Chemicals used for treatment of water intended for human consumption — Sulfur dioxide

ICS 13.060.20; 71.100.80

National foreword

This British Standard is the UK implementation of . It supersedes BS EN 1019:1996 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment.

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

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 cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2008

ISBN 978 0 580 55208 3

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1019

June 2005

ICS 71.100.80

Supersedes EN 1019:1995

English version

Chemicals used for treatment of water intended for human consumption - Sulfur dioxide

Produits chimiques pour le traitement de l'eau destinée à la consommation humaine - Dioxyde de soufre

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Schwefeldioxid

This European Standard was approved by CEN on 25 April 2005.

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Ref. No. EN 1019:2005: E

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Foreword

This document (EN 1019:2005) 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of an identical text or by endorsement, at the latest by December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005.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 1019:1995.

Significant technical differences between this edition and EN 1019:1995 are as follows:

deletion of the reference to EU Directive 80/778/EEC of July, 15 1980 in order to take into account the latest Directive. (see [1]).

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.

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 document is subject to regulation or control by National Authorities.

1 Scope

This European Standard is applicable to sulfur dioxide used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements and the corresponding test methods for sulfur dioxide. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use (see annex B).

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

ISO 760, *Determination of water-Karl Fischer method. (General method)*

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

ISO 6206, *Chemical products for industrial use – Sampling – Vocabulary*

3 Description

3.1 Identification

3.1.1 Chemical name

Sulfur dioxide.

3.1.2 Synonym or common name

Sulfurous acid anhydride.

3.1.3 Relative molecular mass

64.

3.1.4 Empirical formula

SO_2.

3.1.5 Chemical formula

SO_2.

3.1.6 CAS Registry Number[1)]

7446-09-5.

1) Chemical Abstracts Service Registry Number.

3.1.7 EINECS reference[2)]

231-195-2.

3.2 Commercial form

The product is available as a liquefied gas

3.3 Physical properties

3.3.1 Appearance

The product is ,at ambient temperature and normal pressure, a colourless gas with a pungent characteristic odour .

3.3.2 Density

The liquid density of this product is 1,4 g/ml at 10 °C.

The vapour density is 2,7 g/l at 0 °C.

3.3.3 Solubility in water

The product is soluble at 110 g/l at 20 °C.

3.3.4 Vapour pressure

320 kPa at 20 °C.

3.3.5 Boiling point at 100 kPa[3)]

-9,4 °C.

3.3.6 Melting point

-75,5 °C.

3.3.7 Specific heat

Liquid : 1,337 J/(g.K) at 0 °C

3.3.8 Viscosity (dynamic)

Gas: 11,40 x 10^{-3} mPa.s at 20 °C.

Liquid: 0,76 mPa.s at –50 °C

3.3.9 Critical temperature

157,5 °C

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2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.

3.3.10 Critical pressure

7 780 kPa

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Sulfur dioxide is an acidic gas and a reducing agent. The pH value of an aqueous solution is about 1,5.

Sulfur dioxide reacts violently with oxidizing agents, e.g. peroxides, permanganates.

4 Purity criteria

4.1 General

This document specifies the minimum purity requirements for sulfur dioxide 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 99,9 % of sulfur dioxide

4.3 Impurities and main by-products

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

The concentration limits refer to pure sulfur dioxide

Table 1 — Impurities

Impurity		Limit in mass fraction in % of sulfur dioxide
Water	max.	0,01
Sulfuric acid	max.	0,005

4.4 Chemical parameters

The chemical parameters defined in the UE Water Directive are not found in liquid sulfur dioxide. Pesticides and polycyclic aromatic Hydrocarbons are not by-products of the manufacturing process.

5 Test methods

5.1 Sampling

Observe the recommendations of ISO 3165 and also take account of ISO 6206.

Sampling shall be carried out by an expert; handling of liquid sulfur dioxide is very dangerous and can lead to serious emissions.

5.2 Analyses

5.2.1 Water

The water content shall be determined by Karl Fischer method in accordance with ISO 760.

5.2.2 Sulfuric acid

5.2.2.1 Principle

A measured volume of the laboratory sample is evaporated in a stream of dry nitrogen and the residual sulfuric acid is titrated with a standard volumetric solution alkali.

Note: The method will determine sulfuric acid originally present in the sample but will exclude any which might be formed by reaction of water with any sulfur trioxide present.

WARNING: Liquid sulfur dioxide boils at – 10 °C giving off an irritating toxic gas. Since the liquid is contained in vulnerable glass apparatus great care is necessary in handling. Goggles and rubber gloves should be worn and the test should be carried out in a fume cupboard.

5.2.2.2 Reagents

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

5.2.2.2.1 Sodium hydroxide, solution, *c*(NaOH) = 0,1 mol/l.

5.2.2.2.2 Bromocresol green indicator, aqueous solution at mass fraction of 0,04 %.

5.2.2.2.3 Nitrogen , dry.

5.2.2.3 Apparatus

Ordinary laboratory apparatus and:

5.2.2.3.1 Evaporator

5.2.2.3.2 Water bath

5.2.2.4 Procedure

5.2.2.4.1 Conditioning the apparatus

Condition the evaporator for 12 h with dry nitrogen and transfer sufficient liquid sulfur dioxide for the analysis.

