



CD/K/017:2009
ICS 71.100.80

EAST AFRICAN STANDARD

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

EAST AFRICAN COMMUNITY

Draft for comments only — Not to be cited as East African Standard

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

© East African Community 2010 — All rights reserved*

East African Community

P O Box 1096

Arusha

Tanzania

Tel: 255 27 2504253/8

Fax: 255-27-2504481/2504255

E-Mail: eac@eachq.org

Web: www.each.int

Introduction

BS EN 896:2005, *Chemicals used for treatment of water intended for human consumption — Sodium hydroxide*

Draft for comments only — Not to be cited as East African Standard

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

The European Standard EN 896:2005 has the status of a
British Standard

ICS 71.100.80

National foreword

This British Standard is the official English language version of EN 896:2005. It supersedes BS EN 896:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Additional information

The United Kingdom, as a member of CEN, is obliged to publish EN 896 as a British Standard. However, attention is drawn to the fact that the United Kingdom voted against the approval of EN 896. The main reasons for this disapproval were as follows.

- a) The limits for sodium chloride and sodium chlorate in Table 1 are expressed as percentage mass fractions of the sodium hydroxide content whereas the analytical methods give the results as the percentage mass fraction of chloride for the product and the sodium chlorate content in grams per litre in the measured test solution, respectively. Similarly, the limits for chemical parameters in Table 2 are expressed as milligrams per kilogram of sodium hydroxide but the calculation described in **B.3.6.2** gives the results as milligrams per kilogram of the product and, for mercury, the result of the determination in accordance with EN 1483 will be in micrograms per litre of test solution.
- b) In **B.2.3.1** the concentrations of sodium carbonate and sodium hydrogen carbonate in the eluant solution are not stated.

Summary of pages

This document comprises a front cover, an inside front cover, page i, a blank page, the EN title page, pages 2 to 27 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 22 February 2006

© BSI 22 February 2006

ISBN 0 580 47448 8

Amendments issued since publication

Amd. No.	Date	Comments

c) There is confusion regarding the operation of the spectrometer used for the determinations of antimony, arsenic, cadmium, chromium, lead, nickel and selenium. The parameters and operating conditions for the spectrometer are specified in Table B.3 but the instructions in **B.3.5.4.1** require the parameters to be set in accordance with the operating manual of the instrument's manufacturer. If there are any conflicts between these two requirements, the BSI technical committee recommends that the parameters in question be set in accordance with the operating manual.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

EUROPEAN STANDARD

EN 896

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2005

ICS 71.100.80

Supersedes EN 896:1998

English version

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumhydroxid

This European Standard was approved by CEN on 12 May 2005.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

Page

Foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Description	5
Figure 1-Solubility of sodium hydroxide	7
4 Purity criteria	8
Table 1 — Impurities	9
Table 2 — Chemical parameters	10
5 Test methods	10
6 Labelling – Transportation – Storage	12
Annex A (informative) General information on sodium hydroxide	15
Annex B (normative) Analytical methods	16
Table B.1 - Calibration solutions	19
Table B.2 - Concentration range	20
Table B.3 - Parameters and operating conditions of the spectrometer	21
Table B.4 - Calibration solutions for the different elements	22
Table B.5 - Wavelength per element	23
Annex C (normative) General rules relating to safety	26
Bibliography	27

Foreword

This European Standard (EN 896:2005) 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 December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005.

This document supersedes EN 896:1998.

Significant technical differences between this edition and EN 896:1998 are as follows:

- a) deletion of the reference to EU Directive 80/778/EEC of July, 15 1980 in order to take into account the latest Directive in force (see [1]);
- b) replacement of ISO 5666-1 by EN 1483.

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

EN 896:2005 (E)

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 hydroxide used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements and the corresponding test methods for sodium hydroxide. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use (see Annex C).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1483:1997, *Water quality – Determination of mercury*

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

ISO 979; *Sodium hydroxide for industrial use - Method of assay*

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

ISO 3196; *Sodium hydroxide for industrial use- Determination of carbonates content- Titrimetric method*

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 hydroxide.

3.1.2 Synonym or common name

Caustic soda.

3.1.3 Relative molecular mass

40,0.

3.1.4 Empirical formula

NaOH.

3.1.5 Chemical formula

NaOH.

