SLOVENSKI STANDARD
SIST EN 900:2000

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Kemikalije, ki se uporabljajo za pripravo pitne vode - Kalcijev hipoklorit

Chemicals used for treatment of water intended for human consumption - Calcium hypochlorite

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Calciumhypochlorit

Produits chimiques utilisés pour le traitement de l'eau destinée a la consommation humaine - Hypochlorite de calcium

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13.060.20	Pitna voda	Drinking water
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EUROPEAN STANDARD
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EN 900

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English version

Chemicals used for treatment of water intended for human consumption - Calcium hypochlorite

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Calciumhypochlorit

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 164 "Water supply", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Annex A is informative.

The Annexes B and C are normative.

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this Standard :

1) this Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA ;

2) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This European Standard is applicable to calcium hypochlorite used for treatment of water intended for human consumption. It describes the characteristics of calcium hypochlorite and specifies the requirements and the corresponding test methods for calcium hypochlorite. It gives information on its use in water treatment.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods* (ISO 3696:1987).

ISO 3165, *Sampling of chemical products for industrial use - Safety in sampling.*

ISO 5666-1:1983, *Water quality - Determination of total mercury by flameless atomic absorption spectrometry - Part 1 : Method after digestion with permanganate-peroxodisulfate.*

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.*

ISO 8288, *Water quality - Determination of cobalt, nickel, copper, zinc, cadmium and lead - Flame atomic absorption spectrometric methods.*

ISO 9174, *Water quality - Determination of chromium - Atomic absorption spectrometric methods.*

3 Description

3.1 Identification

3.1.1 Chemical name

Calcium hypochlorite.

3.1.2 Synonym or common name

None.

3.1.3 Relative molecular mass

142,99.

3.1.4 Empirical formula

$Ca(ClO)_2$.

3.1.5 Chemical formula

$Ca(ClO)_2$.

3.1.6 CAS Registry Number [1)]

7778-54-3.

3.1.7 EINECS reference [2)]

231-908-7.

3.2 Commercial form

The product is available as a granular solid or in the form of tablets.

3.3 Physical properties

3.3.1 Appearance

The product is white free-flowing granules or white tablets

3.3.2 Density

The bulk density is approximately 0,8 g/cm^3 for loose granular material, and 1,9 g/cm^3 for tablets.

3.3.3 Solubility in water

The solubility is180 g/l at 25 °C.

3.3.4 Vapour pressure

Not applicable.

3.3.5 Boiling point at 100 kPa [3)]

Not applicable.

3.3.6 Melting point

Not applicable as the product decomposes at 177 °C.

3.3.7 Specific heat

Not known.

3.3.8 Viscosity, dynamic

Not applicable.

3.3.9 Critical temperature

Not applicable.

[1)] Chemical Abstracts Service Registry Number.

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

[3)] 100 kPa = 1 bar.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Solutions of calcium hypochlorite are alkaline. The pH value of a solution of concentration 10 g/l is about 11,5 at 25 °C.

Calcium hypochlorite is a strong oxidant, it reacts with acids and acidic salts to form chlorine. In the presence of inflammable substances, it causes fires and explosions of organic compounds, oxidation reactions occur with release of heat and of moisture, it is highly corrosive to most metals.

4 Purity criteria

Limits have been given for impurities and toxic substances where these are likely to be present in significant quantities from the current production process and raw materials. If a change in the production process or raw materials leads to significant quantities of other impurities or by-products being present, this shall be notified to the user.

4.1 Composition of commercial product

The product shall contain a minimum of 65,5 percent by mass (% (*m/m*)) calcium hypochlorite (equivalent to an available active chlorine content of at least 65 % (*m/m*)).

Dissolution quality, calculated as available chlorine which is obtainable within 1 min after dissolution in water, shall not be less than 45, 5 % (*m/m*).

4.2 Impurities and main by-products

The sodium chloride content shall not exceed 18 % (*m/m*) of the product.

The content of water-insoluble matter shall not exceed 4 % (*m/m*) of the product.

NOTE The water content at the time of delivery should not exceed 5,5 % (*m/m*) of the product. As the test method is usually not conducted by the user without danger of explosion, the manufacturer should guarantee to maintain this value. If necessary a test laboratory can be requested to carry out this test. This determination should be carried out by specialists only.

4.3 Toxic substances

NOTE For the purpose of this standard, "toxic substances" are those defined in the EU Directive 80/778/EU of July 15, 1980 (see [1]).

The content of toxic substances shall conform to the requirements specified in table 1.

Table 1 - Toxic substances

Parameter		Limit in mg/kg of available chlorine	
		Type 1	Type 2
Arsenic (As)	max.	5	10
Cadmium (Cd)	max.	5	10
Chromium (Cr)	max.	15	15
Mercury (Hg)	max.	5	7
Nickel (Ni)	max.	8	10
Lead (Pb)	max.	15	15
Antimony (Sb)	max.	15	15
Selenium (Se)	max.	20	20
NOTE Cyanide which does not exist in a strong oxidizing medium such as calcium hypochlorite is not a relevant toxic substance. Pesticides and polycyclic aromatic hydrocarbons are not by-products of the manufacturing process.			

5 Test methods

5.1 Sampling

Observe the general recommendations of ISO 3165 and take account of ISO 6206. Prepare the laboratory sample(s) required by the relevant procedure described in ISO 8213.

5.2 Analysis

5.2.1 Determination of calcium hypochlorite content(main product)

5.2.1.1 General

This method applies to products with available chlorine contents within the range 40 % (*m/m*) to 70 % (*m/m*).

