BS EN 15031:2013

BSI Standards Publication

Chemicals used for treatment of swimming pool water — Aluminium based coagulants

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National foreword

This British Standard is the UK implementation of EN 15031:2013. It supersedes BS EN 15031:2006 which is withdrawn.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.

ISBN 978 0 580 80013 9

ICS 13.060.25; 71.100.80

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15031

May 2013

ICS 71.100.80

Supersedes EN 15031:2006

English Version

Chemicals used for treatment of swimming pool water - Aluminium based coagulants

Produits chimiques utilisés pour le traitement de l'eau des piscines - Coagulants à base d'aluminium

Produkte zur Aufbereitung von Schwimm- und Badebeckenwasser - Flockungsmittel auf Aluminiumbasis

This European Standard was approved by CEN on 21 March 2013.

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 CEN-CENELEC Management Centre or to any CEN member.

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Ref. No. EN 15031:2013: E

Contents

Page

Foreword

This document (EN 15031:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.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 15031:2006.

Significant technical differences between this edition and EN 15031:2006 are as follows:

— Updating of subclause 6.2 in line with current legislation..

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 for swimming pools, caused by the products covered by this European Standard:

a) this European Standard provides no information as to whether the products 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 these products remain in force.

NOTE Conformity with this European Standard does not confer or imply acceptance or approval of the products in any of the Member States of the EU or EFTA. The use of the products covered by this European Standard is subject to regulation or control by National Authorities.

1 Scope

This European Standard is applicable to aluminium based coagulants (aluminium sulfate, aluminium chloride (monomeric), aluminium chloride hydroxide (monomeric), aluminium chloride hydroxide sulfate (monomeric), sodium aluminate and polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate) used directly or for the production of formulations for treatment of water for swimming pools.

It describes the characteristics of aluminium based coagulants and specifies the requirements and the corresponding test methods for aluminium based coagulants. It gives information on their use in swimming pool water treatment. It also determines the rules relating to safe handling and use (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 Aluminium sulfate

3.1.1 Identification

3.1.1.1 Chemical name

Aluminium sulfate.

3.1.1.2 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.

3.1.1.3 Relative molecular mass

342,14 for $Al_2(SO_4)_3$.

3.1.1.4 Empirical formula

$Al_2(SO_4)_3$.

3.1.1.5 Chemical formula

$Al_2(SO_4)_3.nH_2O$.

3.1.1.6 CAS Registry Number [1)]

$Al_2(SO_4)_3$: 10043-01-3.

$Al_2(SO_4)_3 \cdot 16\ H_2O$: 16828-11-8.

$Al_2(SO_4)_3 \cdot 18\ H_2O$: 7784-31-8.

3.1.1.7 EINECS reference [2)]

$Al_2(SO_4)_3$: 233-135-0.

3.1.2 Commercial forms

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

3.1.3 Physical properties

3.1.3.1 Appearance

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

3.1.3.2 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

3.1.3.3 Solubility

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

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

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 solubilisation of the solid form (slabs, kibbled, ground or granulated).

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

3.1.3.4 Vapour pressure at 20 °C

Not known.

3.1.3.5 Boiling point at 100 kPa [3)]

Not known.

3.1.3.6 Crystallisation point

The crystallisation 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.

3.1.3.7 Specific heat

Not known.

3.1.3.8 Viscosity (dynamic)

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.

3) 100 kPa = 1 bar.

Table 4 — Viscosity

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

3.1.3.9 Critical temperature

Not applicable.

3.1.3.10 Critical pressure

Not applicable.

3.1.3.11 Physical hardness

Not applicable.

3.1.4 Chemical properties

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

Since aluminium compounds are amphoteric in nature, the solubility of aluminium depends on the pH value and the product should be used within an appropriate pH range.

3.2 Aluminium chloride (monomeric), aluminium chloride hydroxide (monomeric) and aluminium chloride hydroxide sulfate (monomeric)

3.2.1 Identification

3.2.1.1 Chemical name

a) aluminium chloride (monomeric);

b) aluminium chloride hydroxide (monomeric);

c) aluminium chloride hydroxide sulfate (monomeric).

3.2.1.2 Synonym or common names

a) aluminium chloride;

b) aluminium chloride hydroxide;

c) aluminium chloride hydroxide sulfate.