EN 896:2005 (E)

3.1.6 CAS Registry Number¹⁾

1310-73-2.

3.1.7 EINECS reference²⁾

215-185-5.

3.2 Commercial forms

The product is available as flakes, pearls, solid, or as an aqueous solution of different concentrations.

3.3 Physical properties

3.3.1 Appearance

Solid: the product is white, deliquescent.

Liquid: the product is a clear solution, slightly turbid colourless solution, slightly viscous.

3.3.2 Density

Solid : the density of this product is 2,1 g/cm³.

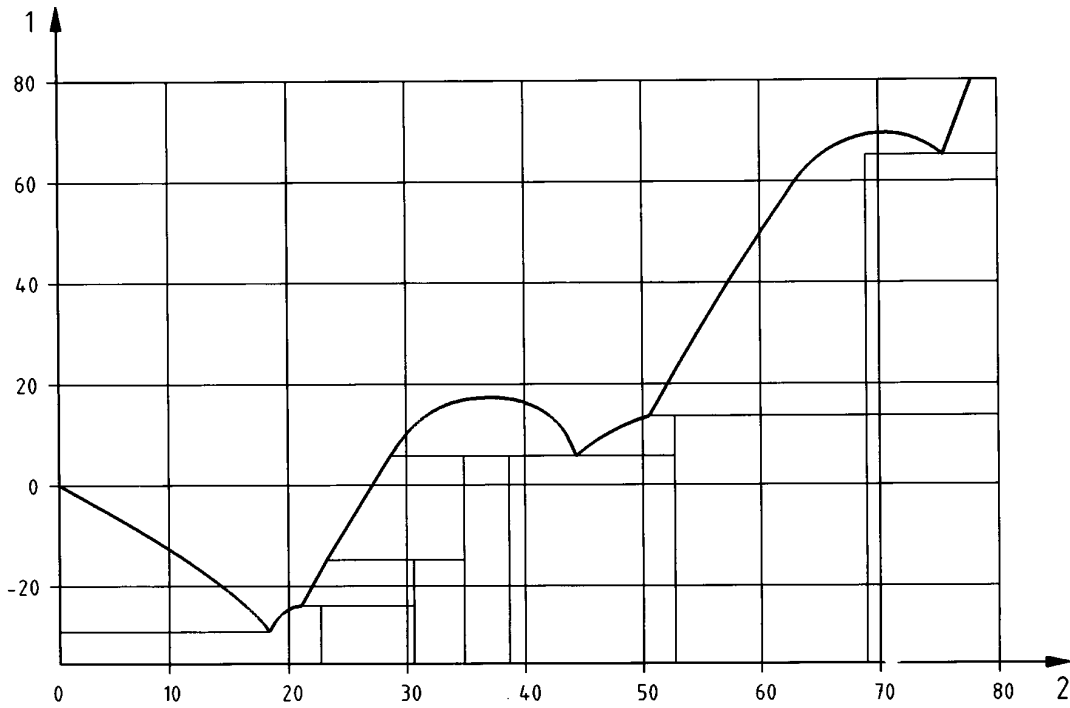
The bulk density of pearls is 1,2 kg/dm³.

Liquid : the density of solution is 1,52 g/ml for a product concentration of mass fraction of 50 % at 20 °C.

3.3.3 Solubility in water

The product is highly soluble at all temperatures above 20 °C (partial crystallization occurs above concentration of mass fraction of 55 %, (see Figure 1).

1) Chemical Abstracts Service Registry Number.
2) European Inventory of Existing Commercial Chemical Substances.



Key

1-Temperature in ° C.

2-NaOH concentration in mass fraction in %

Figure 1-Solubility of sodium hydroxide

3.3.4 Vapour pressure

Solution of concentration of mass fraction of 50 %

- 120 Pa at 20 °C;
- 450 Pa at 40 °C;
- 5 000 Pa at 80 °C.

3.3.5 Boiling point at 100 kPa³⁾

145 °C for a solution of concentration of mass fraction of 50 %.

3) 100 kPa = 1 bar.

EN 896:2005 (E)

3.3.6 Crystallization point

+ 12 °C for a solution of concentration of mass fraction of 50 % (see Figure 1).

3.3.7 Specific heat

3 220 J/(kg K) at 20 °C for a solution of concentration of mass fraction of 50 %.

