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BSI Standards Publication

Chemicals used for treatment of water intended for human consumption — Sodium aluminate

bsi.

National foreword

This British Standard is the UK implementation of EN 882:2016. It supersedes BS EN 882:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Chemicals used for treatment of water intended for human consumption - Sodium aluminate

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Aluminate de sodium

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumaluminat

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European foreword

This document (EN 882:2016) 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of an identical text or by endorsement, at the latest by September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.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 882:2004.

Significant technical differences between this edition and EN 882:2004 are as follows:

a) addition of chemical names for aluminium sodium dioxide and for aluminium sodium tetrahydroxide;

b) replacement of warning and safety precautions notes by labelling according to Regulation (EC) No 1272/2008.

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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 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 document 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.

1 Scope

This document is applicable to sodium aluminate used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements of sodium aluminate and refers to the corresponding analytical methods. It gives information for its use in water treatment. It also determines the rules relating to safe handling and use of sodium aluminate (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*

3 Description

3.1 Identification

3.1.1 Chemical name

Aluminium sodium oxide

Aluminium sodium dioxide

Aluminium sodium tetrahydroxide

3.1.2 Synonym or common name

Sodium aluminate

3.1.3 Relative molecular mass

82 for $NaAlO_2$.

3.1.4 Empirical formula

$NaAlO_2$ 0,1 $Na_2O.nH_2O$ (*n* varies from 0,3 to 0,4)

3.1.5 Chemical formula

$NaAlO_2$

3.1.6 CAS Registry Number [1)]

1302-42-7

12251-53-5

3.1.7 EINECS reference [2)]

215-100-1

235-487-0

3.2 Commercial form

Sodium aluminate is available as solids (powder or granules) or solutions.

3.3 Physical properties

3.3.1 Appearance

The product is a white powder or granules or colourless to yellow liquid.

3.3.2 Density

The absolute density of solids products is 2,35 g/cm^3.

The tamped bulk density (powder) is between 1 g/cm^3 to 1,2 g/cm^3 (depends on grain size).

The density of solutions is 1,5 g/ml for a solution containing 10 % of active matter, expressed as mass fraction of aluminium in the product (10 % Al).

3.3.3 Solubility

Sodium aluminate is soluble in water to yield solutions of up to 12,7 % Al at 20 °C (concentration higher than 400 g/l).

NOTE Depending on temperature and degree of dilution, solutions of sodium aluminate can hydrolyse and form a precipitate.

3.3.4 Vapour pressure

— Solid not applicable

— Solution not known

3.3.5 Boiling point at 100 kPa [3)]

— Solid not applicable

— Solution not known

3.3.6 Melting or crystallization point

— Solid melting point: approximately 1 650 °C

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1) Chemical Abtracts Service Registry Number.

2) European inventory of Existing Commercial chemicals Substances.

3) 100 kPa = 1 bar

— Solutiontypical values for crystallization point range between - 15 °C and - 25 °C

3.3.7 Specific heat

Not known

3.3.8 Viscosity (dynamic)

Typical values of dynamic viscosity for sodium aluminate solutions, containing 10 % Al and 12,7 % Al are given in Table 1.

Table 1 — Viscosity

Temperature **°C**	**Viscosity** mPa.s	
	10 % Al	12,7 % Al
- 5	1 250	15 000
0	650	7 000
5	360	2 850
10	200	1 650
15	140	900
20	120	560

3.3.9 Critical temperature

Not applicable

3.3.10 Critical pressure

Not applicable

3.3.11 Physical hardness

— Solid not known

— Solutionnot applicable

3.4 Chemical properties

Sodium aluminate solutions are highly alkaline. Their solutions hydrolyse and form a precipitate of aluminium hydroxide when diluted beyond a particular level or neutralized.

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.

When dissolved in drinking water, calcium is partially precipitated with aluminium hydroxide.

4 Purity criteria

4.1 General

This document specifies the minimum purity requirements for sodium aluminate 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 document.

