SLOVENSKI STANDARD
oSIST prEN 1278:2024

01-julij-2024

Kemikalije, ki se uporabljajo za pripravo pitne vode - Ozon

Chemicals used for treatment of water intended for human consumption - Ozone

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Ozon

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

Ta slovenski standard je istoveten z: **prEN 1278**

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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

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English Version

Chemicals used for treatment of water intended for human consumption - Ozone

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Ozon

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 1278:2024) 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 1278:2010.

prEN 1278:2024 includes the following significant technical changes with respect to EN 1278:2010:

— proposed harmonized classification of ozone according to EU CLP regulation is added;

— reference for use of ozone is made to EU BPR and EU REACH regulation;

— new threshold limit for ozone in air;

— reference is made to FprEN 17971, standard for ozone generation devices. Device related matters are shifted to FprEN 17971, e.g. operational safety of the installation room. Matters of the chemical ozone itself remain within this standard.

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this document, it provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA.

NOTE 1 While awaiting the adoption of verifiable European criteria, attention is drawn to national regulations.

Ozone is a biocidal product according to the regulation (EU) No 528/2012 [1]. The use of *in situ* generated ozone for disinfection purposes falls under the provisions of the BPR, requiring access by the user to a data set for the product authorization of ozone under the BPR. This access may be achieved directly or indirectly e.g. via the manufacturers' authorization for ozone generated by their devices.

Users of *in situ* generated ozone should verify with their device manufacturer, if they can use ozone in accordance to his product authorization for the disinfection of water intended for human consumption (included in the BPR for drinking water use).

Non biocidal use of ozone, e.g. for oxidative purposes, falls under the provisions of the REACH Regulation [2]. The use of ozone for non-biocidal purposes requires individual access by the user to the data set provided for the authorization of ozone under REACH.

NOTE 2 Conformity with the standard does not confer or imply authorization 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 document is applicable to ozone used for treatment of water intended for human consumption. It describes the characteristics of ozone, specifies tests methods for determining the ozone concentration in gases and determines rules for safe handling of the chemical ozone.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

FprEN 17971, *Devices for in-situ generation of biocides — Ozone*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
normal temperature and pressure of gas
NTP
gas under the conditions of normal temperature tn = 0 °C and normal pressure pn = 101 325 Pa

3.2
feed gas
substance that is fed as gas to the ozone generation device to generate ozone

4 Description

4.1 Identification

4.1.1 chemical name

Ozone.

General information on Ozone is described in Annex A.

4.1.2 synonym or common name

None (has sometimes been called improperly “allotropic oxygen”).

4.1.3 relative molecular mass

48.

4.1.4 Empirical formula

O_3.

4.1.5 chemical formula

O_3.

4.1.6 CAS Registry Number [1)]

10028-15-6.

4.1.7 EINECS reference [2)]

Not applicable.

4.2 Commercial form

Ozone is very unstable; it is exclusively generated on-site nearby its use by ozone generation devices.

4.3 Physical properties

4.3.1 Appearance

Bluish gas, the liquid is dark blue.

NOTE A weak absorption in the visual range between 435 nm and 475 nm.

4.3.2 Density

Gas: 2,144 kg/m^3 at NTP (Normal Temperature Pressure, 273 K and 1013,25 hPa);

Liquid: 1,574 g/cm^3 at - 183 °C;

Solid: 1,728 g/cm^3.

4.3.3 The gas-liquid partition coefficient

In pure water, the partition coefficient values (S) expressed in grams per cubic meter water per (grams per cubic meter) gas at 1013,25 hPa are given in Table 1.

Table 1 — The gas-liquid partition coefficient between water and gas phase

Temperature of water °C	Solubility S, in $\frac{g/m^3\ H_2O}{g/m^3\ gas}$
0	0,64
5	0,5
10	0,39
15	0,31
20	0,24
25	0,19
30	0,15
35	0,12

NOTE 1 Recent surveys of literature data are given in Bibliography. See [3], [4] and [5].

NOTE 2 S is a ratio, not an absolute concentration.

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

4.3.4 Vapour pressure

The vapour pressure of ozone depending on temperature is given in Table 2.

Table 2 — Vapour pressure

Temperature °C	Vapour pressure hPa
- 183	0,147
- 180	0,28
- 170	01,88
- 160	8,97
- 150	33,06
- 140	98,92
- 130	253,31
- 120	569,28
- 110	1153,22
- 100	2 1390,79

4.3.5 Boiling point at 1000 hPa [3)]

– 112 °C.

NOTE Vaporization heat: 681 kJ/m3at NTP.

4.3.6 Melting point

– 196 °C.

4.3.7 Specific heat (liquid)

Not applicable.

4.3.8 Viscosity (dynamic)

0,004 2 Pa.s at – 195 °C;

0,0015 5 Pa.s at – 183 °C.

4.3.9 Critical temperature

– 12,1 °C.

4.3.10 Critical pressure

5 4600 hPa.

4.3.11 Physical hardness

Not applicable.

[3)] 1000 hPa = 1 bar

4.4 Chemical properties

Ozone is a powerful oxidant and disinfectant. The standard redox potentials (ORP) at 25 °C are:

(E_O^H values in volts):

$O_3 + 2H^+ + 2e^- \rightarrow O_2 + H_2O \quad E_O^H = 2{,}07\ V$ (1)

$O_3 + H_2O + 2e^- \rightarrow O_2 + 2OH^- \quad E_O^H = 1{,}24\ V$ (2)

$OH° + H^+ + e^- \rightarrow H_2O \quad E_O^H = 2{,}42\ V$ (calculated value) (3)

If the pH increases by one unit, the E^H -values shall decrease by 30 mV per electron transferred. At 1000 hPa and 25 °C and pH = 7 the E^H -values, versus the normal hydrogen electrode, become:

O_3 (1) = 1,66 V;

O_3 (2) = 0,82 V;

OH° (3) = 2,21V

In water treatment most of the direct reactions of ozone are dipolar cyclo-additions and electrophilic substitution reactions. Moreover ozone, in water, can generate radicals such as OH° in particular at alkaline pH: ($O_3 + H_2O \rightarrow 2\ OH° + O_2$). The OH° radical is a strong general oxidant.

5 Purity criteria

5.1 General

The purity of the generated ozone depends strongly on the purity of the precursors and the technology of the applied ozone generation device. The generation of ozone used for the treatment of water intended for human consumption takes place usually by the technology of dielectric barrier discharge. This technology uses ambient air or oxygen as feed gas for the ozone generation device to generate ozone. The generation technology, purity requirements for the feed gas, by-products of the ozone generation, and by products of ozone dosed in water are described in the FprEN 17971. The purity requirements of FprEN 17971 apply for this standard.

NOTE Attention is drawn to national regulation for the users of Ozone 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 document.

5.2 Composition of *in situ* generated Ozone gas

According to FprEN 17971 the nominal ozone concentration using:

— clean dry air is typically 20 g ozone per m^3_n of process gas = ca. 1,5 % *w*/*w* (in practice 70 g/m^3_n = ca. 5,3 % *w*/*w* can be achieved).

— oxygen as a feed gas is typically 100 g per m^3_n of process gas = ca. 7 % w/w (in practice 300 g/m^3_n = ca. 21 % *w*/*w* can be achieved).

The concentration (in grams per cubic metre NTP) at the nominal operating condition of the generators shall be specified in the tendering documents.