



SLOVENSKI STANDARD
oSIST prEN 12671:2014

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Kemikalije, ki se uporabljajo za pripravo pitne vode - Klorov dioksid, proizveden na kraju samem

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Vor Ort erzeugtes Chlordioxid

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

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13.060.20	Pitna voda	Drinking water
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English Version

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

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 164.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Foreword

This document (prEN 12671:2014) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12671:2009.

Significant technical differences between this edition and EN 12671:2009 are as follows:

- a) deletion of reference to EU Directive 67/548/EEC of June 27, 1967 in order to take into account the latest Regulation in force (see [3]);
- b) section 6.2 – updating of risk and safety labelling according to EU Regulation [3] and its latest Adaptations to Technical Progress):

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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 document:

- 1) this document 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.

NOTE 1 Conformity with this 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.

NOTE 2 This product is a biocide and has to comply with the relevant legislation in force. In the European Union, at the time of publication, this legislation is REGULATION (EU) No 528/2012 [2].

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1 Scope

This document is applicable to chlorine dioxide generated on site for treatment of water intended for human consumption. It describes the characteristics for chlorine dioxide and specifies the composition and the corresponding test methods for chlorine dioxide. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use of chlorine dioxide generated on site (see Annex B).

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)*

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

Chlorine dioxide.

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⁾

10049-04-4

3.1.7 EINECS reference ²⁾

233-162-8

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

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3.2 Presentation form

For water treatment, chlorine dioxide is generated in situ 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 pure product is an orange gas or liquid, which forms a yellow solution in water.

Note 1 to entry: If the solution becomes red-brown, it is sign of decomposition.

3.3.2 Density

Gas: 3,09 g/l, (2,4 g/l relative, air = 1) at 273 K and 101,3 kPa ³⁾.

Liquid: 1,64 g/ml at 20 °C.

3.3.3 Solubility in water

In Table 1 the solubility values (S) for chlorine dioxide are given in grams per m³ water at a pressure of 101,3 kPa for different temperatures 1:

Table 1 — Solubility values

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

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

NOTE 2 The S values are directly measured values except those in brackets which are extrapolated data.

3) 100 kPa = 1 bar

3.3.4 Vapour pressure

The vapour pressure of pure chlorine dioxide as a function of temperature is given in Table 2.

Table 2 — Vapour pressure of pure chlorine dioxide

Temperature [C°]	Vapour pressure [kPa]	
0	82,3	
5	90,4	
10	98,8	
11	100,5	
20	116,5	(extrapolated)
25	125,8	(extrapolated)
30	135,3	(extrapolated)
35	145,1	(extrapolated)
40	155,0	(extrapolated)

3.3.5 Boiling point at 101,3 kPa ⁴⁾

11 °C (for pure chlorine dioxide).

3.3.6 Crystallisation point

- 59 °C (for pure chlorine dioxide).

3.3.7 Specific heat

The specific heat of solutions of chlorine dioxide is very similar to that of pure water.

3.3.8 Viscosity (dynamic)

The dynamic viscosity of solutions of chlorine dioxide is very similar to that of pure water.

3.3.9 Critical temperature

153 °C (for pure chlorine dioxide).

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.3.12 Dissolution heat

The heat of the dissolution in water is – 26,8 kJ/mol (exothermic).

4) 100 kPa = 1 bar

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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 of chlorine dioxide and related molecules are (E_o values at 25 °C in volts):



4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for chlorine dioxide generated in situ 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 product 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 lead to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of in-situ generated product

Chlorine dioxide (ClO_2) is produced as aqueous solution on or near the site of use. For safety reasons the aqueous ClO_2 -solution without intermediate storage in a storage tank (i.e. without headspace) may not exceed a concentration of 20 g/l.

The concentration of the aqueous ClO_2 solution with intermediate storage in a storage tank (i.e. with headspace) should not exceed a concentration of 3 g/l, to ensure an adequate distance to the explosion limit (see B.1).

4.3 Impurities and main by-products

Impurities and main by-products of the starting products used for the generation (indicated in A.1.1) can be found in the in situ generated product in respective proportional concentrations.

Inadequate design, operation and maintenance of reactors can give rise to the formation of chlorine and traces of chlorate ion and, eventually, the presence of unreacted chlorite, chlorate and/or chlorine (see [6]); for analysis see 5.2 and A.4.

4.4 Chemical parameters

Limits of chemical parameters being potentially present in chlorine dioxide solution have been specified in the corresponding EN standards of the starting products (indicated in A.1.1).

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 or from the storage tank with a sampling tube and the analytical procedures started as fast as possible.

In order to achieve these objectives the 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 (> 10 g/l) the samples shall be collected in a vessel, containing 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.

NOTE Other oxidizing agents could interfere with the determination.