3.3.8 Viscosity (dynamic)

For a solution of concentration of mass fraction of 50 %:

- 100 Pa.s at 20 °C;
- 25 Pa.s at 40 °C;
- 5 Pa.s at 80 °C.

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 solutions of sodium hydroxide are strongly alkaline.

Dilution of sodium hydroxide is very exothermic.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for sodium hydroxide used for the treatment of water intended for human consumption. Limits are given for impurities commonly present in the product. Depending on the raw material and the manufacturing process other impurities may be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

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

4.2 Composition of commercial product

The product shall contain not less than a mass fraction of 96 % of NaOH for the solid form. Typical concentration for solutions of sodium hydroxide is either a mass fraction of 50 % or 30 % , and shall be in any case within the manufacturer's stated tolerance.

4.3 Impurities and main by-products

The product shall conform to the requirements specified in Table 1.

The concentration limits refer to pure NaOH mass fraction of 100 %.

Table 1 — Impurities

Impurity		Limit in mass fraction in % of NaOH
Sodium chloride (NaCl) ^{a)}	max.	2,4
Sodium carbonate (Na ₂ CO ₃) ^{b)}	max.	0,4
Sodium chlorate (NaClO ₃) ^{c)}	max.	0,7
a) Too high concentrations can cause problems with some ion exchange resins. b) Sodium carbonate is formed in contact with atmospheric carbon dioxide. c) The presence of any oxidizing agent in sodium hydroxide is to be avoided.		

4.4 Chemical parameters

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

Table 2 — Chemical parameters

Parameter		Limit in mg/kg of NaOH	
		Type 1	Type 2
Arsenic (As)	max.	2	10
Cadmium (Cd)	max.	1	5
Chromium (Cr)	max.	1	10
Mercury (Hg)	max.	0,1	1
Nickel (Ni)	max.	2	10
Lead (Pb)	max.	5	20
Antimony (Sb)	max.	5	5
Selenium (Se)	max.	5	5

NOTE Cyanides, pesticides and polycyclic aromatic hydrocarbons are not relevant in sodium hydroxide. For parametric values of sodium hydroxide on trace metal content in drinking water, see [1].

5 Test methods

5.1 Sampling

Prepare the laboratory sample (s) required by the relevant procedure described in ISO 8213, observe the recommendations of ISO 3165 and also take into account ISO 6206. The nature of caustic alkalis requires special care at all points of sampling and preparation for analysis. Sampling techniques shall be such as to limit or prevent atmospheric exposure since sodium hydroxides, either as aqueous solutions or as anhydrous products, rapidly absorb moisture and carbon dioxide (and other acid gases) from the atmosphere. Additional precautions are necessary if trace constituents are to be determined.

NOTE For sampling liquids see [3].

5.2 Analyses

5.2.1 Main product

5.2.1.1 Total alkalinity

The total alkalinity shall be determined by titration with an acid standard volumetric solution in accordance with ISO 979.

5.2.1.2 Caustic alkalinity

The caustic alkalinity equals the total alkalinity as NaOH (see 5.2.1.1) minus the alkalinity as Na₂CO₃ multiplied by 0,755 determined in accordance with ISO 3196.

5.2.2 Impurities

5.2.2.1 Sodium chloride

The sodium chloride content shall be determined by potentiometric titration with silver nitrate solution (see B.1).

5.2.2.2 Sodium carbonate

The sodium carbonate content shall be determined by the titrimetric method, in accordance with ISO 3196.

5.2.2.3 Sodium chlorate

The sodium chlorate content shall be determined by ionic chromatography (see B.2).

5.2.3 Chemical parameters

5.2.3.1 Principle

The elements antimony, arsenic, cadmium, chromium, lead, nickel and selenium are determined by inductively coupled plasma optical emission spectrometry. Mercury is determined by cold vapour atomic absorption spectrometry.

5.2.3.2 Arsenic

The arsenic content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.3 Cadmium

The cadmium content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.4 Chromium

The chromium content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

EN 896:2005 (E)

5.2.3.5 Nickel

The nickel content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.6 Lead

The lead content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.7 Antimony

The antimony content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.8 Selenium

The selenium content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.3).

5.2.3.9 Mercury

The mercury content shall be determined by cold vapour atomic absorption spectrometry in accordance with EN 1483 (see B.4).