3.2.1.3 Relative molecular mass

133,3 for $AlCl_3$.

3.2.1.4 Empirical formula

a) $AlCl_3$;

b) $Al(OH)_aCl_b$ with $(a + b) = 3$ and *a* less than or equal to 1,05;

c) $Al(OH)_aCl_b(SO_4)_c$ with $(a + b + 2c) = 3$ and a less than or equal to 1,05.

3.2.1.5 Chemical formula

Variable (see 3.1.4).

3.2.1.6 CAS Registry Number [4)]

a) 7446-70-0;

b)

1) a and b variable: 1327-41-9 with a less than or equal to 1,05;

2) $a = 1$, $b = 2$: 14215-15-7;

c) a, b and *c* variable: 39290-78-3 with a less than or equal to 1,05.

3.2.1.7 EINECS reference [5)]

a) 231-208-1;

b)

1) 215-477-2;

2) 238-071-7;

c) 254-400-7.

3.2.2 Commercial forms

Aluminium chloride in the form of hexahydrate is available as crystals.

Liquid forms of aluminium chloride, aluminium chloride hydroxide and aluminium chloride hydroxide sulfate (monomeric) are available as solutions or suspensions.

3.2.3 Physical properties

3.2.3.1 Appearance

The product is colourless to yellow.

4) Chemical Abstracts Service Registry Number.

5) European Inventory of Existing Commercial Chemical Substances.

3.2.3.2 Density

The density depends on the particular composition, especially the aluminium ion content, expressed as mass fraction of aluminium (Al) in %.

Typical values for solutions:

a) aluminium chloride: 1,3 g/ml for 5,8 % Al;

b) aluminium chloride hydroxide: 1,35 g/ml to 1,40 g/ml for 9,5 % Al;

c) aluminium chloride hydroxide sulfate:

— 1,18 g/ml to 1,22 g/ml for 5,3 % Al;

— 1,18 g/ml for 4,2 % Al.

3.2.3.3 Solubility

Aluminium chloride, aluminium chloride hydroxide and aluminium chloride hydroxide sulfate (monomeric) are fully miscible with water.

NOTE Depending on the particular product, dilute solutions can hydrolyze and form a precipitate.

3.2.3.4 Vapour pressure

Not known.

3.2.3.5 Boiling point at 100 kPa[6)]

Not known.

3.2.3.6 Crystallisation point

Typical values for solutions:

a) aluminium chloride: - 20 °C for 5,8 % Al;

b) aluminium chloride hydroxide:

— ≤ - 20 °C for 9,5 % Al;

— ≈ - 20 °C for 12,4 % Al;

c) aluminium chloride hydroxide sulfate:

— 10 °C to - 15 °C for 5,3 % Al;

— 5 °C for 4,2 % Al.

3.2.3.7 Specific heat

Not known.

6) 100 kPa = 1 bar.

3.2.3.8 Viscosity (dynamic)

Typical values for solutions at 20 °C:

a) aluminium chloride solution: ≈ 10 mPa.s for 5,8 % Al;

b) aluminium chloride hydroxide:

— 10 mPa.s to 50 mPa.s for 9,5 % Al;

c) aluminium chloride hydroxide sulfate:

— 3 mPa.s to 10 mPa.s for 5,3 % Al.

3.2.3.9 Critical temperature

Not applicable.

3.2.3.10 Critical pressure

Not applicable.

3.2.3.11 Physical hardness

Not applicable.

3.3 Sodium aluminate

3.3.1 Identification

3.3.1.1 Chemical name

Aluminium sodium oxide.

3.3.1.2 Synonym or common name

Sodium aluminate.

3.3.1.3 Relative molecular mass

82 for $NaAlO_2$.

3.3.1.4 Empirical formula

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

3.3.1.5 Chemical formula

$NaAlO_2$.

3.3.1.6 CAS Registry Number [7)]

11138-49-1.

3.3.1.7 EINECS reference [8)]

234-391-6.

3.3.2 Commercial form

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

3.3.3 Physical properties

3.3.3.1 Appearance

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

3.3.3.2 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).

3.3.3.3 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.

3.3.3.4 Vapour pressure

— Solid not applicable;

— Solution not known.

