BS EN 12912:2012

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Products used for treatment of water intended for human consumption — Barite

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National foreword

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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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Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Baryt

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Foreword

This document (EN 12912:2012) 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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

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The significant technical difference between this edition and EN 12912:2005 is as follows:

— Updating of 8.2 in line with current legislation.

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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 barite used for treatment of water intended for human consumption. It describes the characteristics of barite and specifies the requirements and the corresponding test methods for barite and gives information on its use in 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 12901:1999, *Products used for treatment of water intended for human consumption — Inorganic supporting and filtering materials — Definitions*

EN 12902, *Products used for treatment of water intended for human consumption — Inorganic supporting and filtering materials — Methods of test*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696)*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in EN 12901:1999 apply.

4 Description

4.1 Identification

4.1.1 Chemical name

Barium sulfate.

4.1.2 Synonym and common names

Barite, baryte, heavy spar, tiff, cawk.

4.1.3 Chemical formula

$BaSO_4$.

4.1.4 CAS Registry number [1)]

13462-86-7.

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1) Chemical Abstracts Service Registry Number.

4.1.5 EINECS reference [2)]

236-664-5.

4.2 Commercial form

Barite according to this European Standard is available in different particle size ranges.

5 Physical properties

5.1 Appearance

The product has various light shades, including white to yellow, with a vitreous lustre. The product has an angular shape and a crystalline structure.

The product shall be generally homogeneous and shall be visibly free of extraneous matter.

5.2 Particle size distribution

The particle size distribution shall be determined on samples taken at the point of manufacture using the method of test given in EN 12902.

NOTE 1 The particle size can decrease during transportation and handling.

The particle size distribution shall be described by either:

a) effective size: (d_{10}) with a maximum deviation of ± 5%;

uniformity coefficient: (U) which shall be less than 1,5;

minimum size: (d_1) with a maximum deviation of ± 5%;

or

b) by particle size range and by mass fraction of oversize and undersize particles according to application.

The maximum contents of oversize and undersize shall be a mass fraction of 5 % for application of the product as a filtration layer in multi media filters and a mass fraction of 10 % for use in single media filters. For use as a support layer, maximum mass fractions of oversize and undersize of 15 % are acceptable. See A.2.3 for examples of available particle sizes that are used.

NOTE 2 Other values can be necessary for certain applications.

5.3 Density

5.3.1 Bulk density loose

The bulk density loose shall be in the range of 2 200 kg/m^3 to 2 400 kg/m^3.

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2) European Inventory of Existing Commercial Chemical Substances.

5.3.2 Bulk density packed

The bulk density packed shall be in the range of 2 500 kg/m^3 to 2 600 kg/m^3.

6 Chemical properties

This European Standard specifies the minimum purity requirements for barite 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, contents of other impurities and additives used in the products 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.

The composition of the commercial product shall conform to the requirements specified in Table 1.

Table 1 — Composition of commercial product

Parameter		Limit in mass fraction %
Barium sulfate	min	92
Acid-soluble material	max	3
NOTE The contents of $BaSO_4$ and acid-soluble material do not influence filtration properties but give information about the source of barite..		

After filling, washing and commissioning of a filter system producing drinking water, barite should not increase the concentrations of chemical parameters (see [1]).

NOTE Water extractable substances, determined in accordance with the method for granular materials given in EN 12902, can be used to estimate the leaching of the chemicals specified in EN 12902.

7 Test methods

7.1 Sampling

Prepare the laboratory sample(s) required by the relevant procedures described in EN 12902.

7.2 Analysis

7.2.1 Particle size distribution

The particle size distribution shall be determined in accordance with EN 12902.

7.2.2 Bulk density loose

The bulk density loose shall be determined in accordance with EN 12902.

7.2.3 Bulk density packed

The bulk density packed shall be determined in accordance with EN 12902.

7.2.4 Main product - barium sulfate

7.2.4.1 Principle

Melting of mineral with sodium carbonate followed by disintegration in water and filtration to recover water insoluble carbonates. The solid is treated with hydrochloric acid solution and the acid insoluble fraction is filtered off.

Barium sulfate is precipitated by addition of ammonium sulfate solution and gravimetrically determined.