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 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 in the commercial product, expressed as a mass fraction of aluminium in the product (Al %) shall be within ± 3 % of the manufacturer's declared values.

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

	Al % of the product
Solid forms	27,5 to 29,1
Solution forms	10 to 13,2

4.3 Impurities and main by-products

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

Table 2 — Limits of impurities

Impurity	**Limit** g/kg of Al
Iron (Fe) max.	0,8
Insoluble matter (solid product) max	8
NOTE The value quoted for iron is 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 3.

Table 3 — 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 sodium aluminate on trace metal content in drinking water see A.2.				

5 Test methods

5.1 Sampling

5.1.1 General

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

5.1.2 Solid

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

5.1.3 Liquid

5.1.3.1 Sampling from drums and bottles

5.1.3.1.1 General

5.1.3.1.1.1 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.

5.1.3.1.1.2 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 5.1.3.1.1.3.

5.1.3.1.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.3.1.2; otherwise, take samples as described in 5.1.3.1.3.

5.1.3.1.2 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.

5.1.3.1.3 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 to 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.

5.1.3.2 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 5.1.3.1.2 ;

b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.3.1.3 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

Use the relevant methods for analysis described in EN 1302.

6 Labelling – Transportation – Storage

6.1 Means of delivery

Solids (sodium aluminate): the product shall be delivered in suitable packages, paper or plastics bags, or by rubber or plastics-lined bulk truck (20 t to 35 t depending on transport regulations if applicable).

Bulk liquids: the product shall be delivered in tankers of corrosion-resistant materials suitable for the purpose.

NOTE The manufacturer can provide advice on suitable materials.

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 Labelling in accordance with the EU legislation [4)]

One of the following labelling requirements shall apply to sodium aluminate at the date of the publication of this document.

4) See [2].

For solids and solutions	
Hazard pictogram  **Figure 1 — GHS05**	Signal word: Danger Hazard statement H314: Causes severe skin burns and eye damage. H290: May be corrosive to metals.
Precautionary statements ("P statements") should be provided by the company being responsible for the marketing of the substance. They should be indicated on the packaging label and in the extended safety data sheet (eSDS) of the substance.	

The regulation [2], along with its amendments for the purposes of its adaptation to technical and scientific progress, contains a list of substances classified by the EU. Substances not listed in this regulation should be classified on the basis of their intrinsic properties according to the criteria in the regulation by the person responsible for the marketing of the substance.

6.3 Transportation regulations and labelling

Depending on the composition, the commercial product can be subject to transportation regulations and, if so, this product is listed as UN number [5]:

UN 2812: Sodium aluminate, solid

Class 8, Classification Code C6

(Not subject to ADR!)

UN 1819: SODIUM ALUMINATE SOLUTION

Class 8, PG II

RID [6] as above;

ADR [7] as above;

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

IMDG [8] as above;

IATA [9] as above.

6.4 Marking

The marking shall include the following:

— the name: “sodium aluminate”, trade name, type ;

— the net mass ;

— the name and the address of supplier and/or manufacturer ;

— the statement “This product complies with EN 882”.

6.5 Storage

6.5.1 General

Storage tanks for solutions shall be of corrosion-resistant material suitable for the purpose

NOTE 1 The manufacturer can provide advice on suitable materials.

NOTE 2 Storage tanks for solutions located outside can require protection against extreme temperatures to avoid freezing or unacceptable increase of viscosity: refer to manufacturer's information on permissible temperatures.

6.5.2 Long term stability

Solid product is stable no more than one year as the product is hygroscopic.

Solutions are stable maximum three months, depending on mole ratio Na_2O / Al_2O_3, concentrations of active matter and stabilizer. Unstabilized solutions of 2,6 % Al to 5,3 % Al will be decomposed within some days.

6.5.3 Storage incompatibilities

Avoid contact with acid compounds. The products are incompatible with iron salts and aluminium sulfates/chlorides/polyaluminium chlorides.