3.3.3.5 Boiling point at 100 kPa [9)]

— Solid not applicable;

— Solution not known.

3.3.3.6 Melting or crystallisation point

— Solid melting point : ≈ 1 650 °C;

7) Chemical Abstracts Service Registry Number.

8) European inventory of Existing Commercial chemicals Substances.

9) 100 kPa = 1 bar

— Solution typical values for crystallisation point range between - 15 °C and - 25 °C.

3.3.3.7 Specific heat

Not known.

3.3.3.8 Viscosity (dynamic)

Typical values of dynamic viscosity for sodium aluminate solutions, containing 10 % Al and 12,7 % Al are given in Table 5.

Table 5 — 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

3.3.3.9 Critical temperature

Not applicable.

3.3.3.10 Critical pressure

Not applicable.

3.3.3.11 Physical hardness

— Solid not known;

— Solution not applicable.

3.3.4 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 neutralised.

Since aluminium compounds are amphoteric in nature, the solubility of aluminium depends on the pH value and the product should be used within an appropriate pH range.

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

3.4 Polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate

3.4.1 Identification

3.4.1.1 Chemical names

a) Polyaluminium chloride hydroxide;

b) Polyaluminium chloride hydroxide sulfate.

3.4.1.2 Synonym or common names

a) Polyaluminium chloride, PAC, PACl; basic aluminium chloride, BAC.

NOTE In French, the term "Polychlorure d'aluminium" is deprecated.

b) Polyaluminium chloride, PAC; polyaluminium chloride sulfate, PACS.

3.4.1.3 Relative molecular mass

Variable (see 3.1.4).

3.4.1.4 Empirical formula

a) $Al(OH)_aCl_b$ with $(a + b) = 3$ and a greater than 1,05;

b) $Al(OH)_aCl_b(SO_4)_c$ with $(a + b + 2c) = 3$ and a greater than 1,05.

3.4.1.5 Chemical formula

Variable (see 3.1.4).

3.4.1.6 CAS Registry Number [10)]

(a_1) a and b variable: 1327-41-9 with a greater than 1,05;

(a_2) $a = 2,5$; $b = 0,5$: 12042-91-0;

(a_3) $a = 2$; $b = 1$: 10284-64-7;

(b) a, b and c variable: 39290-78-3 with a greater than 1,05.

3.4.1.7 EINECS reference [11)]

(a_1) 215-477-2;

(a_2) 234-933-1;

(a_3) 233-632-2;

(b) 254-400-7.

10) Chemical Abstracts Service Registry Number.

11) European Inventory of Existing Commercial Chemical Substances.

3.4.2 Commercial forms

These products are generally available as liquids.

3.4.3 Physical properties

3.4.3.1 Appearance

The product is colourless to yellow.

3.4.3.2 Density

The density depends on the particular composition, especially the aluminium ion content, expressed as mass fraction of aluminium (Al %).

Typical values:

a) Polyaluminium chloride hydroxide : 1,35 g/ml to 1,40 g/ml for 9,5 % Al;

b) Polyaluminium chloride hydroxide sulfate:

   1) 1,18 g/ml to 1,22 g/ml for 5,3 % Al;

   2) 1,16 g/ml for 4,2 % Al.

3.4.3.3 Solubility

All polyaluminium chloride hydroxides and polyaluminium chloride hydroxide sulfates are fully miscible with water.

NOTE Depending on the particular product, dilute solutions can hydrolyze and form a precipitate.

3.4.3.4 Vapour pressure

Not known.

3.4.3.5 Boiling point at 100 kPa [12)]

Not known.

3.4.3.6 Crystallisation point

Typical values for solutions:

a) Polyaluminium chloride hydroxide:

   1) - 20 °C for 9,5 % Al;

   2) 0 °C for 12,4 % Al;

b) Polyaluminium chloride hydroxide sulfate:

   1) - 10 °C to - 15 °C for 5,3 % Al;

12) 100 kPa = 1 bar.

2) - 5 °C for 4,2 % Al.

3.4.3.7 Specific heat

Not known.

3.4.3.8 Viscosity (dynamic)

Typical values for solutions at 20 °C:

a) polyaluminium chloride hydroxide : 10 mPa.s to 50 mPa.s for 9,5 % Al;

b) polyaluminium chloride hydroxide sulfate : 3 mPa.s to 10 mPa.s for 5,3 % Al.