7.2.4.2 Reagents

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

7.2.4.2.1 Ammonium hydroxide solution, NH_4OH ρ = 0,9 g/ml.

7.2.4.2.2 Ammonium sulfate solution, $(NH_4)_2SO_4$ 100 g/l solution.

7.2.4.2.3 Hydrochloric acid, HCl ρ = 1,18 g/ml.

7.2.4.2.4 Sodium carbonate, Na_2CO_3.

7.2.4.2.5 Sodium carbonate solution, (Na_2CO_3) 30 g/l solution.

7.2.4.2.6 Methyl red, 0,5 g/l solution.

7.2.4.3 Apparatus

Ordinary laboratory apparatus and glassware together with the following.

7.2.4.3.1 Platinum crucible.

7.2.4.3.2 Electric furnace, capable of being controlled at (850 ± 25) °C.

7.2.4.3.3 Porcelain crucible.

7.2.4.3.4 Oven, capable of being controlled at (105 ± 2) °C.

7.2.4.4 Procedure

Weigh in the platinum crucible (7.2.4.3.1), to the nearest 0,1 mg, about 0,5 g of barite previously finely powdered and dried at 105 °C (m_1). Add about 3 g of sodium carbonate (7.2.4.2.4), mix and heat until the melt is clear. Cool and carefully disintegrate the solid with hot water. Filter and wash thoroughly the crucible and solid with hot sodium carbonate solution (7.2.4.2.5).

Transfer the filter paper and the filtered solid to a 250 ml beaker and acidify with hydrochloric acid (7.2.4.2.3). Wash the crucible with few millilitres of hydrochloric acid and add the liquid to the solution. Boil the solution for 5 min and filter into a 600 ml beaker. Carefully wash the filter and the 250 ml beaker with water.

Add to the filtrate a few drops of methyl red indicator solution (7.2.4.2.6) and ammonium hydroxide solution (7.2.4.2.1) until the colour turns to yellow. Acidify the solution with 3 ml of hydrochloric acid (7.2.4.2.3) and dilute to approximately 300 ml.

Heat the solution to boiling and add slowly 50 ml of ammonium sulfate solution (7.2.4.2.2) stirring with a glass rod. Cover the beaker with a watch glass and allow to stand for at least 4 h at a temperature of about 80 °C. Then filter on a close-texture ashless filter paper. Wash the precipitate with boiling water until the chlorides disappear from the filtrate (test with silver nitrate solution).

Ignite the porcelain crucible (7.2.4.3.3) in the electric furnace at (850 ± 25) °C (7.2.4.3.2) for 1 h. Place the crucible in a desiccator, cool to room temperature and weigh to the nearest 0,1 mg and note the mass m_0.

Place the filter paper with the precipitate in the ignited and weighed porcelain crucible and dry in an oven. Ignite the paper in air, then ignite for 2 h in the furnace at (850 ± 25) °C. Allow to cool in a desiccator and weigh to the nearest 0,1 mg (m_2).

7.2.4.5 Expression of results

The barium sulfate content, expressed as a percentage mass fraction, is calculated from the following formula:

$$X = \frac{m_2 - m_0}{m_1} \times 100 \qquad (1)$$

where

— m_0 is the mass in grams of the empty ignited porcelain crucible;

— m_2 is the mass, in grams of the ignited porcelain crucible plus barium sulfate;

— m_1 is the mass, in grams of the test portion.

7.2.5 Acid-soluble material

The content of acid-soluble material shall be determined in accordance with EN 12902.

8 Labelling, transportation and storage

8.1 Means of delivery

Barite shall be delivered in bags (paper or plastics materials), semi-bulk containers or bulk.

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.

8.2 Labelling according to the EU legislation [3)]

Barite is not listed within Annex VI of Regulation (EC) No 1272/2008 at the date of publication of this European Standard.

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3) See [2].

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.

8.3 Transportation regulations and labelling

Barite is not listed under a UN Number [4)], it is not a dangerous cargo.

8.4 Marking

The marking shall include the following:

— name "Barite", trade name and grade;

— net mass;

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

— statement " This product conforms to EN 12912".

8.5 Storage (long term stability)

Barite can be stored for an unlimited period of time.

4) United Nations Number.

