SLOVENSKI STANDARD
SIST EN 901:2000

01-november-2000

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumhypochlorit

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

Ta slovenski standard je istoveten z: **EN 901:1999**

ICS:

13.060.20	Pitna voda	Drinking water
71.100.80	Kemikalije za čiščenje vode	Chemicals for purification of water

SIST EN 901:2000 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 901

October 1999

ICS 71.100.80

English version

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumhypochlorit

This European Standard was approved by CEN on 5 September 1999.

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 Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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

Ref. No. EN 901:1999 E

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 sodium hypochlorite used for treatment of water intended for human consumption. It describes the characteristics of sodium hypochlorite and specifies the requirements and the corresponding test methods for sodium 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 - Specifications 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 8288, *Water quality - Determination of cobalt, nickel, copper, zinc, cadmium and lead - Flame atomic absorption spectrometric methods.*

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

3 Description

3.1 Identification

3.1.1 Chemical name

Sodium hypochlorite.

3.1.2 Synonym or common names

Liquid bleach, soda bleach, etc.

3.1.3 Relative molecular mass

74,44.

3.1.4 Empirical formula

NaClO.

3.1.5 Chemical formula

NaClO.

3.1.6 CAS Registry Number [1)]

7681-52-9.

3.1.7 EINECS reference [2)]

231-668-3.

3.2 Commercial form

The product is supplied as aqueous solution with an available (active) chlorine concentration up to 15 percent by mass (% (*m/m*)).

3.3 Physical properties

3.3.1 Appearance and odour

The product is a clear yellowish-green solution with a faint chlorinous odour.

3.3.2 Density

The density of the product varies between 1,13 g/ml and 1,28 g/ml at 20 °C.

3.3.3 Solubility in water

The product is capable of being mixed with water in any proportion.

3.3.4 Vapour pressure

Approximately 2,5 kPa at 20 °C.

3.3.5 Boiling point at 100 kPa [3)]

Not applicable.

3.3.6 Crystallization and freezing point

Freezing starts at -17 °C.

The crystallization point is between -20 °C and -30 °C.

3.3.7 Specific heat

3,48 kJ/(kg.K) for a solution with an available active chlorine concentration of between 14 % (*m/m*) and 15 % (*m/m*).

3.3.8 Viscosity (dynamic)

2,6 mPa.s at 20 °C.

---

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

The product is an alkaline solution with a pH value greater than 11 at 20 °C.

It reacts with acids and acidic salts to form chlorine.

Vigorous reactions occur with reducing chemicals. It is a strong oxidant ($E°_{Red}$ for (ClO^-) = 0,89 V).

$$ClO^- + 2H^+ + 2e^- \rightarrow Cl^- + H_2O$$

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 sodium hypochlorite is available in solution with concentration up to 160 g of available chlorine per litre at the time of delivery by the producer. The concentration of sodium hypochlorite shall be equal to or greater than the value specified by the manufacturer.

4.2 Impurities and main by-products

The sodium chlorate ($NaClO_3$) content shall not exceed 5,4 % (*m/m*) of available chlorine at the time of delivery by the producer. The product shall be visibly free from deposits or suspended matter.

NOTE Sodium chlorate is a by-product of the manufacturing process and can be formed during storage (see 6.5.1).

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.	1	5
Cadmium (Cd)	max.	2,5	5
Chromium (Cr)	max.	2,5	5
Mercury (Hg)	max.	3,5	5
Nickel (Ni)	max.	2,5	10
Lead (Pb)	max.	15	15
Antimony (Sb)	max.	20	25
Selenium (Se)	max.	20	25
NOTE Cyanide which does not exist in a strong oxidizing medium such as sodium 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.

5.1.1 Sampling from drums and bottles

5.1.1.1 General

5.1.1.1.1 Mix the contents of the 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.

5.1.1.1.2 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 5.1.1.3.

5.1.1.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.1.2 ; otherwise, take samples as described in 5.1.1.3.

5.1.1.2 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.

5.1.1.3 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 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 5.1.1.2 ;

b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.1.3 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 available chlorine content (main product)

5.2.1.1 General

This method applies to products with available chlorine contents within the range 70 g/l to 170 g/l.

5.2.1.2 Principle

Sodium 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 solution, 10 % (*m/m*).

Weigh, to the nearest 0,1 mg, 100 g of potassium iodide, iodate-free, and dissolve in water and dilute to 1 l.

5.2.1.3.2 Acetic acid concentrated, of purity at least 99 % (*m/m*).

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 into a 1000 ml one-mark volumetric flask with water 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.

5.2.1.5 Procedure

5.2.1.5.1 Test solution

Pipette 1,0 ml of the laboratory sample and transfer to a 250 ml conical flask. Add water up to 100 ml approximately.

5.2.1.5.2 Determination

Add 10 ml of the potassium iodide solution (5.2.1.3.1) and 5 ml of concentrated acetic acid (5.2.1.3.2).

Titrate at once with the sodium thiosulfate standard volumetric solution (5.2.1.3.3) until the iodine colour is nearly gone. Add 3 ml of the starch indicator solution (5.2.1.3.4) and complete the titration to the disappearance of the blue-black colour. Record the volume V_1, of the sodium thiosulfate standard volumetric solution added.