BS EN 13176:2015

BSI Standards Publication

Chemicals used for treatment of water intended for human consumption — Ethanol

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National foreword

This British Standard is the UK implementation of EN 13176:2015. It supersedes BS EN 13176:2008 which is withdrawn.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.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

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EN 13176

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English Version

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

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Ethanol

This European Standard was approved by CEN on 20 December 2014.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 13176:2015) 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of an identical text or by endorsement, at the latest by September 2015, and conflicting national standards shall be withdrawn at the latest by September 2015.

This document supersedes EN 13176:2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

Significant technical difference between this edition and EN 13176:2008 is 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 [2]);

b) 6.2 – updating of risk and safety labelling according to EU Regulation [2] 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 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 synthetic ethanol used for treatment of water intended for human consumption. It describes the characteristics of synthetic ethanol and specifies the requirements and the corresponding test methods for synthetic ethanol. It gives information on its use in water treatment.

NOTE This European Standard does not apply to anhydrous ethanol which is not used for drinking 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 1233, *Water quality - Determination of chromium - Atomic absorption spectrometric methods*

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

EN 26595, *Water quality — Determination of total arsenic — Silver diethyldithiocarbamate spectrophotometric method (ISO 6595)*

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 3856-2, *Paints and varnishes — Determination of "soluble" metal content — Part 2: Determination of antimony content — Flame atomic absorption spectrometric method and Rhodamine B spectrophotometric method*

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

ISO 8288:1986, *Water quality — Determination of cobalt, nickel, copper, zinc, cadmium and lead — Flame atomic absorption spectrometric methods*

ISO 9965, *Water quality — Determination of selenium — Atomic absorption spectrometric method (hydride technique)*

3 Description

3.1 Identification

3.1.1 Chemical name

Ethanol.

3.1.2 Synonym or common name

Ethyl alcohol.

3.1.3 Relative molecular mass

46,07

3.1.4 Empirical formula

C_2H_60

3.1.5 Chemical formula

C_2H_5OH

3.1.6 CAS Registry Number [1)]

64-17-5

3.1.7 EINECS reference [2)]

200-57-86

3.2 Commercial form

The product is available as colourless liquid.

3.3 Physical properties

3.3.1 Appearance

The product is colourless liquid at 20 °C.

3.3.2 Density

The density at 20 °C is given in Table 1 (see [3] and [4]).

Table 1 — Density

Concentration **Mass fraction %**	**Density** g/ml
95	0,8114
95,1	0,8110
95,2	0,8106
95,3	0,8104
95,4	0,8100
95,5	0,8096
95,6	0,8092
95,7	0,8088
95,8	0,8084
95,9	0,8080
96	0,8076

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3.3.3 Solubility in water

Miscible.

3.3.4 Vapour pressure (at 20 °C)

5,81 kPa (for pure ethanol)

3.3.5 Boiling point at 100 kPa [3)]

78,2 °C (for pure ethanol)

3.3.6 Melting point

- 112,3 °C (for pure ethanol)

3.3.7 Specific heat

2,399 kJ/(kg K) at 20 °C (for pure ethanol)

3.3.8 Viscosity, dynamic

1,2 mPa.s at 20 °C (for pure ethanol)

3.3.9 Critical temperature (for gas)

240,77 °C

3.3.10 Critical pressure (for gas)

6 400 kPa

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Ethanol is a polar and protic organic solvent.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for Ethanol 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.

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 the product standard.

3) 100 kPa = 1 bar

Limits have been given for impurities and chemicals 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(s) 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 a mass fraction of at least 95 % synthetic ethanol.

The commercial product may contain up to a mass fraction of 5 % water.

4.3 Impurities and main by-products

The acetaldehyde content shall not exceed 100 mg/kg of pure ethanol.

4.4 Chemical parameters

NOTE For the purpose of this European Standard, “chemical parameters” are those defined in the EU Directive 98/83/EC of 3 November 1998 (see [1]).

The content of chemical parameters shall conform to the requirements specified in Table 2.