Annex A
(informative)

General information on barite

A.1 Origin

A.1.1 Raw materials

Natural barite.

A.1.2 Manufacturing process

Barite is produced by mining, then crushing, washing with water, sieving, and drying.

A.2 Typical properties

A.2.1 Chemical composition

The composition depends on the origin. Typical values are given as an example in Table A.1.

Table A.1 — Chemical composition

Parameter	Typical values in mass fraction %
$BaSO_4$	94,0
SiO_2	2,0
Al_2O_3	0,5
Fe_2O_3	1,4
CaO	0,5
K_2O, Na_2O, others	1,5

A.2.2 Mechanical strength

The mechanical strength of barite is high.

Abrasion products consist of dust and small particles of material. They are formed during transportation, filling, and washing. Abrasion products are not completely removed by washing.

The existing methods for determination of abrasion do not lead to exact results regarding behaviour of filter media during operation. They can only be used for comparison of different filter media.

A.2.3 Examples of particle size distribution

Examples of particle size distribution described by different particle size ranges and a permissible mass percentage of oversize and undersize product, are given in Table A.2.

Table A.2 — Example of particle size range

Particle size range in mm	**Permissible mass fraction %**	
	Undersize	**Oversize**
0,3 to 0,6	5	5
2,4 to 4,8	5	10
NOTE Other particle size ranges can be specified.		

A.2.4 Physical properties

A.2.4.1 Absolute density

The absolute density is generally in the range of 4,2 g/cm^3 to 4,5 g/cm^3.

A.2.4.2 Particle density dry

The particle density dry is generally in the range of 4,2 g/cm^3 to 4,5 g/cm^3.

A.2.4.3 Particle density wet

The particle density wet is generally in the range of 4,2 g/cm^3 to 4,5 g/cm^3.

A.2.4.4 Solubility in water

The solubility product, K_S, of barium sulfate is 1,07 x 10^{-10} at 25 °C.

NOTE In natural waters, the solubility of barium is suppressed, through the common ion effect, by the presence of sulfate. For example, a sulfate concentration of 25 mg/l reduces the solubility to approximately 0,06 mg/l (around 5 % of the value in water). See also A.3.4.

A.2.5 Porosity

The porosity of the particles is practically negligible.

A.3 Use

A.3.1 Function

Barite is used as a filtering or supporting material in multilayer filters.

A.3.2 Specific amount

The amount of barite used depends on the application. Filtration rate and filter media depth vary with the suspended matter content of the water to be filtered.

A.3.3 Means of application

Barite is used in open or closed multilayer filters.

A.3.4 Secondary effects

The solubility of $BaSO_4$ in distilled water at 20 °C is about 2,2 mg/l (1,3 mg/l of Ba). Because of its low rate of solubilisation, granular barite, properly used, does not induce any significant increase of barium in treated water.

When used after a long period of filter inactivity, it is advisable to discard the first effluent.

A.4 Hydraulic characteristics

A.4.1 Interstitial volume

The approximate interstitial volumes for the typical particle size ranges are given in Table A.3. If used for calculations the interstitial volume should be measured.

Table A.3 — Example of interstitial volume ranges

Particle size range in mm	Interstitial volume, (*V/V*)
0,3 to 0,6	0,39 to 0,41
2,4 to 4,8	0,43 to 0,45

A.4.2 Head loss in filtration

Head loss depends on size, shape and roughness of particles, filtration rate, filter bed depth, and water temperature.

A.4.3 Expansion in up-flow washing

The expansion during washing depends on flow rate, effective size, density, shape and roughness of particles, and water temperature.

A.5 Rules for safe handling and use

Barite is not a hazardous product but the following precautions should be taken:

— it is recommended to avoid dust formation;

— when handling dry product the use of a dust mask is recommended.

A.6 Emergency procedures

A.6.1 First aid

In case of contact with skin there is no danger, it is recommended to wash with water.

In case of contact with eyes, it is recommended to flush with plenty of water.

In case of inhalation, it is recommended to move to fresh air.

A.6.2 Spillage

It is recommended to sweep up and to discard in a refuse container or repackage. It is recommended to dispose of in accordance with local regulations.

A.6.3 Fire

Barite is not combustible.

Extinguishing media: no restrictions in fire situations.

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).

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