BS EN 15028:2012

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN 15028:2012. It supersedes BS EN 15028:2006 which is withdrawn.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.

Published by BSI Standards Limited 2013

ISBN 978 0 580 77701 1

ICS 13.060.20; 71.100.80

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15028

November 2012

ICS 71.100.80

Supersedes EN 15028:2006

English Version

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumchlorat

This European Standard was approved by CEN on 16 September 2012.

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Ref. No. EN 15028:2012: E

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Foreword

This document (EN 15028:2012) 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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.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 15028:2006.

Significant technical differences between this edition and EN 15028:2006 are as follows:

a) Modification of 6.2 on labelling, deletion of the reference to EU Directive 80/778/EEC of 15 July 1980 in order to take account of the latest Directive in force.

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 intended for human consumption, caused by the product covered by this European Standard:

a) this European 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.

NOTE Conformity with this European 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.

1 Scope

This European Standard is applicable to sodium chlorate used for treatment of water intended for human consumption. It describes the characteristics of sodium chlorate and specifies the requirements and the corresponding test methods for sodium chlorate. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use of sodium chlorate (see Annex B) and gives the environmental, health and safety precautions within chemical laboratory (see Annex C).

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 ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696)*

EN ISO 11885, *Water quality — Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885)*

EN ISO 12846, *Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment (ISO 12846)*

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

Sodium chlorate

3.1.2 Synonym or common names

None (for the processes related to treatment of drinking water)

NOTE Commercial names of formulations might exist. Purity needs to be checked in case of use for treatment of water.

3.1.3 Relative molecular mass

106,45

3.1.4 Empirical formula

$NaClO_3$

3.1.5 Chemical formula

$NaClO_3$

3.1.6 CAS Registry Number [1]

7775-09-9

3.1.7 EINECS reference [2]

231-887-4

3.2 Commercial form

Sodium chlorate is commercially available in crystalline form or as a powder and as an aqueous solution.

3.3 Physical properties

3.3.1 Appearance and odour

The product is a colourless solid as a powder or the product is a faint blue to colourless solution.

3.3.2 Density

The density of an aqueous solution of sodium chlorate is given in Table 1.

Table 1 — Density of sodium chlorate solution

Concentration of aqueous solution of sodium chlorate solution (Mass fraction in %)	**Density** (g/ml at 20 °C)
30	1,24
40	1,33
50	1,44

3.3.3 Solubility in water

The solubility of sodium chlorate in water is given in Table 2.

Table 2 — Solubility of sodium chlorate

Temperature (°C)	**Solubility** (g/l)
10	650
20	700
40	780
60	880

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[1] Chemical Abstracts Service Registry Number.

[2] European Inventory of Existing Commercial Chemical Substances.

3.3.4 Vapour pressure

Not applicable (thermal decomposition occurs at ≥ 400 °C)

3.3.5 Boiling point at 100 kPa [3]

The boiling point of aqueous solutions of sodium chlorate is given in Table 3.

Table 3 — Boiling point at 100 kPa of aqueous solutions of sodium chlorate

Concentration of aqueous solution of sodium chlorate (g $NaClO_3$ /kg of saturated solution)	400	450	500	550	600	650	700
Boiling point (°C)	106	107	109	110	111	113	116

3.3.6 Crystallisation

The crystallisation point of aqueous solutions of sodium chlorate depending on concentration in water is given in Table 4.

Table 4 – Crystallisation point of sodium chlorate aqueous solutions

Concentration of aqueous solution of sodium chlorate (mass fraction in %)	**Crystallisation point (°C)**
40	-20
45	0
50	20
55	32
60	55

3.3.7 Melting point

The melting point (of the solid) is 248 °C; and the thermal decomposition is at ≥ 400 °C.

3.3.8 Viscosity (dynamic)

The relative viscosity of aqueous solutions of mass fraction of 40 % of sodium chlorate compared with water at the same temperature between 25 °C and 35 °C is 2,07.

3.3.9 Critical temperature in aqueous solution

Not applicable.

3.3.10 Critical pressure

Not applicable.

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[3] 100 kPa = 1 bar.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

The sodium chlorate is a strong oxidising agent.

NOTE 1 When an acidic sodium chlorate solution is treated with a reducing agent (e.g. hydrogen peroxide (EN 902) or oxalic acid), chlorine dioxide can be formed.

NOTE 2 The formation of chlorine dioxide can also be obtained by acidification if the acid applied is capable of acting as a reducing agent in the current environment.