3.4.3.9 Critical temperature

Not applicable.

3.4.3.10 Critical pressure

Not applicable.

3.4.3.11 Physical hardness

Not applicable.

3.4.4 Chemical properties

Polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate are acidic liquids which hydrolyze and form a precipitate of aluminium hydroxide when diluted beyond a particular level.

Since aluminium compounds are amphoteric in nature, the solubility of aluminium depends on the pH value and the products should be used within an appropriate pH range.

NOTE A characteristic of these products is their high tendency to hydrolyze which restricts their use; this tendency results from the particular oligomeric or polymeric composition.

These products vary in their relative basicity (mole ratio OH/3Al), the percentage of chloride and sulfate ions present and in their method of manufacture.

These variations may affect their performance in the water treatment plant. Special water plant requirements regarding, but not limited to, such items as organic matter removal, residual aluminium levels and working pH values should be specified when possible, so that the product which best fits the need can be offered.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for aluminium based coagulants used for the treatment of water for swimming pools. Limits are given for impurities commonly present in the products. 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 these products should check the national regulations in order to clarify whether they are of appropriate purity for treatment of water for swimming pools, taking into account water quality, required

dosage, contents of other impurities and additives used in these products not stated in these product standards.

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 other 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 ion content) in the manufactured product expressed in grams per kilogram of product shall be within ± 3 % of the manufacturer's declared values.

NOTE The concentration of water-soluble aluminium in commercial products varies. Typical values are given in Table 6.

Table 6 — Typical values

Product	**Commercial form**	**Al** g/kg of product
Aluminium sulfate	Solid	72 to 91
	Solution	32 to 44
Sodium aluminate	Solid	225 to 238
	Solution	100 to 132
Aluminium chloride [a]	Solution	30 to 124
Aluminium chloride hydroxide [a]	Solid	30 to 254
Aluminium chloride hydroxide sulfate [a]		
Polyaluminium chloride hydroxide [b]	Solution	30 to 124
Polyaluminium chloride hydroxide sulfate [b]	Solid	30 to 254

[a] The commercial products vary in the proportions of chloride and sulfate ions.

The relative basicity of these products, expressed as the mole ratio OH/3Al, shall be less than or equal to 0,35.

[b] The commercial products vary in the proportions of chloride and sulfate ions.

The relative basicity of these products, expressed as the mole ratio OH/3Al, shall be greater than 0,35.

4.3 Impurities and main by-products

Impurities derived from the manufacturing or extraction processes include insoluble matter, trace metals and organic compounds. If iron is present, the products shall conform to the requirements specified in Table 7.

Table 7 — Limits of impurities

Product	Grade	Impurity	Limit g/kg of Al
Aluminium sulfate	Iron free	Iron (Fe) max.	1,60
	Low iron	Iron (Fe) max.	1,60 <Fe ≤ 115
	All grades	Insoluble matter max.	23
Sodium aluminate		Iron (Fe) max.	0,8
		Insoluble matter (solid product) max.	8
NOTE The value quoted for iron is both iron (II) and iron (III).			

4.4 Chemical parameters

The product shall conform to the requirements specified in Table 8.

Table 8 — 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, see [1]. For maximum impact of these products on trace metal content in drinking water see A.2.				

5 Test methods

5.1 Sampling

5.1.1 Solid

Observe the general rules 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 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 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.

5.1.2.2 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

Use the relevant methods described in EN 1302.

6 Labelling - transportation - storage

6.1 Means of delivery

Solids: the products shall be delivered in suitable packages, paper or plastics bags

Liquids: the products shall be delivered in containers of corrosion-resistant materials suitable for the purpose.

NOTE The manufacturer can provide advice on suitable materials.

In order that the purity of the products 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 in accordance with the EU directives [13)]

The following labelling requirements shall apply to the following aluminium based coagulants at the date of publication of this European Standard:

Aluminium sulfate:

Figure 1 — GHS 05

— Signal word:

Danger

— Classification and hazard statement:

H318: Causes serious eye damage.

13) See [2].