6 Labelling – Transportation – Storage

6.1 Means of delivery

Sodium hydroxide can be delivered in rail or road tankers, in containers, in drums or in plastics bags.

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 according to the EU Directives⁴⁾

The following labelling requirements shall apply to sodium hydroxide at the date of the publication of this European Standard:

a) anhydrous:

- Symbols and indications of danger:

C: Corrosive.

- Nature of special risks attributed to dangerous substances:

R 35: Causes severe burns.

4) See [2]

- Safety advice concerning dangerous substances:

S 2: Keep out of reach of children.

S 26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 27: Take off immediately all contaminated clothing.

S 37/39: Wear suitable gloves and eye/face protection.

b) solution of concentration between (or equal to) mass fraction 1 % and 5 % NaOH:

- Symbols and indications of danger:

Xi: Irritant.

- Nature of special risks attributed to dangerous substances:

R 36/38: Irritating to eyes and skin.

- Safety advice concerning dangerous substances:

S 2: Keep out of reach of children.

S 26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

c) solution of concentration more than mass fraction 5 % NaOH:

- Symbols and indications of danger:

C : Corrosive.

- Nature of special risks attributed to dangerous substances:

R 35: Causes severe burns.

- Safety advice concerning dangerous substances:

S 2: Keep out of reach of children.

S 26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 27: Take off immediately all contaminated clothing.

S 37/39: Wear suitable gloves and eye/face protection.

NOTE Annex I of the Directive 67/548/EEC on classification, packaging and labelling of dangerous substances and its amendments and adaptations in the European Union contains a list of substances classified by the EU. Substances not in this Annex I should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

EN 896:2005 (E)

6.3 Transportation regulations and labelling

Sodium hydroxide solid is listed as UN Number⁵⁾: 1823.

Sodium hydroxide solution is listed as UN Number: 1824.

RID⁶⁾/ADR⁷⁾ : - class 8, classification code C6, packing group II for solid;
- class 8, classification code C5, packing group II for solution.

IMDG⁸⁾ : Class 8, packing group II.

IATA⁹⁾ : Class 8, packing group II.

6.4 Marking

The marking shall include the following information:

- name " sodium hydroxide", trade name, grade and type;
- net mass;
- name and the address of the supplier and/or manufacturer;
- statement " this product conforms to EN 896".

6.5 Storage

6.5.1 Material

Avoid contact with aluminium, zinc or galvanised steel material. Mild steel, polyester or polypropylene are suitable materials. To avoid any iron contamination in the product, a suitable lining of the steel tank can be used.

6.5.2 Long term stability

Absorption of carbon dioxide from the ambient air leads to the formation of sodium carbonate.

6.5.3 Storage incompatibilities

Avoid contact with metals such as zinc, aluminium, copper, tin or their alloys, which produce hydrogen. Violent reaction is to be expected when sodium hydroxide comes in contact with concentrated acids, and organic chemicals, particularly chlorinated hydrocarbons.

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.

Annex A **(informative)**

General information on sodium hydroxide

A.1 Origin

A.1.1 Raw materials

Sodium chloride solution: For alternative production route: sodium carbonate and calcium hydroxide.

A.1.2 Manufacturing process

Electrolysis of sodium chloride solution (brine) in a mercury cell, a membrane cell or a diaphragm cell. Can also be produced by caustification of sodium carbonate with calcium hydroxide.

A.2 Use

A.2.1 Function

Sodium hydroxide is mainly used as a neutralizing agent, for adjustment of pH value, as a softening agent, for alkalinity adjustment or as a regenerant for ion exchange resins.

A.2.2 Form in which it is used

Sodium hydroxide is mainly used as delivered, or diluted if more convenient.

A.2.3 Treatment dose

The treatment dose is depending of the application or the initial pH and the buffer capacity of the water.

A.2.4 Means of application

The product is usually applied using a metering pump or a dissolving tank.

A.2.5 Secondary effects

Temperature rise at the injection point.

A.2.6 Removal of excess product

Excessive pH values can be readjusted by adding acids (such as sulfuric acid).

Annex B (normative)

Analytical methods

B.1 Determination of sodium chloride (potentiometric titration)

B.1.1 General

This method applies to products with a chloride content within the range of mass fraction of 0,5 % to 2 %.

