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Chemicals used for treatment of water intended for human consumption — High-calcium lime

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National foreword

This British Standard is the UK implementation of EN 12518:2014. It supersedes BS EN 12518:2008 which is withdrawn.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.

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English Version

Chemicals used for treatment of water intended for human consumption - High-calcium lime

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Weißkalk

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Foreword

This document (EN 12518:2014) 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of an identical text or by endorsement, at the latest by January 2015 and conflicting national standards shall be withdrawn at the latest by January 2015.

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.

This document supersedes EN 12518:2008.

The significant technical difference between this edition and EN 12518:2008 is the replacement of warning and safety precaution notes by labelling according to REGULATION (EC) No 1272/2008 (see [2]).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the 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 European Standard is subject to regulation or control by National Authorities.

1 Scope

This European Standard is applicable to high-calcium lime used for treatment of water intended for human consumption. It describes the characteristics of high-calcium lime and specifies the requirements and the corresponding test methods for high-calcium lime. 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 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 12485, *Chemicals used for treatment of water intended for human consumption - Calcium carbonate, high-calcium lime, half-burnt dolomite, magnesium oxide and calcium magnesium carbonate - Test methods*

3 Description

3.1 Identification

3.1.1 General

High-calcium limes are calcium oxide, calcium hydroxide and aqueous suspension of calcium hydroxide (milk of lime).

3.1.2 Chemical names

a) Calcium oxide.

b) Calcium hydroxide.

3.1.3 Synonym or common names

a) Calcium oxide: Pulverized high-calcium lime, quicklime, lump high-calcium lime.

b) Calcium hydroxide: Hydrated high-calcium lime, calcium hydroxide - aqueous suspension (milk of lime).

3.1.4 Relative molecular mass

a) Calcium oxide: 56,08.

b) Calcium hydroxide: 74,09.

3.1.5 Empirical formula

a) Calcium oxide: CaO.

b) Calcium hydroxide: $Ca(OH)_2$.

3.1.6 Chemical formula

a) Calcium oxide: CaO.

b) Calcium hydroxide: $Ca(OH)_2$.

3.1.7 CAS Registry Number [1)]

a) Calcium oxide: 1305-78-8.

b) Calcium hydroxide: 1305-62-0.

3.1.8 EINECS reference [2)]

a) Calcium oxide: 215-138-9.

b) Calcium hydroxide: 215-137-3.

3.2 Commercial forms

High-calcium lime is available in the following commercial forms:

— pulverized high calcium lime (quicklime): white powder (CaO);

— lump high-calcium lime (quicklime): white lump (CaO);

— hydrated high-calcium lime: white powder, ($Ca(OH)_2$);

— milk of lime: aqueous suspension of calcium hydroxide (usual content of calcium hydroxide is a mass fraction between 10 % to 40 %).

3.3 Physical properties

3.3.1 Appearance

a) Calcium oxide: white, lumps or powder.

b) Calcium hydroxide: white powder.

c) Calcium hydroxide suspension: aqueous, milky suspension.

3.3.2 Density

a) Calcium oxide: 3,35 kg/dm^3 at 20 °C.

Bulk density: 800 kg/m^3 to 1 200 kg/m^3 ;

b) Calcium hydroxide: 2,24 kg/dm^3 at 20 °C.

Bulk density: 300 kg/m^3 to 600 kg/m^3.

3.3.3 Solubility (in water)

Calcium oxide: not applicable.

Calcium hydroxide: 1,85 g/l at 0 °C
1,65 g/l at 20 °C
1,53 g/l at 30 °C

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1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

1,40 g/l at 40 °C
1,28 g/l at 50 °C
1,16 g/l at 60 °C
1,04 g/l at 70 °C
0,92 g/l at 80 °C
0,81 g/l at 90 °C
0,71 g/l at 100 °C

3.3.4 Vapour pressure

Not applicable.

3.3.5 Boiling point at 100 kPa[3)]

a) Calcium oxide: 2 850 °C.

b) Calcium hydroxide: Decomposes at 580 °C and forms calcium oxide and water.

3.3.6 Melting point

a) Calcium oxide: 2 570 °C.

b) Calcium hydroxide: Decomposes at 580 °C and forms calcium oxide and water.

c) Calcium hydroxide suspension: freezes at 0 °C.