The solution is strongly alkaline and reacts aggressively with some metal surfaces (e.g. galvanised metal, aluminium, magnesium, zinc, and alloys of these metals), The reaction releases flammable hydrogen gas, which can be explosive in confined spaces. Seek manufacturer's advice.

8) International Maritime Dangerous Goods Code

9) International Air Transport Association

Annex A
(informative)

General information on sodium aluminate

A.1 Origin

A.1.1 Raw materials

Depending on product and manufacturer the sodium aluminate is manufactured from:

— aluminium hydroxide;

— aluminium metal;

— sodium hydroxide.

A.1.2 Manufacturing process

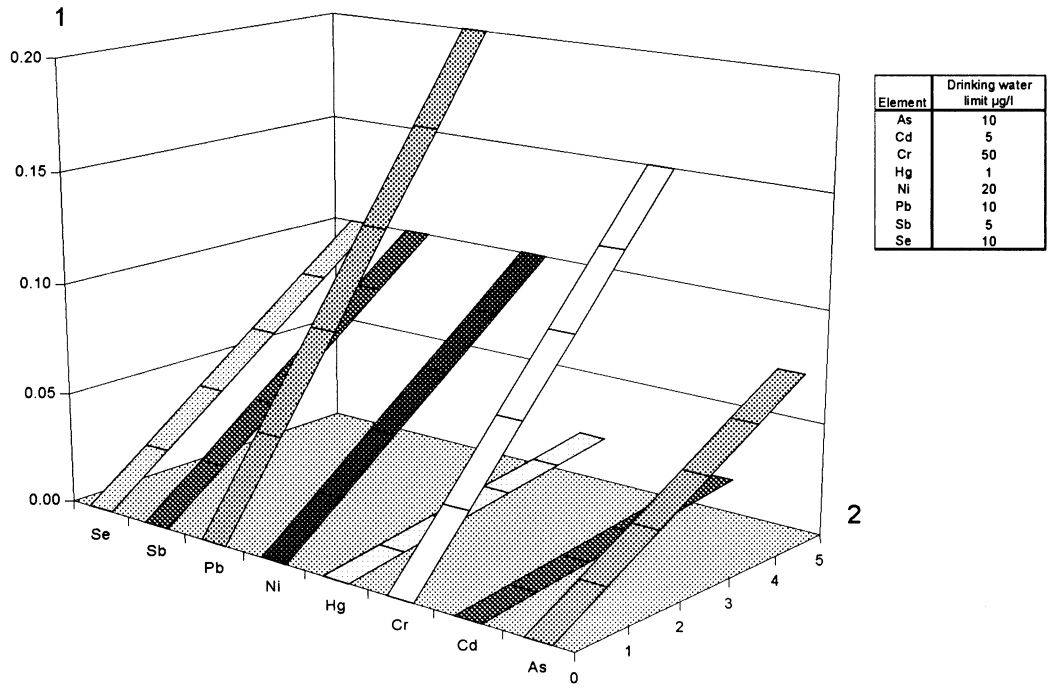
Sodium aluminate is a synthetically manufactured product.

The typical manufacturing process is the digestion of aluminium hydroxide in caustic soda solutions, followed by crystallization and calcination (when the solid product is produced).

Sodium aluminate solutions are also produced by treatment of aluminium metal with caustic soda solution.

A.2 Quality of commercial product

The three types of sodium aluminate specified in Table 3 reflect the quality of commercially available products. Figures A.1 to A.3 show the maximum concentrations of trace metals that would be added to the raw water by the addition of products corresponding to the purity levels specified in Table 3. It can be seen that the concentrations of metal added are well below the Parametric Values given in the EU Directive 98/83/EC (see [1]) at typical product doses. Furthermore, the figures overstate the concentrations of metals that would be present in the treated water since a substantial proportion of the trace metals will be incorporated in the sludge. Users of this product should select an appropriate grade and type to enable them to achieve treated water quality targets taking into account raw water characteristics, required dosage, process plant conditions and other relevant factors.

