg of Al		
		Type 1	Type 2	Type 3
Arsenic (As)	max.	14	40	100
Cadmium (Cd)	max.	3	50	100
Chromium (Cr)	max.	30	700	1 000
Mercury (Hg)	max.	4	10	20
Nickel (Ni)	max.	20	700	1 000
Lead (Pb)	max.	40	200	800
Antimony (Sb)	max.	20	40	120
Selenium (Se)	max.	20	40	120

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 these products on trace metal content in drinking water see A.2.

5 Test methods

5.1 Sampling

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5.1.1 Solid

Observe the general recommendations of ISO 3165 and take into account ISO 6206.

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