5.2.1.2 Principle

Calcium hypochlorite reacts with potassium iodide to release iodine in the presence of acetic acid. The iodine is titrated with sodium thiosulfate standard volumetric solution in the presence of starch indicator solution.

5.2.1.3 Reagents

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

5.2.1.3.1 Potassium iodide crystals (KI)

5.2.1.3.2 Glacial acetic acid

5.2.1.3.3 Sodium thiosulfate standard volumetric solution, $c(Na_2S_2O_3.5H_2O)$ = 0,1 mol/l

Dissolve 24,8 g of $Na_2S_2O_3.5H_2O$ in water. Add 0,5 ml of chloroform as preservative, dilute to volume with water in a 1000 ml one-mark volumetric flask and mix thoroughly.

To standardize : Weigh, to the nearest 0,1 mg, (160 ± 10) mg (*m*)of primary standard potassium dichromate into a tared glass beaker. Place the contents of the beaker in a 500 ml stoppered conical flask, add 100 ml of water and (2 ± 0,5) g of potassium iodide and stir to dissolve. Add (15 ± 1) ml of hydrochloric acid solution (diluted 1 + 1 by volume), swirl, and allow to stand for 5 min. Titrate with the sodium thiosulfate solution until the solution is pale yellow. Add (5 ± 1) ml of starch solution (5.2.1.3.4) and titrate to the end point, i.e. to the disappearance of the blue-black colour. Record the volume *(V)* used.

The concentration, *c*, of the sodium thiosulfate standard volumetric solution ($Na_2S_2O_3.5H_2O$), expressed in moles per litre is given by the following equation :

$$c = \frac{m}{V \times 49{,}0317}$$

where

m is the mass, in milligrams, of potassium dichromate ($K_2Cr_2O_7$) weighed ;

V is the volume, in millilitres, of the sodium thiosulfate standard volumetric solution used.

5.2.1.3.4 Starch solution, 1 % (*m/m*).

Make a slurry with (1 ± 0,1) g starch and (5 ± 1) ml water. Add (90 ± 5) ml boiling water to the slurry. Stir to dissolve it and cool the solution. This solution needs refrigeration to avoid the decomposition of the starch which results in a vague end point. Keep the solution cool and use it within one week.

NOTE Commercial indicators for iodine titration exist and can be used in place of the described starch solution provided that their efficiency has been previously tested.

5.2.1.4 Apparatus

Ordinary laboratory apparatus and glassware, together with the following :

5.2.1.4.1 Laboratory sonic vibrator

5.2.1.5 Procedure

5.2.1.5.1 Test portion

Weigh, to the nearest 0,1 mg, 3,5 g of the laboratory sample *(m_1)* into a tared stoppered weighing bottle.

5.2.1.5.2 Determination

Transfer the test portion to a 500 ml volumetric flask with 300 ml of water, stopper, and place in the sonic vibrator (5.2.1.4.1) for 10 min, swirling it occasionally until the test portion is in solution. Dilute to the mark with water.

Place a magnetic stirring bar into the volumetric flask and begin mixing. Transfer 25 ml, while the test portion is being stirred and without allowing any insoluble matter to settle out, into the 500 ml conical flask.

Add 100 ml of water and 2 g of potassium iodide (5.2.1.3.1), and mix to dissolve. Add 8 ml of glacial acetic acid (5.2.1.3.2), stir and titrate immediately with the sodium thiosulfate standard volumetric solution (5.2.1.3.3) to a light yellow colour. Add 3 ml of the starch solution (5.2.1.3.4) and continue titration to the disappearance of the blue black colour. Record the volume V_1, of the sodium thiosulfate standard volumetric solution used.

5.2.1.6 Expression of results

The chlorine (Cl_2) content, C_1, expressed as a percentage by mass, is given by the following equation :

$$C_1 = \frac{V_1 \times c \times 35{,}453 \times 20 \times 100}{m_1}$$

where

V_1 is the volume, in millilitres, of the sodium thiosulfate solution (5.2.1.3.3) used for the titration ;

c is the concentration, in moles per litre, of the sodium thiosulfate standard volumetric solution (5.2.1.3.3) ;

m_1 is the mass, in milligrams, of the test portion (5.2.1.5.1) ;

35,453 is the mass in milligrams of chlorine (Cl_2) corresponding to 1,00 ml of sodium thiosulfate solution $c(Na_2S_2O_3.5H_2O)$ = 1,000 mol/l.

The $Ca(ClO)_2$ content, C_2, expressed as a percentage by mass of product, is given by the following equation :

$$C_2 = \frac{C_1 \times 3{,}5746}{3{,}5453}$$

5.2.1.7 Repeatability limit

The absolute difference between two single test results, obtained under repeatability conditions, shall not be greater than the repeatability value, r, as calculated from the following equation :

$$r = 0{,}01\ z$$

where z is the mean of the two results, expressed in % (*m/m*).

NOTE Repeatability conditions are conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

5.2.2 Dissolution quality (available chlorine after 1 min)

5.2.2.1 Principle

After dissolving in water, by stirring during 1 min, of a representative sample of calcium hypochlorite, the available chlorine is determined by measuring active chlorine in the solution. The oxidizing chlorine reacts with potassium iodide releasing iodine which is then titrated with sodium thiosulfate in the presence of starch indicator solution.

5.2.2.2 Reagents

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

5.2.2.2.1 Sodium thiosulfate standard volumetric solution, $c(Na_2S_2O_3.5H_2O)$ = 0,1 mol/l (see 5.2.1.3.3).

5.2.2.2.2 Potassium iodide, crystals.

5.2.2.2.3 Glacial acetic acid.

5.2.2.2.4 Starch indicator solution 1 % (*m/m*) (see 5.2.1.3.4).