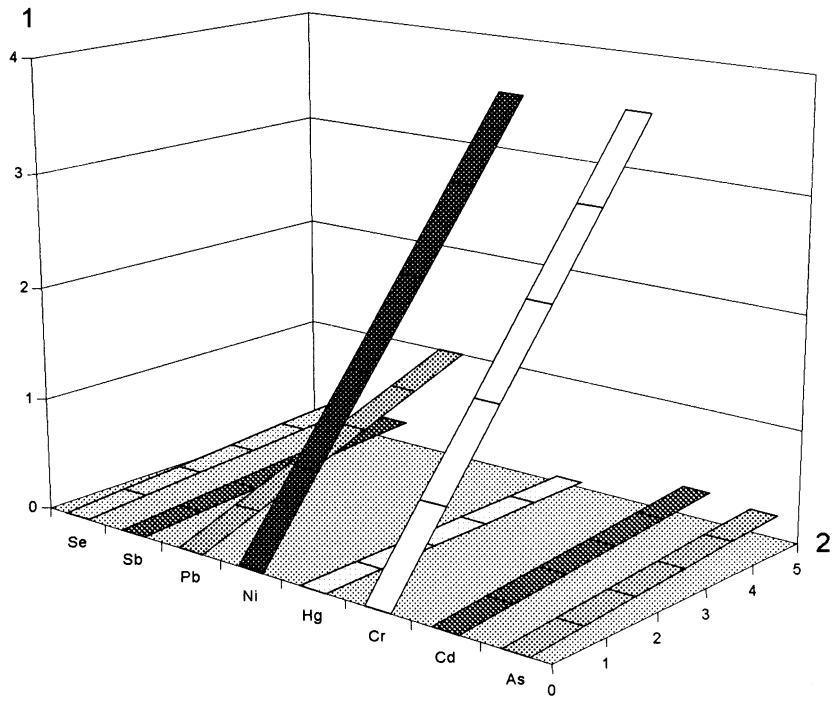


Key

1 maximum addition to water µg/l metal

2 product dosage mg/l Al - Typical dose

Figure A.1 — Maximum impact of sodium aluminate, type 1, on trace metal content of water



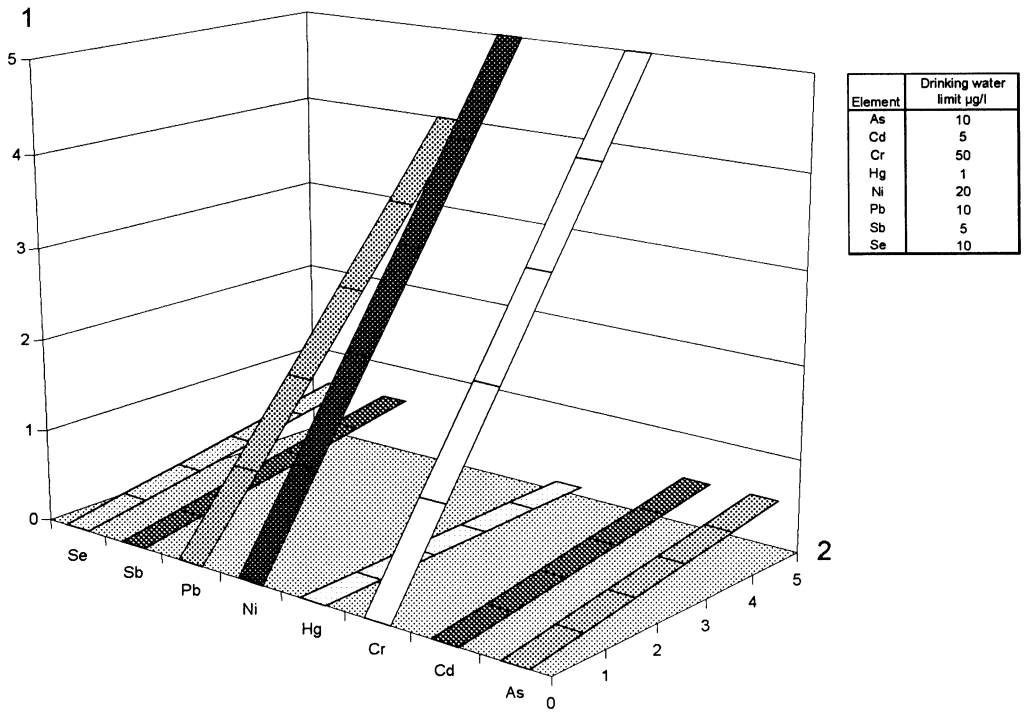
Element	Drinking water limit µg/l
As	10
Cd	5
Cr	50
Hg	1
Ni	20
Pb	10
Sb	5
Se	10