Table 2 — Chemical parameters

Parameter		Limit in mg/kg of pure ethanol
Arsenic (As)	max.	1
Cadmium (Cd)	max.	2
Chromium (Cr)	max.	5
Mercury (Hg)	max.	2
Nickel (Ni)	max.	1
Lead (Pb)	max.	2
Antimony (Sb)	max.	1
Selenium (Se)	max.	1
NOTE Cyanide does not exist in ethanol solvent medium. Pesticides and polycyclic aromatic hydrocarbons are not by-products of the manufacturing process.		

5 Test methods

5.1 Sampling

5.1.1 Relevant standards

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

5.1.2 Sampling from drums and bottles

5.1.2.1 General

5.1.2.1.1 Mix the contents of the container to be sampled by shaking the container, by rolling it or by rocking it from side to side, taking care not to damage the container or spill any of the liquid.

5.1.2.1.2 If the design of the container is such (for example, a narrow-necked bottle) that it is impracticable to use a sampling implement, take a sample by pouring after the contents have been thoroughly mixed. Otherwise, proceed as described in 5.1.2.1.3.

5.1.2.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.2.2; otherwise, take samples as described in 5.1.2.3.

5.1.2.2 Surface sampling

Take a sample using a suitable ladle. Lower the ladle into the liquid until the rim is just below the surface, so that the surface layer runs into it. Withdraw the ladle just before it fills completely and allow any liquid adhering to the ladle to drain off. If necessary, repeat this operation so that, when the other selected containers have been sampled in a similar manner, the total volume of sample required for subsequent analysis is obtained.

5.1.2.3 Bottom sampling

Take a sample using an open sampling tube, or a bottom-valve sampling tube, suited to the size of container and the viscosity of the liquid.

When using an open sampling tube, close it at the top and then lower the bottom end to the bottom of the container. Open the tube and move it rapidly so that the bottom of the tube traverses the bottom of the container before the tube is filled. Close the tube, withdraw it from the container and allow any liquid adhering to the outside of the tube to drain off.

When using a bottom-valve sampling tube, close the valve before lowering the tube into the container and then proceed in a similar manner to that when using an open sampling tube.

5.1.3 Sampling from tanks and tankers

From each access point, take samples as follows:

a) from the surface of the liquid, using a ladle as described in 5.1.2.2;

b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.2.3 or using a specially designed bottom-sampling apparatus;

c) from one or more positions, depending on the overall depth, between the bottom and the surface using a weighted sampling can.

5.2 Analysis

5.2.1 Ethanol (main product)

5.2.1.1 Principle

The ethanol content is determined by measuring the density using a digital density meter.

The measuring principle of the digital density meter is based on the change of the frequency of a hollow oscillator when filled with different liquids. The mass, and thus the density of the liquid, changes this frequency due to a gross mass change of the oscillator caused by the introduction of the liquid.

The oscillator consists of a hollow elastic glass tube which is electronically excited in an undamped harmonic fashion. The density meter gives a direct read-out of the density result.

5.2.1.2 Apparatus

5.2.1.2.1 Digital density meter capable of measuring at (20 ± 0,1) °C.

5.2.1.2.2 Glass syringe, capacity 2 ml.

5.2.1.3 Procedure

5.2.1.3.1 Determination

Introduce the required volume of ethanol into the oscillator cell thermoregulated at (20 ± 0,1) °C. Record the density measurement from the digital density meter.

5.2.1.4 Expression of results

Obtain the value of the ethanol concentration (C_1), as a percentage of mass fraction from the measured density using Table 1.

5.2.1.5 Repeatability limit

The absolute difference between two single test results, obtained under repeatability conditions, shall not be greater than the repeatability limit value, r, as calculated from the following formula:

$$r = 0{,}0001\ z \qquad (1)$$

where

z is the mean of the two results, expressed in mass fraction %.

NOTE Repeatability conditions are conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

5.2.2 Impurities

5.2.2.1 Acetaldehyde content

5.2.2.1.1 Principle

A sample of ethanol is introduced into a gas chromatograph containing a packed column and maintained at 80 °C.

5.2.2.1.2 Reagents

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

5.2.2.1.2.1 Carrier gas

Nitrogen, gas chromatography grade.

5.2.2.1.2.2 Hydrogen

Gas chromatography grade.