For the purpose of drinking water treatment one should use acids of quality in accordance with existing standards for the purpose: hydrochloric acid (EN 939); sulfuric acid (EN 899); phosphoric acid (EN 974).

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for sodium chlorate 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 be user and when necessary to relevant authorities.

NOTE 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 product standard.

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 impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of commercial product

The sodium chlorate is commercially available as solid forms usually with a minimum dry mass fraction of 99 % of $NaClO_3$.

Commercial solutions if used for water treatment shall be certified to be made-up on the basis of the product with a dry mass fraction of 99 %. No additional substances like colorants shall be added to the basic product or to the solutions.

The content of sodium chlorate in commercially available solutions shall be within 3 % of the manufacturer's declared value.

4.3 Impurities and main by-products

NOTE Sodium chlorate in crystalline form contains normally a maximum mass fraction of 0,1 % of sodium chloride (as NaCl).

4.4 Chemical parameters

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

Table 5 – Chemical parameters

Parameter		**Limit in sodium chlorate (mass fraction 100 %)**
		(mg/kg)
Arsenic (As)	max.	1
Cadmium (Cd)	max.	1
Chromium (Cr)	max.	5
Mercury (Hg)	max.	1
Nickel (Ni)	max.	1
Lead (Pb)	max.	1
Antimony (Sb)	max.	1
Selenium (Se)	max.	1

NOTE Cyanide which does not exist in a strong oxidising medium such as sodium chlorate is not a relevant chemical parameter. Pesticides and polycyclic aromatic hydrocarbons are not by-products of the manufacturing process. For parametric values of sodium chlorate on trace metal content in drinking water, see [1].

5 Test methods

5.1 Sampling

5.1.1 General

Observe the recommendations of ISO 3165 and take account of 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 a 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 Analysis

5.2.1 Determination of sodium chlorate (main product)

5.2.1.1 General

This method is valid for determination of sodium chlorate in products containing sodium chlorate exclusively, mainly as a solid made up in solution for analytical purposes.

5.2.1.2 Principle

Chlorate ion is reduced by excess of iron (II) by heating at low pH. Remaining iron (II) is determined titrimetrically with chromium (VI).

Reactions: $ClO_3^- + 6\,e^- + 6\,H^+ \rightarrow Cl^- + 3\,H_2O$

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

$Cr_2O_7^{2-} + 14\,H^+ + 6\,e^- \rightarrow 2\,Cr^{3+} + 7\,H_2O$

5.2.1.3 Reagents

All reagents shall be of a recognised analytical grade and the water used shall conform to grade 3 in accordance with EN ISO 3696.

5.2.1.3.1 Mixed acid solution

Add 150 ml concentrated sulfuric acid and 150 ml concentrated phosphoric acid slowly in 700 ml water while cooling.

5.2.1.3.2 Iron (II) ion solution, 0,23 mol/l

Dissolve 75,2 g of ammonium iron (II) sulfate hexahydrate ($(NH_4)_2Fe(SO_4)_2.6H_2O$) in 1 l of sulfuric acid solution at 1 mol/l.

This solution is used without further standardization.

5.2.1.3.3 Indicator

Weigh 0,20 g of sodium diphenylamine sulfonate indicator and place in a 100 ml volumetric flask. Add 50 ml water to dissolve the indicator, followed by 5 ml of mixed acid (5.2.1.3.1). Make up to the mark with water.

5.2.1.3.4 Potassium dichromate solution, $c(K_2Cr_2O_7)$ =0,05 mol/l (primary standard)

Dry potassium dichromate ($K_2Cr_2O_7$) crystals (primary standard or analytical grade) between 140 °C and 180 °C for 30 min to 60 min. Weigh 13,82 g of dry $K_2Cr_2O_7$, place into a 1 000 ml volumetric flask and add water to approximately 750 ml. Dissolve and make up to the mark with water. Pour into a clean, dry container.

5.2.1.4 Apparatus

Ordinary laboratory apparatus and glassware, together with the following.

5.2.1.4.1 Titration apparatus, a manual titrator or a titroprocessor with redox electrode

5.2.1.4.2 Analytical balance (0,1 mg accuracy)

5.2.1.4.3 Weighing glasses, small

5.2.1.4.4 Hotplate

5.2.1.5 Procedure

5.2.1.5.1 General

Prepare samples and a blank.

5.2.1.5.2 Test portion

Weigh, to the nearest 0,1 mg, a test portion (*m*) containing between 0,2 g and 0,3 g of the sodium chlorate in solution into a weighing glass (5.2.1.4.3).