Aluminium chloride(monomeric), aluminium chloride hydroxide (monomeric), aluminium chloride hydroxide sulfate (monomeric)

Depending on the relative basicity, composition and concentration:

a) Anhydrous (solid)

Figure 2 — GHS 05

— Signal word :

Danger

— Classification and hazard statement:

H314: Causes severe skin burns and eye damage.

b) Aqueous solutions (liquid)

Figure 3 — GHS 05

— Signal word:

Danger

— Classification and hazard statement:

H318: Causes serious eye damage.

H290: May be corrosive to metals.

Sodium aluminate

— Signal word :

Danger

— Classification and hazard statement:

H290: May be corrosive to metals.

Additional text : corrosive to aluminium, but not to steel

H314: Causes severe skin burns and eye damage

H318 : Causes serious eye damage

Figure 4 — GHS 05

Polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate

Depending on the relative basicity, composition and concentration, there are two possible labels:

(a1)

— Signal word:

Danger

— Classification and hazard statement:

H318: Causes serious eye damage.

H290: May be corrosive to metals.

Figure 5 — GHS 05

(a2) Conclusive but not sufficient for classification

(b)

— Signal word:

Danger

— Classification and hazard statement:

H318: Causes serious eye damage.

H290: May be corrosive to metals.

Figure 6 — GHS 05

The regulation [2], and 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

6.3.1 Aluminium chloride(monomeric), aluminium chloride hydroxide (monomeric), aluminium chloride hydroxide sulfate (monomeric), polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate

Depending on the composition, the commercial product can be subject to transportation regulations and, if so, these products are listed as UN [14] number 1760 (corrosive liquid not otherwise specified):

— RID [15]: class 8, classification code C9; packing group I;

— ADR [16]: class 8, classification code C9; packing group I;

— IMDG [17]: class 8;

— IATA [18]: class 8.

Or UN Number 2581:

— RID: class 8, classification code C1; packing group III;

14) United nations Number.

15) Regulations concerning International carriage of Dangerous goods by rail.

16) European Agreement concerning the international carriage of Dangerous goods by Road.

17) International Maritime transport of Dangerous Goods.

18) International Air Transport Association.

— ADR: class 8, classification code C1; packing group III;

— IMDG: class 8;

— IATA: class 8.

6.3.2 Sodium aluminate

Depending on the composition, the commercial product can be subject to transportation regulations and, if so, these products are listed as UN number 2812:

— RID class 8; classification code C6;

— ADR class 8; classification code C6;

— IMDG: class 8;

— IATA: class 8.

6.3.3 Aluminium sulfate

The commercial product is not subject to transportation regulations.

6.4 Marking

The marking shall include the following information:

— name:

  — "Polyaluminium chloride hydroxide"; or

  — "Polyaluminium chloride hydroxide sulfate"; or

  — "Aluminium chloride (monomeric)"; or

  — "Aluminium chloride hydroxide (monomeric)"; or

  — "Aluminium chloride hydroxide sulfate (monomeric)";

  — "Aluminium sulfate"; or

  — "Sodium aluminate";

— trade name, grade and type;

— net mass;

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

— statement "This product conforms to EN 15031".

6.5 Storage

6.5.1 General

Storage containers shall be of corrosion-resistant material suitable for the purpose.

The manufacturer can provide advice on suitable materials.

Storage containers located outside can require protection against extreme temperature, depending on freezing point and maximum storage temperature: refer to manufacturer's information on permissible temperatures.

6.5.2 Long term stability

The aluminium based coagulants are usually stable except for solid sodium aluminate which is stable for no more than one year as the product is hygroscopic.

Sodium aluminate solutions are stable for a maximum of three months, depending on mole ratio Na_2O/Al_2O_3, concentrations of active matter and stabiliser. Unstabilised sodium aluminate solutions of 2,6 % Al to 5,3 % Al will decompose within a few days.

6.5.3 Storage incompatibilities

Avoid contact with chlorites, hypochlorites and sulfites. Only for sodium aluminate, avoid contact with acidic compounds.

The products react aggressively with some metal surfaces (e.g. galvanised metal, aluminium, copper, zinc and alloys of these metals).