B.1.2 Principle

Chloride is determined by potentiometric titration with silver nitrate using a silver electrode.

NOTE An automatic titrator or a manual system can be used to determine the end point.

B.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.

B.1.3.1 Nitric acid (HNO₃), density $\rho \approx 1,40$ g/ml

B.1.3.2 Silver nitrate standard volumetric solution $c(\text{AgNO}_3) = 0,1$ mol/l

B.1.3.3 Phenolphthalein indicator solution 10 g/l in ethanol volume fraction 95 %

B.1.4 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

B.1.4.1 Automatic titrator or pH meter used in mV mode (reading of scale in millivolts)

B.1.4.2 Silver combined electrode with double junction

B.1.4.3 Burette, automatic or manual type

B.1.5 Procedure**B.1.5.1 Test portion**

Weigh, to the nearest 0,01 g, a mass of laboratory sample corresponding to 10 g of NaOH.

B.1.5.2 Determination

Transfer the test portion to a 250 ml conical flask. Add 100 ml of water, 2 or 3 drops of phenolphthalein (B.1.3.3) and dissolve using a magnetic stirrer.

Neutralize the solution with the nitric acid (B.1.3.1) and add 2 or 3 drops in excess.

After cooling, insert the silver combined electrode (B 1.4.2) in the solution and titrate with the silver nitrate standard volumetric solution (B.1.3.2), either manually using the pH meter (B 1.4.1) in the mV mode or with an automatic titrator (B 1.4.1), following the manufacturer's instructions for titration and end point determination.

Perform a blank titration on the same volume of nitric acid used for the acidification of the test portion.

NOTE For manual titration, record the mV readings obtained after each addition of the silver nitrate standard volumetric solution, plot a graph showing the volumes of standard volumetric solution used versus the mV readings and determine the volume corresponding to the end-point at the point of the inflection.

B.1.6 Expression of results

The chloride content [$c(Cl)$], expressed in mass fraction in % is given by the following equation:

$$c(Cl) = \frac{(V_1 - V_2) \times c \times 0,035453 \times 100}{m} \quad (1)$$

where:

- V_1 is the volume in millilitres of silver nitrate standard volumetric solution used for the sample;
- V_2 is the volume in millilitres of silver nitrate standard volumetric solution used for the blank;
- c is the concentration, in moles per litre, of the silver nitrate standard volumetric solution used;
- m is the mass, in grams, of the test portion.

0,035453 is the mass in grams of chloride corresponding to 1,00ml of silver nitrate solution $c(AgNO_3)=1,000mol/l$.

B.2 Determination of sodium chlorate (ion chromatography)**B.2.1 General**

This method applies to products with sodium chlorate ($NaClO_3$) contents within the range of 2 g/kg to 20 g/kg.

B.2.2 Principle

Direct determination of the chlorate ion in a diluted sample solution by ionic chromatography apparatus equipped with a chemical suppression device and a conductimetric detector.

EN 896:2005 (E)

B.2.3 Reagents

All reagents shall be of recognized analytical grade and the water used shall be with conductivity lower than 56 $\mu\text{S}/\text{cm}$.

B.2.3.1 Eluant solution, solution containing Na_2CO_3 and NaHCO_3 .

B.2.3.2 Regenerant solution, $c(\text{H}_2\text{SO}_4) = 0,025 \text{ mol/l}$.

B.2.3.3 Sodium chlorate standard stock solution, $c(\text{NaClO}_3) = 1\,000 \mu\text{g/ml}$.

Dissolve $(0,2000 \pm 0,0001) \text{ g}$ of NaClO_3 , with water. Dilute with water to 200 ml in a volumetric flask and mix.

B.2.4 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

B.2.4.1 Ionic chromatograph equipped with:

- a) chemical suppressor;
- b) conductivity detector;
- c) anion separation column and precolumn : Consists of polystyrene/divinylbenzene substrate agglomerated with aminated anion exchange latex;
- d) data logger/plotter.

B.2.4.2 Cartridge of cation exchange resin (H^+ form) type "ON-GUARD H^{+10} ") or equivalent (cation exchange capacity $\approx 1,8 \text{ meq}$).

B.2.5 Procedure

B.2.5.1 Test portion

Weigh, to the nearest 0,001 g, 0,5 g of the laboratory sample.