5.2.1.5.3 Determination

Transfer the test portion (5.2.1.5.2) to a 250 ml conical flask containing 50 ml iron (II) solution (5.2.1.3.2) and 20 ml of mixed acid solution (5.2.1.3.1).

Heat to boil.

Add 150 ml of water and 10 drops of indicator (5.2.1.3.3) to the solution.

Titrate with the potassium dichromate solution (5.2.1.3.4) to the end point, the colour changes from green to purple.

Record the volume V_x for the test solution end point and the volume V_y for the blank test solution end point. The blank test solution volume, V_y, is approximately 40,5 ml and the volume V_x is approximately 8,5 ml for 0,40 g of mass fraction of 40 % $NaClO_3$ solution.

5.2.1.6 Expression of results

The sodium chlorate ($NaClO_3$) content, C_1, expressed as mass fraction in %, is given by the following formula:

$$C_1 = \frac{(V_y - V_x) \times C_{K_2Cr_2O_7} \times M \times 100}{m \times 1000} = \frac{(V_y - V_x) \times 0{,}500}{m} \quad (1)$$

where

V_y	is the volume, in millilitres, of potassium dichromate solution (5.2.1.3.4) used for titration at the end point for the blank test solution;
V_x	is the volume, in millilitres, of potassium dichromate solution (5.2.1.3.4) used for titration at the end point for the test solution sample;
$C_{K2Cr2O7}$	is the concentration of the potassium dichromate solution (5.2.1.3.4), 0,046 97 mol/l;
m	is the mass in grams of the test portion;
M	is the molar mass of sodium chlorate (M = 106,441).

Express the result with one decimal.

For certification of the product at least three samples shall be analyzed in parallel and the results shall be found consistent within a standard deviation of mass fraction of 0,004 %.

5.2.2 Chemical parameters

5.2.2.1 Determination of antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), nickel (Ni) and selenium (Se)

5.2.2.1.1 Principle

The elements arsenic, antimony, cadmium, chromium, lead, nickel and selenium are determined by inductively coupled plasma optical emission spectrometry (ICP/OES).

5.2.2.1.2 Reagents

All reagents shall be of a recognised analytical grade and the water used shall conform to the grade 3 specified in EN ISO 3696.

5.2.2.1.2.1 Nitric acid, concentrated, density ρ = 1,42 g/ml.

5.2.2.1.2.2 As, Cd, Cr, Ni, Pb, Sb and Se element, stock solution, *c*(element) = 1 000 mg/l commercial solution.

5.2.2.1.2.3 Yttrium, internal standard, solution, *c*(Y) = 100 mg/l.

Prepare this solution by adding 10,00 ml of yttrium solution *c* (Y) = 1 000 mg/l to a 100 ml volumetric flask. Add 1 ml concentrated nitric acid (5.2.2.1.2.1). Make up to the mark with water.

5.2.2.1.3 Procedure

5.2.2.1.3.1 Test portion

Weigh, to the nearest 0,001 g, 10,0 g of sodium chlorate crystals or 20,0 g of a solution of a known amount of sodium chlorate into a 100 ml volumetric flask.

5.2.2.1.3.2 Test solution

To the test portion (5.2.2.1.3.1) add 10,00 ml of the yttrium solution (5.2.2.1.2.3) and 0,5 ml of nitric acid (5.2.2.1.2.1) and make up to 100 ml with water.

5.2.2.1.3.3 Determination

Determine the content of the elements in the test solution (5.2.2.1.3.2) in accordance with EN ISO 11885.

In addition to the determination carried out with EN ISO 11885 allow to add 10 mg/l of yttrium to reagent blank solution and to all reference solutions. Calibrate the instrument using yttrium as internal standard. The yttrium wavelengths is 371 nm or if not available 224 nm.

This method is providing an interim result (*y*) expressed in milligrams per litre which needs to be converted to give the final concentration according to the formula in 5.2.2.1.4.

5.2.2.1.4 Expression of results

From the interim result (*y*) determined (see 5.2.2.1.3.3), the content, C_2, of each element in the laboratory sample, expressed in milligrams per kilogram of sodium chlorate of mass fraction 100 % is given by the following formula:

$$C_2 = \frac{y \times V \times 100}{m \times C_1} \qquad (3)$$

where

y is the interim result (5.2.2.1.3.3);

V is the volume, expressed in millilitres, of the test solution (5.2.2.1.3.2) (= 100 ml);

m is the mass, expressed in grams, of the test portion;

C_1 is the content of the sodium chlorate in mass fraction in % (5.2.1.6).

