



SLOVENSKI STANDARD

SIST EN 12671:2000

01-november-2000

Kemikalije, ki se uporabljajo za pripravo pitne vode - Klor dioksid

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Chlordioxid

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

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Ta slovenski standard je istoveten z: **EN 12671:2000**

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ICS:

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

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12671

April 2000

ICS 71.100.80

English version

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Chlordioxid

This European Standard was approved by CEN on 22 March 2000.

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.

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

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

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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 October 2000, and conflicting national standards shall be withdrawn at the latest by October 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 of this European Standard is informative, annex B is informative.

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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.

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1 Scope

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

2 Normative references

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

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

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

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

3 Description

3.1 Identification

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3.1.1 Chemical name

Chlorine dioxide.

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3.1.2 Synonym or common name

None.

3.1.3 Relative molecular mass

67,46.

3.1.4 Empirical formula

ClO₂

3.1.5 Chemical formula

°O - Cl = O (resonance structure).

3.1.6 CAS Registry Number ¹⁾

10 049 - 04-4.

¹⁾ Chemical Abstracts Service Registry Number.

3.1.7 EINECS reference²⁾

162 - 8.

3.2 Commercial form

For water treatment, chlorine dioxide is generated as an aqueous solution on or near the site of use and transferred to the site of use.

3.3 Physical properties**3.3.1 Appearance**

The product is an orange gas or liquid, which forms a yellow solution in water.

NOTE If the solution becomes red-brown, it is sign of decomposition.

3.3.2 Density

Gas : 2 400 mg/dm³ at NTP (Normal Temperature Pressure, 273 K and 101,3 kPa³⁾).

Liquid : 1,64 g/ml at 20 °C .

3.3.3 Solubility (in water)

In pure water, the solubility values (S) expressed in grams per cubic meter water of the equilibrating gas at 101,3 kPa are given in Table 1 :

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Table 1 - Solubility in water

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Temperature of water °C	S value : $\frac{\text{g/m}^3\text{H}_2\text{O}}{\text{g/m}^3\text{gas}}$
0	$70 \pm 0,7$ ⁽¹⁾
5	(60,3)
10	(53,7)
15	45 ⁽¹⁾
20	(42,7)
25	(33)
30	(30,1)
35	$26,5 \pm 0,8$ ⁽¹⁾

NOTE 1 S is a ratio, not an absolute value of concentration.

NOTE 2 The values marked ⁽¹⁾ are directly measured values, the values between brackets () are extrapolated data. (The heat of exothermic dissolution in water is 26,8 kJ/mol).

²⁾ European Inventory of Existing Commercial Chemical Substances.

3.3.4 Vapour pressure

$$\text{Log } p = \frac{1,31 \times 10^3}{T} ; \text{ (equation holds up to } 40 \text{ } ^\circ\text{C)} ;$$

where

p is the pressure expressed in kilopascals ;

T is the temperature expressed in kelvins.

3.3.5 Boiling point at 101,3 kPa³⁾

11 °C (for pure chlorine dioxide).

3.3.6 Crystallization point

- 59 °C (for pure chlorine dioxide).

3.3.7 Specific heat

Not applicable.

3.3.8 Viscosity (dynamic)

Not applicable.

3.3.9 Critical temperature

153 °C (for pure chlorine dioxide).

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3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Chlorine dioxide is a molecule containing an unpaired electron and has the characteristics of a "molecule-free-radical". Relevant Redox potentials (25°C) of chlorine dioxide and related molecules are (E_0 values in volts) :



³⁾ 100 kPa = 1 bar



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 product

The chlorine dioxide (ClO_2) is produced as aqueous solution on or near the site of use with concentration lower than 50 g/l.

4.2 Impurities and main by-products

NOTE The concentrations of impurities are those resulting of the secondary components of the reagents used for the generation (see A.1.1). Inadequate design, operation and maintenance of reactors can give rise to the secondary formation of chlorine and traces of chlorate ion and eventually, presence of unreacted chlorite and/or chlorine (see [5]).

4.3 Toxic substances

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

The potentially toxic substances contained in chlorine dioxide are those specified in the standards of starting products.

Starting products and the corresponding EN-standards are indicated in A.1.1.

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5 Test methods

5.1 Sampling

Sampling of chlorine dioxide solutions shall avoid photochemical decompositions, losses by evaporation of the product and consumption by the glassware and dilution water. Samples shall be taken at the exit of the reactor and the analytical procedures started as fast as possible.

In order to achieve these objectives following step by step procedure shall be adopted :

- sampling shall be made in accordance with the general requirements given in ISO 3165 and take into account ISO 6206 ;
- all glassware is to be conditioned **immediately** before sampling, with the solution under investigation and this preliminary rinsing sample is to be discarded ;
- liquid samples for analytical control shall be introduced **directly** into the analytical reagent solutions. The sampling device and procedure shall take care that the sample is directly contacted with the analytical reagent without running along the walls of the analytical glassware ;
- the sample vessels shall be stoppered leaving no -or only a little- a head-space, to store the sample with reagent mixture ;
- at high concentration of chlorine dioxide (20 g/l or higher up to maximum 50 g/l) the samples shall be diluted immediately with water. The analytical result shall be corrected accordingly for the dilution factor ;
- titration analysis shall best be carried out immediately after sampling plus reaction ;
- if immediate titration or measurement is not possible, prior to the analytical measurements the sample plus reagent shall be stored in the dark at low temperature about 5° C, and, contact with ambient air shall be avoided ;
- if immediate collection and analysis are not possible, sample the reactor effluent in a 250 ml conical flask stored on crushed ice and, by introducing the liquid at the bottom of the flask and fill the flask **completely** allowing overflow of chlorine dioxide solution.

The volume of the samples shall be adjusted in accordance with the analytical procedure described hereafter.

5.2 Determination of chlorine dioxide and chlorite concentrations

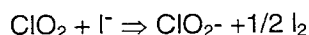
5.2.1 General

This standard method concerns the determination of chlorine dioxide and chlorite concentrations in stored solution.

5.2.2 Principle

Phosphate-buffered iodide is first reacted with the chlorine dioxide sample and titrated at pH 7,2 and subsequently acidified to pH 2 and titration is continued.

5.2.2.1 With iodometry at pH 7,2



and