3.3.7 Specific heat

Not applicable.

3.3.8 Viscosity (dynamic)

For calcium hydroxide suspension: depends on concentration and particle size.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Aqueous suspensions are strongly alkaline. Calcium oxide (CaO) reacts with water to form calcium hydroxide $Ca(OH)_2$, and with acids to form calcium salts. These reactions are highly exothermic.

[3)] 100 kPa = 1 bar.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for high-calcium lime 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 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 products shall conform to the requirements specified in Table 1.

Table 1 — Major constituents and grading

Parameter	Pulverized high-calcium lime			Lump high-calcium lime			Hydrated high-calcium lime			Milk of lime[b]		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
Content of water-soluble CaO expressed as CaO in mass fraction in %	≥ 87[a]	≥ 84	≥ 80	≥ 87[a]	≥ 84	≥ 80						
Content of water-soluble $Ca(OH)_2$ in dry substance expressed as $Ca(OH)_2$ in mass fraction in %							≥ 92[a]	≥ 87	≥ 83	≥ 92[a]	≥ 87	≥ 83
Retention on sieving in mass fraction in % dry substance												
0,60 mm	≤ 0,1	≤ 0,1	≤ 0,1	not applicable			≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,1	≤ 0,1
0,09 mm	≤ 7,0	≤ 7,0	≤ 7,0	not applicable			≤ 5,5	≤ 5,5	≤ 5,5	≤ 5,5	≤ 5,5	≤ 5,5

[a] The user may specify a higher content of lime.
[b] See A.2.3 (for solubility index).

4.3 Impurities

The products shall conform to the requirements specified in Table 2.

Table 2 — Impurities

Impurity	Limit in mass fraction in % of dry product		
	Grade 1	Grade 2	Grade 3
Si expressed as SiO_2 max.	2,5	3,0	4,0
Al expressed as Al_2O_3 max.	0,5	1,0	2,0
Fe expressed as Fe_2O_3 max.	0,5	1,0	1,5
Mn expressed as MnO_2 max.	0,2	0,4	0,5
$CaCO_3$ max.	7,0	8,0	9,0
NOTE The user can specify a lower content of impurities.			

4.4 Water insoluble matter

The product shall conform to the requirements specified in Table 3.

Table 3 — Water insoluble matter

Parameter	Pulverized / Lump high calcium lime			Hydrated high calcium lime / milk of lime		
	Grade A	Grade B	Grade C	Grade A	Grade B	Grade C
Content of water insoluble matter in mass fraction in %	≤ 13	≤ 16	≤ 20	≤ 8	≤ 13	≤ 17
NOTE The user can specify a lower value for water insoluble matter.						

4.5 Chemical parameters

The product shall conform to the requirements specified in Table 4.

Table 4 — Chemical parameters

Parameter	Limit in mg/kg of dry product	
	Type 1	Type 2
Arsenic (As) max.	5	20
Cadmium (Cd) max.	2	2
Chromium (Cr) max.	20	20
Mercury (Hg) max.	0,3	0,5
Nickel (Ni) max.	10	20
Lead (Pb) max.	10	50
Antimony (Sb) max.	3	4
Selenium (Se) max.	3	4
NOTE 1 Other chemical parameters and indicator parameters are not relevant in high-calcium lime because the raw materials used in the manufacturing process are free of them. For parametric values of high-calcium lime on trace metal content in drinking water, see Directive 98/83/EC [1]. NOTE 2 The user can specify a lower content of chemical parameters.		

4.6 Free water

The content of free water in the delivered product shall be less than a mass fraction of 2,0 %.

NOTE The user can specify a lower content of free water.

5 Test methods

5.1 Sampling

Prepare the laboratory samples in accordance with EN 12485.

5.2 Analyses

Use the relevant methods for analysis described in EN 12485.

6 Labelling - Transportation - Storage

6.1 Means of delivery

High-calcium lime shall be delivered in bags, containers or as bulk material.

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 Labelling according to the EU legislation[4)]

The following labelling requirements shall apply to high-calcium-limes at the date of publication of this European Standard.

4) See [2].