5.2.2.2 Determination of mercury content (Hg)

5.2.2.2.1 Principle

The element mercury is determined by flameless atomic absorption spectrometry in accordance with EN ISO 12846.

5.2.2.2.2 Reagents

All reagents shall be of a recognised analytical grade and the water used shall conform to the grade 3 specified in EN ISO 3696.

5.2.2.2.2.1 Potassium permanganate solution, $c(KMnO_4)$ = 50 g/l.

5.2.2.2.2.2 Sulfuric acid, concentrated, density p = 1,84 g/ml.

5.2.2.2.2.3 Hydroxylammonium chloride, $c(NH_2OH{\cdot}HCl)$ = 100 g/l.

5.2.2.2.2.4 Potassium dichromate solution, $c(K_2Cr_2O_7)$ = 4 g/l in volume fraction 50 % nitric acid solution.

5.2.2.2.3 Procedure

5.2.2.2.3.1 Test portion

Weigh 10,0 g of sodium chlorate crystals or pipette 20,0 g of a solution containing sodium chlorate of content C_1 into a 100 ml volumetric flask. Make up to the mark with water and mix (solution A).

5.2.2.2.3.2 Test solution

Pipette, accurately 10 ml of the solution A. Transfer to a 250 ml conical flask, add 60 ml of water, 20 ml of a potassium permanganate solution (5.2.2.2.2.1) and five 1 ml portions of sulfuric acid (5.2.2.2.2.2). Heat and keep boiling for 10 min. Allow to cool. Dissolve the precipitate (MnO_2) with hydroxylammonium chloride (5.2.2.2.2.3), add 5 ml of the potassium dichromate solution (5.2.2.2.2.4) and transfer to a 100 ml (V_T) volumetric flask. Make up to the mark with water and mix.

5.2.2.2.3.3 Determination

Proceed as described in EN ISO 12846.

5.2.2.2.3.4 Expression of results

The interim result for mercury content (y) expressed in milligrams per litre is given by the following formula:

$$y = y_A \times \frac{V_T}{10} \qquad (4)$$

where

y_A is the result obtained, for the concentration of mercury in solution A, expressed in milligrams per litre;

V_T is the volume in millilitres of the test solution.

The content of mercury, C_2, in milligrams per kilogram of sodium chlorate with mass fraction of 100 % is given by the formula:

$$C_2 = y \, x \, \frac{10}{m_3} \, x \, \frac{100}{C_1} \qquad (5)$$

where

m_3 is the mass expressed in grams, of the test portion;

C_1 is the content of sodium chlorate in mass fraction in % (5.2.1.6).

6 Labelling - transportation - storage

6.1 Means of delivery

Sodium chlorate crystals shall be delivered in approved bags or bulk containers.

Aqueous solutions of sodium chlorate shall be delivered in approved polyethylene or stainless steal containers or tankers of up to 25 t capacity in accordance with national regulations.

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 according to the EU legislation 4)

The following labelling requirements shall apply to sodium chlorate in crystalline form or solution at the date of the publication of this European Standard.

Hazard pictograms

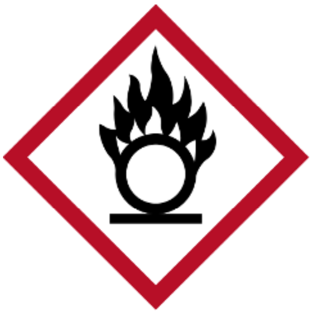

Figure 1 — GHS03

Figure 2 — GHS07

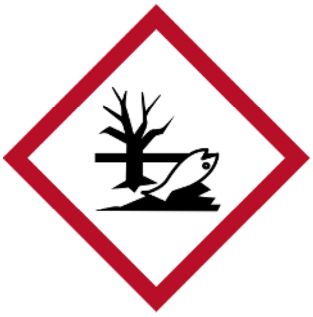

Figure 3 — GHS09

- Signal word :

Danger

- Hazard statement

H271 May cause fire or explosion; strong oxidiser

H 302 Harmful if swallowed

H411 Toxic to aquatic life with long lasting effects

NOTE 1 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.

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4) See [2].

NOTE 2 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

Sodium chlorate crystals are listed as UN Number[5] 1495.

RID[6] ADR[7] : Class 5.1, classification code O2; packing group II.

IMDG[8]: Class 5.1, packing group II

IATA[9]: Class 5.1, packing group II.

Sodium chlorate solution is listed as UN Number[5] 2428.

RID[6] ADR[7]: Class 5.1, classification code O1; packing group II.