For aluminium chloride (monomeric), aluminium chloride hydroxide (monomeric), aluminium chloride hydroxide sulfate (monomeric), polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate, these products are incompatible with iron salts and aluminium sulfate and are also incompatible with other polyaluminium salts. Special care has to be taken regarding any mixing with products previously used in order to avoid gel formation or precipitation. Seek manufacturer's advice.

Annex A
(informative)

General information on aluminium based coagulants

A.1 Origin

A.1.1 Raw materials

See EN 878, EN 881, EN 882 and EN 883.

A.1.2 Manufacturing process

See EN 878, EN 881, EN 882 and EN 883.

A.2 Use

A.2.1 Function

The products are used as coagulants to enhance the removal of dissolved, colloidal and suspended material (including micro-organisms) by filtration.

A.2.2 Form in which the products are used

The products are used either as delivered or prediluted according to the manufacturer's recommendations.

A.2.3 Treatment dose

The treatment dose depends on the quality of the swimming pool water. The minimum dose is normally approximately 0,05 g aluminium per cubic metre of water recirculated through the filter.

A.2.4 Means of application

The products are usually applied either using a positive-displacement metering pump or manually:

— by metering pump: sufficient turbulence should be provided at the point of addition to promote rapid dispersion;

— manually:

  — liquid: application on water surface, filtration stopped and with no skimmer. The precipitate will be removed after one night by using a pool vacuum and the water sent to waste;

  — solid: put in the basket (prefilter) of the filtration pump or in the basket of the skimmer to improve the performance of sand filter.

The products are dosed prior to medium rate sand filters; a delay time of at least 10 s should be provided between dosing and the water reaching the filters whereby the flow velocity of the water should not exceed 1,5 m/s.

A.2.5 Secondary effects

— Reduction of pH value and alkalinity;

— increase of respective anion concentration.

A.2.6 Removal of excess product

The water purification process should be operated under conditions (e.g. pH) in which the aluminium ions in the system are precipitated and reduced to an acceptable concentration. Aluminium-based coagulants perform best when the pH is between 6,5 and 7,4. Coagulant dosing is not recommended with high rate sand filters, because the precipitated coagulant could pass through the filter, or with diatomaceous earth filters which would block.

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 First aid

In case of contact with the skin, take off immediately all contaminated clothing; wash thoroughly with plenty of cold water and seek medical advice if irritation persists.

In case of contact with the eyes, immediately rinse with plenty of water and seek medical advice.

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

In case of ingestion, do not induce vomiting. Seek medical advice immediately.

B.2.2 Spillage

Put on protective clothing. Collect and dispose of liquid spillages carefully.

Dilute small liquid spillages with plenty of water and flush to sewer. Neutralise and dispose of large spillages of liquids.

NOTE 1 Local regulations might apply to the disposal of these products.

NOTE 2 Suitable neutralising chemicals are diluted sodium hydroxide or sodium carbonate, lime or calcium carbonate for the products that are weak acids. For sodium aluminate, the suitable neutralising chemical is diluted (10 %) sulfuric acid.

B.2.3 Fire

The products are non-flammable. Any extinguishing media may be used.

For aluminium chloride (monomeric), aluminium chloride hydroxide (monomeric), aluminium chloride hydroxide sulfate (monomeric), polyaluminium chloride hydroxide and polyaluminium chloride hydroxide sulfate, these products can liberate hydrogen chloride (or sulfur oxides) when boiled to dryness or heated above 200 °C.

For aluminium sulfate, the product can liberate toxic and corrosive fumes of sulfur dioxide and trioxide under extreme conditions when boiled to dryness or heated above 600 °C.

For sodium aluminate, protective clothing shall be put on. Be aware that the product forms with water aggressive alkaline solutions.

Bibliography

[1] Directive 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)

[3] EN 878, *Chemicals used for treatment of water intended for human consumption — Aluminium sulphate*

[4] EN 881, *Chemicals used for treatment of water intended for human consumption — Aluminium chloride (monomeric), aluminium chloride hydroxide (monomeric) and aluminium chloride hydroxide sulfate (monomeric)*

[5] EN 882, *Chemicals used for treatment of water intended for human consumption — Sodium aluminate*

[6] EN 883, *Chemicals used for treatment of water intended for human consumption — Polyaluminium chloride hydroxyde and polyaluminium chloride hydroxyde sulfate*

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