B.2.5.2 Test solutions

Transfer the test portion to a 200 ml volumetric flask, dilute to the mark with the eluant solution (B 2.3.1) and mix. This is the first test solution.

Prepare a second test solution by dilution of 25 ml of the first test solution with the eluant solution (B.2.3.1) in a 100 ml volumetric flask.

¹⁰⁾ ON-GUARD H^+ is the trade name of a product supplied by DIONEX. This information is given for the convenience of users of this standard and does not constitute an endorsement by CEN/CENELEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

B.2.5.3 Calibration solutions

Prepare calibration solutions by diluting the chlorate stock solution (B.2.3.2) with the eluant solution (B.2.3.1) according to the Table B.1.

Table B.1 - Calibration solutions

Calibration solution No	Sodium chlorate concentration mg/l
0	0
1	4
2	8
3	12
4	16

B.2.5.4 Determination**B.2.5.4.1 Test solutions pretreatment**

Proceed as follows to eliminate the OH⁻ ions from the test solution(s).

Flush 25 ml of water through a cartridge containing cation exchange resin on H⁺ form (B 2.4.2).

Slowly push 10 ml of the test solution through the cartridge. Reject the first millilitre and use the rest for the determination.

B.2.5.4.2 Preparation of the apparatus

Set all instrument parameters of ionic chromatograph (B.2.4.1) in accordance with the operating manual of the instrument's manufacturer with the following conditions:

- eluant (B 2.3.1) flow rate: 2 ml/min;
- regenerant(B 2.3.2) flow rate: 2,5 ml/min;
- full scale of conductivity: 30 µS;
- residual conductivity: < 18 µS;
- number of replicates: 3.

B.2.5.4.3 Measurements

Measure each solution at least three times in order to obtain a relative standard deviation lower than 1 %.

Calibrate the instrument with the five calibration solutions.

Measure the test solution (first or second) having a chlorate concentration located more or less in the middle of the range of the calibration curve.

EN 896:2005 (E)

B.2.6 Expression of results

The chlorate content $c(\text{NaClO}_3)$ of the sample expressed in grams per litre, is given by the equation:

$$c_1(\text{NaClO}_3) = \frac{200 \times c_1}{1\,000\,m} \quad (2)$$

in case of undiluted test solution (first),

or

$$c_2(\text{NaClO}_3) = \frac{800 \times c_1}{1\,000\,m} \quad (3)$$

in case of diluted test solution (second),

where:

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

c_1 is the concentration of sodium chlorate in the measured test solution expressed in milligrams per litre.

B.3 Determination of antimony, arsenic, cadmium, chromium, lead, nickel and selenium (inductively coupled plasma optical emission spectrometry (ICP/OES))

B.3.1 General

The concentration range covered for each element is given in the Table B.2.

Table B.2 - Concentration range

Element	Concentration range, mg/kg of product
Cr, Cd	0,2 to 40
Ni	0,5 to 40
As, Sb, Se	1 to 40
Pb	2 to 40

B.3.2 Principle

Dissolution of the sample with nitric acid and direct nebulization of the acid solution into inductively coupled argon plasma formed by a high frequency. Measurement of the radiations at specific wavelengths using background correction and internal standardization.

B.3.3 Reagents

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

Store all prepared solutions in polyethylene or polytetrafluoroethylene (PTFE) flasks to prevent contamination.

B.3.3.1 Nitric acid solution, $\rho \approx 1,40$ g/ml, mass fraction 65 %.

B.3.3.2 Hydrochloric acid solution, $\rho \approx 1,19$ g/ml, mass fraction 37 %.

B.3.3.3 Sodium chloride solution, $c(\text{NaCl}) = 250$ g/l.
 Dissolve 250 g of NaCl (very high purity grade) with water and transfer to a 1 000 ml volumetric flask. Add 10 ml of nitric acid (B.3.3.1), make up to the mark with water and mix.

B.3.3.4 Scandium (internal standard) solution, $c(\text{Sc}) = 50$ mg/l.
 Transfer 50 ml of a scandium stock solution [$c(\text{Sc}) = 1\,000$ mg/l] and 10 ml nitric acid (B.3.3.1) to a 1 000 ml volumetric flask. Make up to the mark with water and mix.

B.3.3.5 As, Cd, Cr, Ni, Pb, Sb or Se elements stock solution, $c(\text{element}) = 1\,000$ mg/l commercial solution.

