BRITISH STANDARD

BS EN 13753:2009

Products used for treatment of water intended for human consumption — Granular activated alumina

ICS 13.060.20; 71.100.80

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 13753:2009. It supersedes BS EN 13753:2002 which is withdrawn.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

Products used for treatment of water intended for human consumption - Granular activated alumina

Produits utilisés pour le traitement de l'eau destinée à la consommation humaine - Alumine active en grains

Produkte zur Aufbereitung von Wasser für den menchlichen Gebrauch - Granuliertes aktiviertes Aluminiumoxid

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN 13753:2009) 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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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This document supersedes EN 13753:2002.

Differences between this edition and EN 13753:2002 are editorial to harmonize the text with other standards in this series.

Annex A is informative.

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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 standard:

a) this 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 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 granular activated alumina used for treatment of water intended for human consumption. It describes the characteristics of granular activated alumina and specifies the requirements and the corresponding test methods for granular activated alumina. It gives information on its use in water treatment.

2 Normative references

The following referenced documents are indispensable for the application 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.

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*

ISO 9277, *Determination of the specific surface area of solids by gas adsorption using the BET method*

3 Terms, definitions and symbols

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

3.1
activated alumina
virgin alumina that has not been used and has not been regenerated

4 Description

4.1 Identification

4.1.1 Chemical name

Aluminium oxide (partially hydroxylated).

4.1.2 Synonym or common names

Transition alumina; gamma alumina; alumina; aluminium oxide; activated alumina.

4.1.3 Chemical formula

$Al_2O_{(3-x)}(OH)_{2x}$ x varies from approximately 0 to 0,80.

4.1.4 CAS Registry number [1)]

1344-28-1.

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1) Chemical Abstracts Service Registry Number.

4.1.5 EINECS reference [2)]

215-691-6.

4.2 Commercial form

Activated alumina recommended for use in drinking water treatment is a granular product consisting of irregularly shaped (non-moulded) particles; the product is available in different particle sizes.

5 Physical properties

5.1 Appearance

The product consists of white particles of irregular shape. 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 described by either:

a)

- effective size (d_{10}) with a limit deviation of ± 5 %;
- uniformity coefficient (U) less than 1,5;
- minimum size (d_1) with a limit deviation of ± 5 %;

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

b) or by particle size range and agreed mass of oversize and undersize particles; see A.2.2.1.

The proportion of oversize plus undersize particles shall not exceed a mass fraction of 15 % and not more than a mass fraction of 5 % shall be undersized.

NOTE 2 Other values can be necessary for certain applications.

5.3 Bulk density packed

The bulk density (packed) shall be greater than 600 kg/m^3.

6 Chemical properties

NOTE 1 After filling, washing and commissioning of a filter system producing drinking water, activated alumina should not increase the concentrations of chemical parameters above the regulated values (see [1]).

NOTE 2 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.

NOTE 3 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 the product standard.

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2) European Inventory of Existing Commercial Chemical Substances.

7 Specific properties

The surface area shall not be less than 200 m^2/g.

8 Test methods

8.1 Sampling

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

8.2 Analysis

8.2.1 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.

8.2.2 Bulk density packed

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

8.2.3 Surface area

The surface area shall be determined by the BET method, degassing at a maximum of 200 °C, in accordance with ISO 9277.

9 Labelling, transportation and storage

9.1 Means of delivery

Granular activated alumina shall be delivered in bulk (dry or wet product), in semi-bulk containers or in drums of cardboard, plastics or steel or suitable bags of various sizes.

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.

9.2 Risk and safety labelling according to the EU Directives [3)]

At the date of publication of this European Standard, activated alumina was not listed as a dangerous substance.

NOTE Annex I of the Directive 67/548/EEC on Classification, packaging and labelling of dangerous substances and its amendments and adaptations in the European Union contains a list of substances classified by the EU. Substances not in this Annex I should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

9.3 Transportation regulations and labelling

At the date of publication of this European Standard, activated alumina was not classified as dangerous for transportation by road, rail, sea or air. Activated alumina is not listed under a UN number [4)].

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3) See [2].

4) United Nations number.

9.4 Marking

The marking shall include the following:

— the name “Activated Alumina”, trade name and grade;

— the net mass;

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

— the statement “this product conforms to EN 13753".

9.5 Storage

9.5.1 Long term chemical stability

The product is stable but hygroscopic. It can be stored for at least two years if kept dry and sealed from the atmosphere.