IMDG[8]: Class 5.1, packing group II

IATA[9]: Class 5.1, packing group II.

6.4 Marking

The marking shall include the following:

- name "sodium chlorate", trade name and grade;
- net mass;
- name and address of supplier and/or manufacturer;
- statement "This product conforms to EN 15028".

6.5 Storage

6.5.1 General

The product shall be stored in suitable containers used exclusively for sodium chlorate. It shall be stored away from direct sunlight, in a cool, well-ventilated area, but at a temperature not lower than the crystallisation point (see 3.3.6).

6.5.2 Long-term stability

The product is stable for at least one year.

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[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.

6.5.3 Storage incompatibilities

The product shall not be allowed to come into contact with acids, combustible material or organic compounds (e.g. wood, paper and grease).

Annex A
(informative)

General information on sodium chlorate

A.1 Origin

A.1.1 Raw materials

Sodium chlorate is manufactured from sodium chloride (NaCl).

A.1.2 Manufacturing process

It is produced by an electrochemical process in which sodium chloride is converted to sodium chlorate and hydrogen (H_2).

A.2 Use

A.2.1 Function

Its function in water treatment is mainly the generation of chlorine dioxide by reaction with a reducing agent in acid medium. It can also be temporarily used directly for the cleaning/maintenance of premises, in such case it is mostly not dosed directly in the drinking water.

A.2.2 Form in which it is used

It is used as delivered or as a pre-blended aqueous solutions.

A.2.3 Treatment dose

The treatment dose depends on the composition of the raw water. Care should be taken not to exceed the general allowed residuals.

A.2.4 Means of application

It is applied using a metering-pump for aqueous solutions or by means of a chlorine dioxide generator (see [3]).

A.2.5 Secondary effects

The secondary effects include the following:

- oxidation of iron, manganese;
- odour and colour removal;
- oxidation of organic compounds.

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 General

Textile, cellulose or leather contaminated with dried sodium chlorate ignites easily.

B.2.2 First aid

Keep clothing contaminated with sodium chlorate wet, remove as quickly as possible and wash or immerse in water before it dries.

In case of inhalation remove to fresh air. Seek medical care immediately if toxic symptoms occur.

In case of contact with the skin wash skin with soap and water.

In case of contact with the eyes rinse immediately with water. Seek medical care if symptoms remain.

In case of ingestion rinse mouth and drink immediately two or more glasses of water or milk. Do not induce vomiting. Seek medical care if more than a negligible amount has been swallowed.

B.2.3 Spillage

Rinse with plenty of water.

Textile, cellulose or leather contaminated with dried sodium chlorate ignites easily.

If used in closed rooms, foresee preventive venting.

B.2.4 Fire

Use water as extinguishing medium. Do not use powder or CO_2-type extinguisher.

Annex C
(informative)

Environmental, health and safety precautions within chemical laboratory

When preparing the analytical methods for application of this European Standard consideration was given to the minimisation of environmental impacts caused by the use of the methods of analysis.

It is the user's responsibility to use safe and proper techniques in handling materials in the methods of analysis specified in this European Standard.

The following list is not exhaustive but users of the analytical methods referred in this European Standard may use it as a guide to the use of safe and proper techniques. They should:

- investigate if European Directives, transposed European legislation and national laws, regulations and administrative provisions apply;
- consult manufacturers/ suppliers for specific details such as material safety data sheets and other recommendations;
- use safety equipment and wear protective clothing, usually goggles and coats, appropriate for the test product and the test chemicals, in all laboratory areas, to ensure the safety of the operator;
- be careful about flammable materials and substances that are toxic and/ or human carcinogens and generally take care during transportation, decanting, diluting and dealing with spillages;
- use a fume cupboard during preparation of organic solvent solutions;
- store, handle and dispose of chemicals in a safe and environmentally satisfactory manner: including chemicals for laboratory test, test specimens, unused solvents and reagents that have to be disposed of.

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)

[3] General information on chlorine dioxide in Water Quality Control: *Numéro Spécial de la Tribune de l'Eau, Vol. 54, N^{os}; Ed. CEBEDOC, Rue Armand Stévart, 2, B-4000 Liège*

[4] EN 899, *Chemicals used for treatment of water intended for human consumption — Sulfuric acid*

[5] EN 902, *Chemicals used for treatment of water intended for human consumption — Hydrogen peroxide*

[6] EN 939, *Chemicals used for treatment of water intended for human consumption — Hydrochloric acid*

[7] EN 974, *Chemicals used for treatment of water intended for human consumption — Phosphoric acid*

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