5.2.2.1.2.3 Air

Suitable for gas chromatography.

5.2.2.1.2.4 Ethanol

5.2.2.1.2.5 Acetaldehyde

5.2.2.1.3 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

5.2.2.1.3.1 Chromatograph

Use a gas chromatographic apparatus with typical set up described in the following subclauses.

NOTE Different instrumental parameters can be required for specific chromatographic apparatus

5.2.2.1.3.2 Column oven

Air oven at 80 °C.

5.2.2.1.3.3 Gas controls

Carrier gas at 16 ml/min.

Hydrogen at 33,9 ml/min.

Air at 293 ml/min.

5.2.2.1.3.4 Injections

Direct on-column injector at 80 °C, 1 μl sample.

5.2.2.1.3.5 Column

A glass column of 3 m nominal length and an internal diameter of 2 mm. Packing Carbowax 20M® (80/120 mesh)[4)] or equivalent.

Other columns may be used if they give equivalent results.

5.2.2.1.3.6 Flame ionization detector

5.2.2.1.4 Procedure

5.2.2.1.4.1 Calibration

Prepare accurately four synthetic mixtures with acetaldehyde (5.2.2.1.2.5) in the range of 1 mg/kg to 200 mg/kg in ethanol (5.2.2.1.2.4).

Inject the samples and a sample of the ethanol (5.2.2.1.2.4) in turn onto the gas chromatograph.

Plot on linear graph paper the area ratio of each component on the x-axis and the mass ratio on the y-axis. The response shall be linear. Determine the absolute mass response of the acetaldehyde component (F_x) as the slope of the graph.

4) Carbowax 20 M® is the trade-name of a product supplied by Johns Manville. This information is given for the convenience of users of this standard and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same results.

5.2.2.1.4.2 Determination

Inject 1 µl of the test sample and adjust the amplification so that each peak obtained remains on the scale.

5.2.2.1.5 Expression of results

The acetaldehyde content (C_2) expressed in milligrams per kilogram of pure ethanol is given by the following formula:

$$C_2 = \frac{F_x \times A_x \times 100}{C_1} \quad (2)$$

where

F_x is the absolute mass response factor of acetaldehyde component;

A_x is the peak area of acetaldehyde component;

C_1 is the concentration, expressed in mass fraction percent of ethanol (see 5.2.1.4).

5.2.2.1.6 Repeatability limit

The absolute difference between two single test results, obtained under repeatability conditions, shall not be greater than the repeatability limit value, r, as calculated from the following formula:

$$r = 0{,}03\ z \quad (3)$$

where

z is the mean of the two results, expressed in milligrams per kilogram.

NOTE Repeatability conditions are conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

5.2.3 Chemical parameters

5.2.3.1 Determination of antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), nickel (Ni) and selenium (Se)

5.2.3.1.1 Principle

The elements antimony, cadmium, chromium, lead, nickel and selenium are determined by atomic absorption spectrometry. Arsenic is determined by molecular absorption spectrometry.

5.2.3.1.2 Reagents

All reagents shall be of a recognized analytical grade and the water used shall conform to the appropriate grade specified in EN ISO 3696.

5.2.3.1.2.1 Nitric acid, concentrated, ρ = 1,42 g/ml

5.2.3.1.3 Procedure

5.2.3.1.3.1 Test portion

Weigh, to the nearest 0,01 g, 20 g (m) from the laboratory sample into a glass beaker.

5.2.3.1.3.2 Test solution

Evaporate until a wet residue is obtained, cool, add 1 ml of nitric acid (5.2.3.1.2.1); dilute with a few millilitres of water, transfer quantitatively to a 100 ml one-mark volumetric flask, make up to the mark with water and mix.

Carry out the evaporation carefully and not to dryness in order to avoid possible losses of arsenic and selenium.

5.2.3.1.3.3 Determination

Determine the content of chemical parameters in the test solution (5.2.3.1.3.2) in accordance with the following methods:

— **Cd, Ni and Pb**: In accordance with ISO 8288:1986, method A;

— **Cr**: In accordance with EN 1233;

— **As**: In accordance with EN 26595;

— **Sb**: In accordance with ISO 3856-2;

— **Se**: In accordance with ISO 9965.