B.3.3.6 Multi-element solution, $c(\text{As, Cd, Cr, Ni, Pb, Sb, Se}) = 100$ mg/l
 Transfer 10 ml of each stock solution (B.3.3.5) and 10 ml of hydrochloric acid (B.3.3.2) to a 100 ml volumetric flask, make up to the mark with water and mix.

B.3.3.7 Argon, the pressure shall not be less than 700 kPa, and the argon used can be compressed or liquefied gas.

B.3.4 Apparatus

Ordinary laboratory apparatus and glassware with together the following:

NOTE All vessels (glassware, polyethylene, polypropylene and polytetrafluoroethylene (PTFE) flasks) should be washed with hydrochloric acid $c(\text{HCl}) \approx 6$ mol/l and water successively.

B.3.4.1 Inductively coupled plasma optical emission spectrometer (ICP/OES) fitted with a nebulizer for high salt concentration. This instrument can be simultaneous and/or sequential. The spectrometer parameters and operating conditions are given in Table B.3:

Table B.3 - Parameters and operating conditions of the spectrometer

Parameter	Unit	Specification
Type		monochromator or /and polychromator
Argon humidifier (water)		yes
Argon (B 3.3.7)flows :		
Plasma	l/min	14
Auxiliary	l/min	1,5
Nebulizer (180 kPa)	l/min	0,7
Sample flow	ml/min	1,5
RF power	W	$\pm 1\,000$
Integration time	s	10

EN 896:2005 (E)

B.3.5 Procedure

B.3.5.1 Test portion

Weigh, to the nearest 0,1 g, 14 g of the laboratory sample.

B.3.5.2 Test solution

Transfer the test portion (B.3.5.1) and 50 ml of water to a 250 ml polyethylene flask. After dissolution, neutralize the solution with hydrochloric acid (B.3.3.2) and add 1 ml nitric acid (B.3.3.1).

After cooling, transfer to a 100 ml volumetric flask, add 5 ml of scandium solution (B.3.3.4), make up to the mark with water and mix.

B.3.5.3 Calibration and verification solutions

Transfer 80 ml of sodium chloride solution (B.3.3.3), 5 ml of scandium solution (B.3.3.4) and the volumes of multi-element solution (B.3.3.6) given in Table B.4 to a series of four 100 ml volumetric flasks. Make up to the mark with water and mix.

Table B.4 - Calibration solutions for the different elements

Calibration solution No	Multi-element solution, ml	Corresponding concentration of each element (As, Cd, Cr, Ni, Pb, Sb, Se) mg/l
1 ¹⁾	0	0
2 ²⁾	5,0	5,0
3	10,0	10,0
4 ³⁾	10,0	10,0

1) Blank calibration solution.
 2) Linearity standard matching solution.
 3) Control solution prepared with different pipettes, flasks and if possible with different stock solutions.

B.3.5.4 Determination

B.3.5.4.1 Preparation of the apparatus

Set all instrument parameters of the optical emission spectrometer (B 3.4.1) in accordance with the operating manual of the instrument's manufacturer.

Prepare the analytical procedure including the lines shown in the Table B.5, with background correction, concentrations of calibration solutions 1 and 3 described in (B.3.5.3) and internal standardization (B 3.3.4).

Table B.5 - Wavelength per element

Element	Wavelength nm	
	line	background
As	193,759	193,79
Cd	228,802	228,83
	214,438	-
Cr	267,716	267,75
Ni	231,604	231,63
Pb	220,353	220,38
Sb	217,581	217,61
Se	196,026	196,05
Sc (internal standard)	424,683	-
	or 361,384	-

B.3.5.4.2 Spectrometric measurements

Repeat the measurements for at least five integration periods.

Rinse with water after each solution.

Calibrate the instrument with the calibration solutions 1 and 3 (B.3.5.3.).

Control and check the linearity of the calibration curve by measurement of the following calibration solutions considered as unknown solutions:

- solution 3;
- solution 1;
- solution 1;
- solution 2;
- solution 4;
- solution 3.

Continue the measurements in the following order:

- solution 3;
- solution 1;
- solution 1;
- test solution (B.3.5.2);

EN 896:2005 (E)

- solution 3;
- solution 1 (B.3.5.3.);
- solution 1 (B.3.5.3.).

