

BS EN 898:2012



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Chemicals used for treatment of water intended for human consumption — Sodium hydrogen carbonate

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National foreword

This British Standard is the UK implementation of EN 898:2012. It supersedes BS EN 898:2005 which is withdrawn.

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

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English Version

Chemicals used for treatment of water intended for human consumption - Sodium hydrogen carbonate

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Natriumhydrogencarbonat

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

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COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 898:2012) 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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

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This document supersedes EN 898:2005.

Significant technical differences between this edition and EN 898:2005 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 (see [1]).

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 hydrogen carbonate used for the treatment of water intended for human consumption. It describes the characteristics and specifies the requirements and the corresponding test methods for sodium hydrogen carbonate. It gives information on its use in water treatment.

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 12846:2012, *Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment (ISO 12846:2012)*

ISO 746, *Sodium carbonate for industrial use — Determination of matter insoluble in water at 50 degrees C*

ISO 2199, *Sodium hydrogen carbonate for industrial use — Determination of sodium hydrogen carbonate content — Titrimetric method*

ISO 2460, *Sodium hydrogen carbonate for industrial use — Determination of iron content — 1,10-Phenanthroline photometric method*

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 hydrogen carbonate.

3.1.2 Synonym or common name

Sodium bicarbonate, bicarbonate of soda, baking soda.

3.1.3 Relative molecular mass

84,01.

3.1.4 Empirical formula

NaHCO₃.

3.1.5 Chemical formula

NaHCO₃.

3.1.6 CAS Registry Number¹⁾

144-55-8.

3.1.7 EINECS reference²⁾

205-633-8.

3.2 Commercial forms

The product is available as powder or crystals.

3.3 Physical properties

3.3.1 Appearance

The product is a white powder or crystals, slightly hygroscopic.

3.3.2 Density

The density of this product is 2,2 g/cm³.

The bulk density is ranging from 0,5 kg/dm³ to 1,1 kg/dm³.

3.3.3 Solubility in water

The product is soluble at 95 g/l at 20 °C.

3.3.4 Vapour pressure

Not applicable.

3.3.5 Boiling point at 100 kPa³⁾

Not applicable.

3.3.6 Melting point

Not applicable .The product decomposes at 50 °C.

3.3.7 Specific heat

1,197 J/(kg K).

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.

3.3.8 Viscosity (dynamic)

Not applicable.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

The hardness of solid sodium hydrogen carbonate is given as 1,5 to 2 on the Mohs' scale of hardness.

3.4 Chemical properties

Sodium hydrogen carbonate as specified is technical water-free NaHCO_3 .

Sodium hydrogen carbonate reacts exothermically with acids with formation of carbon dioxide.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for sodium hydrogen carbonate 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 98,5 % of NaHCO_3 .

4.3 Impurities and main by-products

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

The concentration limits refer to pure NaHCO_3 .

Table 1 — Impurities

Impurity		Limit in mg/kg of NaHCO ₃
Iron (II) ¹⁾	max.	5
Insoluble matters ²⁾	max.	200
1) Iron(II) can cause organoleptic problems. 2) Indicate the presence of foreign matter.		

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 NaHCO ₃
Arsenic (As)	max.	2
Cadmium (Cd)	max.	2
Chromium (Cr)	max.	2
Mercury (Hg)	max.	0,1
Nickel (Ni)	max.	2
Lead (Pb)	max.	2
NOTE Antimony, selenium, cyanides, pesticides and polycyclic aromatic hydrocarbons are not relevant in sodium hydrogen carbonate. For parametric values of sodium hydrogen carbonate 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 with ISO 8213, observe the recommendations of ISO 3165 and also take account of ISO 6206.

5.2 Analyses

5.2.1 Main product

The mass fraction in % of NaHCO_3 shall be determined by titration with a standard volumetric acid solution in accordance with ISO 2199.

5.2.2 Impurities

5.2.2.1 Iron

The iron content shall be determined by a spectrometric method with 1,10-phenanthroline in accordance with ISO 2460.

5.2.2.2 Insoluble matters

The mass fraction in % of the insoluble matter in water shall be determined at 50 °C in accordance with ISO 746 replacing sodium carbonate by sodium hydrogen carbonate.

5.2.3 Chemical parameters

5.2.3.1 Principle

The elements arsenic, cadmium, chromium, lead and nickel 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.1).