Key

1 maximum addition to water µg/l metal

2 product dosage mg/l Al - Typical dose

Figure A.2 — Maximum impact of sodium aluminate, type 2, on trace metal content of water



Key

1 maximum addition to water µg/l metal

2 product dosage mg/l Al - Typical dose

Figure A.3 — Maximum impact of sodium aluminate, type 3, on trace metal content of water

A.3 Use

A.3.1 Function

Sodium aluminate is used as a coagulant and flocculant.

A.3.2 Form in which it is used

For a solid product it is preferably diluted to mass fraction of 2,6 % to 5,3 % of sodium aluminate solid (28 % Al) with deionized water.

For a liquid product, the concentration of the solution used, expressed as Al, is generally about 15 g/l of Al to 30 g/l of Al, according to manufacturer's recommendation.

NOTE Very dilute solutions hydrolyze and form a precipitate.

A.3.3 Treatment dose

The treatment dose is generally in the range of 6 mg/l to 10 mg/l of solid sodium aluminate, i.e. 1,7 mg/l of Al to 2,85 mg/l of Al, depending on raw water quality.

A.3.4 Means of application

Solutions are usually applied using a positive displacement metering pump. Sufficient turbulence should be provided at the point of addition to promote rapid dispersion. Product supplied as solution may be dosed by metering of the neat product, followed by dilution with a carrier water.

A.3.5 Secondary effects

— increase of pH value;

— increase of alkalinity;

— decrease of anion concentration (e.g. phosphates, carbonates).

A.3.6 Removal of excess product

The water purification process should be operated under conditions (especially pH) in which the aluminium ions in the system are precipitated and reduced during settling or flotation, and/or filtration below the maximum allowable concentration.

Annex B
(normative)

General rules relating to safety

B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

B.2 Emergency procedures

B.2.1 Accident

In case of contact of skin, wash thoroughly with cold water and seek medical advice if irritation persists.

In case of contact with eyes, rinse thoroughly with cold water and seek medical advice.

In case of inhalation, remove to fresh air, loosen clothing and seek medical advice.

In case of ingestion, seek medical advice immediately.

NOTE In general, it is advised to treat the product as an aggressive alkali.

B.2.2 Spillage

Refer to 6.5.3 for incompatibilities.

Put on protective clothing.

Collect and dispose of solid spillages carefully.

Dilute small spillages of liquid with plenty of water and flush to sewer.

Neutralize and dispose of large spillages of liquid.

NOTE 1 Local regulations might apply to the disposal of this product.

NOTE 2 Suitable neutralizing chemical is diluted (10 %) sulfuric acid.

B.2.3 Fire

The product is non-flammable. All extinguishing media can be used. Protective clothing should be put on. It should be aware that product forms with water an aggressive alkaline solutions.

Bibliography

[1] 98/83/EC: Council Directive of 3 November 1998 on the Quality of Water intended for Human Consumption

[2] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH)

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