9.5.2 Storage incompatibilities

Keep away from moisture, strong acids or strong alkalis, solvents and odorous products.

Annex A
(informative)

General information on granular activated alumina

A.1 Origin

A.1.1 Raw materials

Granular activated alumina is produced from aluminium hydroxide.

A.1.2 Manufacturing process

Activated alumina is prepared by the calcination of aluminium hydroxide. Granular activated alumina can be prepared by granulation of activated alumina powder or calcination of aluminium hydroxide granules.

A.2 Typical properties

A.2.1 Chemical composition

Activated alumina is a partially calcined aluminium trihydroxide with a combined water content of between a mass fraction of 5 % and a mass fraction of 6 %. The crystal structure is predominantly gamma or chi alumina; small amounts of other forms can be present. The crystal structure can be determined by X-ray diffraction. The chemical composition depends on the origin of the raw material. Typical maximum limits are given in Table A.1, the remainder being Al_2O_3.

Table A.1 — Chemical composition of activated alumina

Parameter	Limit as a mass fraction of the product (typical) in %
Water (loss on ignition)	5,5 to 6
Na_2O	0,5
Fe_2O_3	0,015
SiO_2	0,02
TiO_2	0,002

A.2.2 Physical properties

A.2.2.1 Particle size range

Examples of particle size ranges include 1,4 mm to 2,0 mm and 2,0 mm to 4,74 mm.

A.2.2.2 Density

The absolute density of activated alumina is 3,2 g/cm^3; the bulk density can vary with the particle size range.

A.2.2.3 Adsorption properties

Granular activated alumina removes contaminants from water by adsorption. A number of indices are used as surrogates for or measures of the adsorptive capacity of granular activated alumina under specific conditions, including specific surface area (BET isotherm).

Specifications for such properties can be the subject of agreement between the customer and the manufacturer/supplier and the latter should make the test methods available, if requested.

A.3 Hydraulic characteristics

A.3.1 Head loss in filtration

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

A.3.2 Expansion during up-flow washing

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

A.4 Use

A.4.1 Function

The primary function of granular activated alumina is as an adsorbent for the removal of inorganic ions; particularly fluoride, arsenate, chromate and polar organic contaminants.

If granular activated alumina is used as a filter medium for removal of suspended solids, specific tests related to the performance of filter media might need to be carried out.

Activated alumina is also used as a carrier for catalysts.

A.4.2 Treatment dose

The capacity of granular activated alumina (X) is usually expressed as mass of impurity removed by mass of alumina. The effective dose (E) (in grams per litre) of granular activated alumina can be calculated from the following equation:

$$E = \frac{C}{X} \tag{A.1}$$

where

C is the concentration of impurities, in milligrams per litre;

X is the capacity, in milligrams per gram.

Both contact time and bed life depend on water quality and treatment objectives.

A.4.3 Method of use

Granular activated alumina is used either in purpose-built adsorbers or in existing filters. Precise details of use depend on the impurity to be removed and the water quality. Before use, the granular activated alumina is conditioned by contact with an appropriate solution; for example aluminium sulphate solution for the removal of fluoride impurities. In use, water flows through the bed and dissolved impurities are removed by adsorption and/or ion exchange at the activated alumina surface. Once the concentration of impurities to be removed reaches some predetermined level, or after a predetermined time, the granular activated alumina can be regenerated in situ. Regeneration conditions also depend on the impurity to be removed; for fluoride removal regeneration involves neutralization with a dilute sodium hydroxide solution, water washing and reactivation with dilute sulphuric acid solution. Time between regenerations will decrease with each regeneration.

Physical filtration of suspended solids also occurs; trapped solids and dust from initial handling can be removed by backwashing.

A.5 Rules for safe handling and use

It is recommended to handle the product so as to avoid dust formation.

A.6 Emergency procedures

A.6.1 First aid

In case of contact with skin, it is recommended to wash with soap and water.

In case of contact with eyes, it is recommended to flush with plenty of water for 15 min.

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

A.6.2 Spillage

It is recommended to sweep or to vacuum unused alumina and to discard in refuse container.

A.6.3 Fire

Extinguishing media: no restrictions in fire situations; it is recommended to use foam extinguishers.

Bibliography

[1] 98/83/EC, *Council Directive of 3 November 1998 on the quality of water intended for human consumption*

[2] 67/548/EEC, *Council Directive of 27th June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances and its amendments and adaptations*

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