These methods will provide an interim result (y) expressed in milligrams per litre which needs to be corrected to give the final concentration according to the formula in 5.2.3.1.3.4.

5.2.3.1.3.4 Expression of results

From the interim results (y) determined (see 5.2.3.1.3.3), the content, C_3, of each chemical parameter in the laboratory sample, expressed in milligrams per kilogram of pure ethanol is given by the following formula:

$$C_3 = \frac{y \times V \times 100}{m \times C_1} \quad (4)$$

where

y is the interim result (5.2.3.1.3.3);

V is the volume, expressed in millilitres, of the test solution (5.2.3.1.3.2) (= 100 ml);

m is the mass, expressed in grams, of the test portion;

C_1 is the concentration, expressed in mass fraction percent of ethanol (see 5.2.1.4).

5.2.3.2 Determination of mercury content (Hg)

5.2.3.2.1 Principle

The element mercury is determined by flameless atomic absorption spectrometry in accordance with EN ISO 12846.

5.2.3.2.2 Reagents

All reagents shall be of a recognized analytical grade and the water used shall conform to the appropriate grade specified in EN ISO 3696.

5.2.3.2.2.1 Potassium permanganate solution, $c(KMnO_4)$ = 50 g/l.

5.2.3.2.2.2 **Sulfuric acid,** concentrated, ρ = 1,84 g/ml.

5.2.3.2.2.3 **Hydroxylammonium chloride solution,** $c(NH_2OH \times HCl)$ = 100 g/l.

5.2.3.2.2.4 **Potassium dichromate solution,** $c(K_2Cr_2O_7)$ = 4 g/l in 50 % by volume nitric acid solution.

5.2.3.2.3 Procedure

5.2.3.2.3.1 Test portion

Weigh, to the nearest 0,01 g, 10 g (m) from the laboratory sample, into a glass beaker.

5.2.3.2.3.2 Test solution

Quantitatively transfer the test portion to a 100 ml (V) volumetric flask. Dilute with water to the mark and mix (solution A).

Pipette, accurately 10 ml (V_1) of the solution A. Transfer to a 250 ml conical flask and add 60 ml of water, 20 ml of a potassium permanganate solution (5.2.3.2.2.1) and five 1 ml portions of sulfuric acid (5.2.3.2.2.2). Bring to the boil and maintain boiling for 10 min. Allow to cool. Just dissolve the precipitate (MnO_2) with hydroxylammonium chloride (5.2.3.2.2.3), add 5 ml of a potassium dichromate solution (5.2.3.2.2.4) and transfer to a 100 ml (V_2) volumetric flask. Dilute to the mark with water and mix.

5.2.3.2.3.3 Determination

Proceed as described in EN ISO 12846.

5.2.3.2.3.4 Expression of results

The interim result for mercury content (y) expressed in milligrams per litre is given by the following formula:

$$y = y_A \times \frac{V_2}{V_1} \quad (5)$$

where

y_A is the result obtained in 5.2.3.2.3.3, for the concentration of mercury in the test solution, expressed in milligrams per litre;

V_2 is the volume, in millilitres, of the test solution;

V_1 is the volume, in millilitres, of the sample taken from solution A.

The mercury content, C_4, in milligrams per kilogram of pure ethanol is given by the following formula:

$$C_4 = \frac{y \times V \times 100}{m \times C_1} \quad (6)$$

where

y is the previously determined interim result for mercury content;

V is the volume in millilitres of the solution A (see 5.2.3.2.3.2);

m is the mass, expressed in grams, of the test portion (5.2.3.2.3.1);

C_1 is the concentration, expressed in mass fraction percent of ethanol (see 5.2.1.4).

6 Labelling - Transportation - Storage

6.1 Means of delivery

Ethanol shall be delivered in drums, containers or tankers up to 25 t capacity.

In order that the purity of the product 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 [5)]

The following labelling requirements shall apply to ethanol.