5.2.3.3 Cadmium

The cadmium content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.1).

5.2.3.4 Chromium

The chromium content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.1).

5.2.3.5 Nickel

The nickel content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.1).

5.2.3.6 Lead

The lead content shall be determined by inductively coupled plasma optical emission spectrometry (ICP/OES) (see B.1).

5.2.3.7 Mercury

The mercury content shall be determined by cold vapour atomic absorption spectrometry in accordance with EN ISO 12846 (see B.2).

6 Labelling – Transportation – Storage

6.1 Means of delivery

Sodium hydrogen carbonate can be delivered in bulk, bulk bags or in 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 Labelling according to the EU legislation ⁴⁾

Sodium hydrogen carbonate is not subject to labelling regulations at the date of the publication of this European Standard.

NOTE 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 hydrogen carbonate is not listed under a UN Number ⁵⁾. Sodium hydrogen carbonate is not classified as a dangerous product for road, rail, sea and air transportation.

6.4 Marking

The marking shall include the following information:

- name "sodium hydrogen carbonate ", trade name;
- net mass;
- name and the address of the supplier and/or manufacturer;
- statement "this product conforms to EN 898".

6.5 Storage

6.5.1 Long term stability

Sodium hydrogen carbonate is stable up to 50 °C, in dry conditions.

6.5.2 Storage incompatibilities

Keep bags tightly closed and dry. Keep away from acids.

4) See [2]

5) United Nations Number.

Annex A (informative)

General information on sodium hydrogen carbonate

A.1 Origin

A.1.1 Raw materials

Sodium chloride, limestone, or sodium carbonate and carbon dioxide.

A.1.2 Manufacturing process

Ammonia-soda-process (SOLVAY process).

A.2 Use

A.2.1 Function

Sodium hydrogen carbonate is mainly used for pH stabilisation and alkalinity increase.

A.2.2 Form in which it is used

Sodium hydrogen carbonate is mainly used as a solution, at concentration up to about a mass fraction of 5 %.

A.2.3 Treatment dose

The treatment dose is variable depending on raw water quality and application. Treatment dose should be such as sodium ions never exceed sodium Parametric Value (see [1]).

A.2.4 Means of application

The product is usually applied using a positive displacement metering pump.

A.2.5 Secondary effects

Increases in sodium concentration.

A.2.6 Removal of excess product

Not applicable.

A.3 Rules for safe handling

Contact with eyes and skin should be avoided.

A.4 Emergency procedures

A.4.1 First aid

In case of contact with eyes, it should be rinsed with running water for at least 15 min to eliminate particles of the product.

In case of ingestion, plenty of water should be given to drink.

A.4.2 Spillage

The product should be collected; then it should be rinsed with plenty of water.

A.4.3 Fire

Sodium hydrogen carbonate is not combustible.

Annex B (normative)

Analytical methods

B.1 Determination of arsenic, cadmium, chromium, lead and nickel (inductively coupled plasma optical emission spectrometry (ICP/OES))

B.1.1 General

The range covered for each element is given in Table B.1.

Table B.1 - Concentration range

Element	Concentration range, mg/kg of product
Cr, Cd	0,2 to 50
Ni	0,5 to 50
As	1 to 50
Pb	2 to 50

B.1.2 Principle

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

B.1.3 Reagents

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

Store all prepared solutions in polyethylene (polyethene) or polytetrafluorethylene (polytetrafluorethene) (PTFE) flasks to prevent contamination.

B.1.3.1 Nitric acid solution, $\rho \approx 1,40$ g/ml, mass fraction 65 %.

B.1.3.2 Hydrochloric acid solution, $\rho \approx 1,19$ g/ml, mass fraction 37 %.

B.1.3.3 Sodium chloride solution, ρ (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.1.3.1), make up to the mark with water and mix.

B.1.3.4 Scandium (internal standard) solution, $\rho(\text{Sc}) = 50 \text{ mg/l}$.

Transfer 50 ml of a scandium stock solution [$\rho(\text{Sc}) = 1\,000 \text{ mg/l}$] and 10 ml nitric acid (B.1.3.1) to a 1 000 ml volumetric flask. Make up to the mark with water and mix.

B.1.3.5 As, Cd, Cr, Ni or Pb elements stock solution, $\rho(\text{element}) = 1\,000 \text{ mg/l}$ commercial solution.