B.3.6 Expression of results

B.3.6.1 Evaluation

If necessary, correct for drift the results obtained with the test solution and control solutions 2 and 4:

- **for baseline drift** by interpolating in time between both second measurements (the first may be cross-contaminated) of the blank calibration solution (solution 1);
- **for sensitivity drift** by interpolating in time between the measurements of the solution 3.

NOTE Samples of unknown composition should be tested for the presence of matrix effects, caused by present components other than sodium hydroxide, by the analyte addition technique.

B.3.6.2 Calculation

The element content of the sample, $c(\text{element})$ in milligrams per kilogram is given by the equation:

$$c(\text{element}) = \frac{100 \times c_2}{m} \quad (4)$$

where:

- m is the mass, in grams, of the test portion (B.3.5.1);
- c_2 is the corrected concentration of element, in milligrams per litre, in the test solution (B.3.5.2).

B.4 Determination of mercury (cold vapour atomic absorption spectrometry)

B.4.1 General

This method is suitable for the determination of total mercury in sodium hydroxide. The method is applicable to samples whose mercury content is greater than 0,05 mg/kg as Hg.

B.4.2 Principle

After mineralization of the sample with sulfuric acid and potassium permanganate, the total mercury is determined by cold vapour atomic absorption spectrometry as described in EN 1483.

B.4.3 Reagents

See 4.3 of EN 1483:1997.

B.4.4 Apparatus

See 4.4 of EN 1483:1997.

B.4.5 Procedure**B.4.5.1 Test portion**

Weigh, to the nearest 0,01 g, 2 g of the laboratory sample.

B.4.5.2 Test solution

Transfer the test portion and 50 ml of water to a 250 ml conical flask. After dissolution, neutralize the solution with hydrochloric acid solution $c(\text{HCl}) = 6 \text{ mol/l}$. Add 1 ml of potassium permanganate solution (50 g/l) and, with care five 1 ml portions of sulfuric acid ($\rho = 1,84 \text{ g/ml}$).

Heat and keep boiling for 1 min.

After cooling, dissolve the precipitate of manganese dioxide, dropwise, with the hydroxylamine hydrochloride solution (100 g/l), add 5 ml of potassium dichromate solution (4 g/l), dilute to 100 ml with water in a volumetric flask and mix.

B.4.5.3 Blank test solution

Prepare a blank test solution according with the instructions detailed in B.4.5.2 but omitting the test portion.

B.4.5.4 Calibration solutions

Just before use, prepare a series of six calibration solutions containing 0 mg/l, 1 mg/l, 2,5 mg/l, 5 mg/l, 7,5 mg/l and 10 mg/l of Hg.

To 100 ml of those solutions add 1 ml of potassium permanganate solution and with care five 1 ml portions of sulfuric acid and continue as described in B.4.5.2 for the test solution.

B.4.5.5 Determination

Proceed with the calibration solutions, test solution and blank test solution as described in 4th paragraph of 4.7.1 in EN 1483:1997 beginning at "Transfer in a flask..."

B.4.6 Expression of results

See 4.8 and 4.9 of EN 1483:1997.

EN 896:2005 (E)

Annex C (normative)

General rules relating to safety

C.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

C.2 Emergency procedures

C.2.1 General

See also 6.2.

C.2.2 First aid

In case of contact with skin rinse with plenty of water.

In case of ingestion, and the victim is conscious, rinse the mouth with water, let the victim drink fresh water or slightly acidified with acetic acid (vinegar). Consult a doctor in all cases immediately.

C.2.3 Spillage

Collect as much as possible in suitable containers. Neutralize with acids, rinse small spillages with plenty of water.

C.2.4 Fire

Sodium hydroxide is not combustible.

Bibliography

- [1] 98/83/EC, *Council Directive of 3 November 1998 on the Quality of Water intended for Human Consumption.*
- [2] 67/548/EEC, *Council Directive of 27th June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances and its amendments and adaptations.*
- [3] ISO 3195, *Sodium hydroxide for industrial use - Sampling-test sample - Preparation of the main solution for carrying out certain determinations.*

**BS EN
896:2005**

BSI
389 Chiswick High Road
London
W4 4AL

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.
Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.
Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.
Email: copyright@bsi-global.com.

Draft for comments only — Not to be cited as East African Standard