Hazard pictogram	
 **Figure 1 – GHS02**	— Signal word: **Danger** — Hazard statements: H225:Highly flammable liquid and vapour Precautionary statements ('P statements') should be provided by the company being responsible for the marketing of the substance. They should be indicated on the packaging label and in the extended safety data sheet (eSDS) of the substance.

The legislation [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

Ethanol is listed as UN Number [6)] 1170:

— RID [7)]/ADR [8)]: class 3;

— IMDG [9)]: class 3.2, packing group II;

— IATA [10)]: class 3.2, packing group II.

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5) See [2].
6) United Nations Number.
7) Regulations concerning international carriage of Dangerous goods by rail.
8) European Agreement concerning the international carriage of Dangerous goods by Road.
9) International Maritime Transport of Dangerous Goods.
10) International Air Transport Association.

6.4 Marking

The marking shall include the following:

— the name “ethanol”, trade name;

— the net mass;

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

— the statement “this product conforms to EN 13176”.

6.5 Storage

6.5.1 General

Storage area shall be dry, out of direct sunlight, well ventilated. Store away from sources of heat or ignition. Storage and transfer equipment shall be adequately earth bonded to prevent the accumulation of static charges. Storage tanks shall be positioned in a bonded area. Suitable storage materials are: mild steel, stainless steel, iron.

Do not store in aluminium and its alloys.

For gaskets and seals use n-butyl rubber or polytetrafluoroethylene.

6.5.2 Long term stability

Product is stable for at least one year.

6.5.3 Storage incompatibilities

Conditions to avoid: High temperatures.

Materials to avoid: Oxidizing agents, sulfuric acid, nitric acid.

Hazardous decomposition products: Combustion will generate oxides of carbon.

Annex A
(informative)

General information on synthetic ethanol

A.1 Origin

A.1.1 Raw materials

Synthetic ethanol is manufactured from ethylene (C_2H_4) and water (H_2O).

A.1.2 Manufacturing process

It is produced by hydration of ethylene.

$$C_2H_4 + H_2O \rightarrow C_2H_5OH \quad \text{(A.1)}$$

A.2 Use

A.2.1 Function

Its function in water treatment is as a source of carbon for biological denitrification processes.

A.2.2 Form in which it is used

It is used in liquid forms.

A.2.3 Treatment dose

Sufficient ethanol should be added to achieve reduction of dissolved oxygen and reduction of nitrates.

Depending of the initial water composition, carbon source requirements (as C) for dissolved oxygen (DO) are 0,5 mg/mg DO and for nitrates 2,0 mg/mg NO_3/N.

A.2.4 Means of application

It is applied using a metering pump, explosion free type.

A.2.5 Secondary effects

Secondary effects are avoided by correct operation of the process.

A.2.6 Removal of excess product

The process is operated so as to minimize the residual ethanol concentration.

Annex B
(normative)

General rules relating to safety

B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

B.2 Emergency procedures

B.2.1 First aid

Eyes - Immediately rinse the eye with plenty of water for at least 15 min, holding the eye open. Obtain medical attention urgently.

Skin - Wash skin thoroughly with soap and water. Obtain medical attention if blistering occurs or redness persists.

Ingestion - Wash out mouth with water. Do not induce vomiting.

Inhalation - Remove from exposure. Keep warm and at rest. If there is difficulty in breathing, give oxygen. If breathing stops or shows signs of failing, give artificial respiration. If heartbeat absent, give external cardiac compression. Obtain medical attention.

B.2.2 Spillage

Contain and absorb the product using earth, sand, or other inert material. Transfer to suitable containers for recovery or disposal. Disperse vapour with water spray. Spillages will create a fire hazard

B.2.3 Fire

Extinguishing Media - Use water spray, mist or alcohol resistant foam.

Small fires : Use water spray, foam, dry chemical or carbon dioxide. Keep containers and surroundings cool with water spray.

Unsuitable extinguishing media - Do not use water jet.

Protective equipment for fire- fighting - 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] 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).

[3] Practical alcohol tables compiled on the basis of general formula given in the Directive of the Council of the European Communities, dated 27th July 1976, relating to alcohol tables.

[4] HANDBOOK I.S., EDITION T. *E. W. Fink*. Published by Noyes Data Corporation, 1985

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