B.1.3.6 Multi-element solution, $\rho(\text{As, Cd, Cr, Ni, Pb}) = 100 \text{ mg/l}$

Transfer 10 ml of each stock solution (B.1.3.5) and 10 ml of hydrochloric acid (B.1.3.2) to a 100 ml volumetric flask, make up to the mark with water and mix.

B.1.3.7 Argon, the pressure shall not be less than 700 kPa and the argon used may be compressed or liquefied gas.

B.1.4 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

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

B.1.4.1 Inductively coupled plasma optical emission spectrometer (ICP/OES) fitted with a nebuliser for high salt concentration. This instrument can be simultaneous and/or sequential. The spectrometer parameters and operating conditions are given in Table B.2:

Table B.2 - Parameters and operating conditions of the spectrometer

Parameter	Unit	Specification
Type		monochromator or /and polychromator
Argon humidifier (water)		yes
Argon (B.1.3.7) flows:		
Plasma	l/min	14
Auxiliary	l/min	1,5
Nebuliser (180 kPa)	l/min	0,7
Sample flow	ml/min	1,5
RF power	W	$\pm 1\,000$
Integration time	s	10

B.1.5 Procedure

B.1.5.1 Test portion

Weigh, to the nearest 0,1 g, about 29 g (*m*) of the laboratory sample.

B.1.5.2 Test solution

Transfer the test portion (B.1.5.1) and 50 ml of water to a 250 ml polyethylene flask. After dissolution, neutralise the solution with hydrochloric acid (B.1.3.2) and add 1 ml nitric acid (B.1.3.1).

After cooling, transfer to a 100 ml volumetric flask, add 5 ml of scandium solution (B.1.3.4), make up to the mark with water and mix.

B.1.5.3 Calibration and verification solutions

Transfer 80 ml of sodium chloride solution (B.1.3.3), 5 ml of scandium solution (B.1.3.4) and the volumes of multi-element solution (B.1.3.6) given in Table B.3 to a series of four 100 ml volumetric flasks. Make up to the mark with water and mix.

Table B.3 - Calibration solutions for the different elements

Calibration solution No	Multi-element solution, ml	Corresponding concentration of each element (As, Cd, Cr, Ni, Pb,) 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.1.5.4 Determination

B.1.5.4.1 Preparation of the apparatus

Set all instrument parameters of the optical emission spectrometer (B.1.4.1) in accordance with the operating manual of the instrument's manufacturer.

Prepare the analytical procedure including the lines shown in Table B.4, with background correction, concentrations of calibration solutions 1 and 3 described in (B.1.5.3) and internal standardization (B 1.3.4).

Table B.4 - 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
		-
Sc (internal standard)	424,683 or 361,384	-

B.1.5.4.2 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.1.5.3).

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.1.5.2);
- solution 3;
- solution 1 (B.1.5.3);

- solution 1 (B.1.5.3).

B.1.6 Expression of results

B.1.6.1 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 might 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 hydrogen carbonate, by the analyte addition technique.

B.1.6.2 Calculation

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

$$\rho(\text{element}) = 100 \times \frac{\rho}{m}$$

where

m is the mass, in grams, of the test portion (B.1.5.1);

ρ is the corrected concentration of element, in milligrams per litre, in the test solution (B.1.5.2).

B.2 Determination of mercury (cold vapour atomic absorption spectrometry)

B.2.1 General

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

B.2.2 Principle

After mineralisation of the sample with sulfuric acid and potassium permanganate, the total mercury is determined by cold vapour atomic absorption spectrometry as described in EN ISO 12846.

B.2.3 Reagents

See 4.3 of EN ISO 12846:2012.

B.2.4 Apparatus

See 4.4 of EN ISO 12846:2012.

B.2.5 Procedure

B.2.5.1 Test portion

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

B.2.5.2 Test solution

Transfer the test portion and 50 ml of water to a 250 ml conical flask. After dissolution, neutralise 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.2.5.3 Blank test solution

Prepare a blank test solution according to the instructions detailed in B.2.5.2 but omitting the test portion.

B.2.5.4 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.2.5.2 for the test solution.

B.2.5.5 Determination

Proceed with the calibration solutions, test solution and blank test solution as described in 4th paragraph of 4.7.1 in EN ISO 12846:2012 beginning at "Transfer in a flask...".

B.2.6 Expression of results

See 4.8 and 4.9 of EN ISO 12846:2012.

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)

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