<table>
<tr><td>Hazard pictograms
 
GHS05</td><td>Signal word:
Danger
Hazard statement:
H318: Causes serious eye damage</td><td rowspan="2">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.</td></tr>
<tr><td> 
GHS07</td><td>Signal word:
Warning
Hazard statement:
H315: Causes skin irritation
H335: May cause respiratory irritation</td></tr>
</table>

EU Regulation No 1272/2008 [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

Calcium oxide is listed as UN Number [5] 1910.

RID [6]/ ADR [7] not subject to ADR.

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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.

IMDG [8]:class 8, packing group III.

IATA [9]:class 8, packing group III.

Calcium hydroxide and calcium hydroxide suspension are not classified as dangerous products for road, rail, sea and air transportation.

6.4 Marking

The marking shall include the following:

— the name: “calcium oxide” or “calcium hydroxide” or “calcium hydroxide suspension”, trade name, class, grades and type;

— the net mass;

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

— the number of this European Standard, i.e. EN 12518”.

6.5 Storage

6.5.1 Long term stability

Hydrated lime as dry powder is preferably stored in cylindrical silos. A requirement for free water in the delivered product is given in 4.6 to ensure its flowability and ease of discharge from silos.

The product is stable during long-term storage. The product can be stored for an unlimited period of time if kept away from contact with humidity and carbon dioxide. The solid material in milk of lime will settle if left undisturbed.

6.5.2 Storage incompatibilities

Keep all forms of high-calcium lime away from acid.

Solid materials: Avoid contact with water or moisture.

Solutions/Suspensions: Reaction with aluminium to produce hydrogen.

[8] International Maritime transport of dangerous goods.

[9] International Air Transport Association.

Annex A
(informative)

General information on high-calcium lime

A.1 Origin

A.1.1 Raw materials

High-calcium limes are manufactured from limestone or chalk.

A.1.2 Manufacturing process

Calcium oxide is produced by burning limestone or chalk below the sintering point.

Calcium hydroxide is produced by the reaction of calcium oxide with water.

Milk of lime is produced from calcium hydroxide to which water is added or by the reaction of calcium oxide with a large excess of water (wet slaking).

A.2 Use

A.2.1 Function

High-calcium limes are used to adjust the pH value and hardness of water.

A.2.2 Form in which it is used

Calcium hydroxide is used in the form of lime water (saturated solution) or as milk of lime. Dry calcium hydroxide can also be used directly.

When milk of lime is produced from calcium oxide at water plant, special attention should be given to the quality of slaking water with respect to sulfate and alkalinity.

A.2.3 Other properties

When producing milk of lime from calcium oxide in the waterworks, the analysis of calcium oxide should also contain the parameters:

— total sulfur content,

— magnesium oxide content,

because their contents influence the quality of the milk of lime.

For specific applications, such as water softening in pellet reactors, solubility index may be specified by the consumer. The test method is described in EN 12485.

A.2.4 Treatment dose

The quantities of high-calcium lime to be used depend on the quality of the water to be treated and on the purpose of the treatment.

A.2.5 Means of application

Lime water, milk of lime and hydrated lime are usually added to raw water by metering pump under pH control.

A.2.6 Secondary effects

Precipitation of metal hydroxides, carbonates and organic matter.

A.2.7 Removal of excess product

Lowering of pH value by adding acid.

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	Irrigate eyes immediately with plenty of water and seek medical advice.
Inhalation	Move source of dust or move affected person to fresh air. Obtain medical attention immediately.
Ingestion	Wash mouth with water and drink copious quantities of water. Do not induce vomiting. Seek medical advice immediately.
Skin	Carefully and gently brush the contaminated body surfaces in order to remove all traces of product. Wash affected area immediately with plenty of water. Remove contaminated clothing. If necessary seek medical advice.

B.2.2 Spillage

Pulverized high-calcium limes: remove mechanically (dry) and wash the rest away with large amounts of water.

Milk of lime: transfer into a container and wash the rest away with water.

B.2.3 Fire

High-calcium limes are not flammable. To extinguish surrounding fires, only powder type extinguishing agents shall be used since calcium oxide reacts with water to generate considerable heat and forms a crust. Wear protective gear.

Bibliography

[1] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, OJ L 330, 5.12.1998, p. 32–54

[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), OJ L 353, 31.12.2008, p. 1–1355

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