5.2.2.4.2 Determination

Transfer 200 ml to 250 ml of sample from the dispenser into the flask of the evaporator and place it in position on the water bath. Allow the sample to evaporate over 1 h to 2 h in the stream of nitrogen (5.2.2.2.3) , partly immersing the flask in the boiling water for the last 15 min. Remove the flask from the water bath and allow it to cool whilst still under nitrogen purge.

Turn off the nitrogen supply and wash the residual acid from the flask quantitatively into a 25 ml beaker with water. Titrate the solution with sodium hydroxide solution (5.2.2.2.1) using the bromocresol green indicator solution (5.2.2.2.2) (colour change yellow to green).

5.2.2.5 Expression of results

The concentration , *c*, of residual sulfuric acid , expressed in milligrams per kilogram is given by the following equation:

$$c=(V_1 \times 49{,}04/ V_2 \times 1{,}46) \times 100 \qquad (1)$$

where

V_1 is the volume , in millilitres, of the sodium hydroxide titrated;

V_2 is the volume , in millilitres, of the test sample.

Note: 1,46 is the density in grams per millilitre of liquid sulfur dioxide at – 10 °C.

6 Labelling – Transportation – Storage

6.1 Means of delivery

For all means of delivery pressure vessels, e.g. in isocontainers, drums, cylinders, it shall be guaranteed the purity level required for drinking water treatment specified in clause 4 applies.

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 Directives[4)]

The following labelling requirements shall apply to sulfur dioxide at the date of the publication of this standard.

- Symbols and indications of danger :
  T:Toxic.

4) See [2]

- Nature of special risks attributed to dangerous substances :
  R23:Toxic by inhalation;
  R 36/37 : Irritating to eyes and respiratory system.

- Safety advice concerning dangerous substances :
  S 7/9 : Keep container tightly closed and in a well-ventilated place.
  S 44 : If you feel unwell, seek medical advice (show the label where possible).

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.

6.3 Transportation regulations and labelling

Sulfur dioxide is listed under a UN Number [5] 1079:

RID[6] /ADR[7] : class 2, classification code 2TC.

IMDG[8] : class 2 , label poison gas.

IATA[9] : class 2 , label poison gas.

6.4 Marking

The marking shall include the following information :

— name " sulfur dioxide ", trade name and grade ;

— net mass ;

— name and the address of the supplier and/or manufacturer ;

— statement " this product conforms to EN 1019 ".

6.5 Storage

6.5.1 General

The product is stored under pressure in mild steel containers. The containers shall be kept tightly closed and shall be stored in a cool, well-ventilated place , away from direct sunlight.

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[5] United Nations Number.

[6] Regulations concerning International carriage of Dangerous goods by rail.

[7] European Agreement concerning the international carriage of dangerous goods by Road.

[8] International Maritime Transport of Dangerous Goods.

[9] International Air Transport Association

6.5.2 Long term stability

The product is stable during long-term storage

6.5.3 Storage incompatibilities

Storage incompatibilities are covered in 3.4.

Annex A
(informative)

General information on sulfur dioxide

A.1 Origin

A.1.1 Raw materials

Sulfur dioxide is manufactured from sulfur, sulfides and spent acids.

A.1.2 Manufacturing process

Sulfur dioxide is produced from sulfur or sulfides by combustion, from spent acids by decomposition and by desulfurization of stack gases.

A.2 Use

A.2.1 Function

Sulfur dioxide is mainly used for the removal of excess amounts of oxidizing agents , e.g. chlorine and ozone.

A.2.2 Form in which it is used

Sulfur dioxide is used in the form in which it is delivered.

A.2.3 Treatment dose

The treatment dose should be calculated, e.g. as a dechlorination agent, stoichiometric relationship requires 0,9 g of sulfur dioxide to remove 1,0 g chlorine residual.

A.2.4 Means of application

The product is usually applied by vaporizing the liquid , using equipment specially designed for sulfur dioxide , and then dissolving the gas in the water .

A.2.5 Secondary effects

If sulfur dioxide is added in excess, this can lead to a lowering of the pH, resulting in corrosion of equipment and piping.

A.2.6 Removal of excess product

Not applicable.

Annex B
(normative)

General rules relating to safety

B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

Note For the safe handling of liquid sulfur dioxide see the recommendations in [3].

B.2 Emergency procedures

B.2.1 First aid

WARNING : In case of contact of aqueous solutions with eyes and with skin, eyes shall be first treated.

In case of inhalation, remove the patient to fresh air. Lain in a comfortable position. Seek medical advice.

In case of contact with eyes rinse the eyes with running water for at least 15 min, eye lids wide open. Seek medical advice immediately.

In case of contact with skin take off the contaminated clothes and shoes, wash the skin with plenty of water.

In case of respiratory arrest : Give artificial ventilation (mouth-to-mouth or oxygen).

B.2.2 Spillage

Try to stop the release if safe to do so.

If gas is released inside a building, increase the ventilation to limit the concentration of sulfur dioxide.

For a gas released outside a building, close the doors and windows to prevent sulfur dioxide vapour entering.

A water spray is not very efficient for reducing clouds of sulfur dioxide gas. Water shall never be sprayed or poured directly onto a liquid spillage.

B.2.3 Fire

Sulfur dioxide is not combustible .

If there is a fire close to a sulfur dioxide storage vessel, water shall be used to keep the tank cool and prevent the pressure from increasing.

In the event of sulfur dioxide release during a fire, wear self-contained breathing apparatus.

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] CESAS *recommendations for the safe handling of liquid sulfur dioxide*

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