# Products used for treatment of water intended for human consumption — Pyrolyzed coal material

ICS 13.060.20; 71.100.80

# National foreword

This British Standard is the UK implementation of EN 12907:2009. It supersedes BS EN 12907:2003 which is withdrawn.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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# Products used for treatment of water intended for human consumption - Pyrolyzed coal material

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Thermisch behandelte Kohleprodukte

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## Foreword

This document (EN 12907:2009) 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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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## 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 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 pyrolyzed coal material used for treatment of water intended for human consumption. It describes the characteristics of pyrolyzed coal material and specifies the requirements and the corresponding test methods for pyrolyzed coal material. 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*

# 3 Terms and definitions

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

# 4 Description

## 4.1 Identification

### 4.1.1 Chemical name

Carbon (C).

### 4.1.2 Synonym or common names

None.

## 4.2 Commercial forms

Pyrolyzed coal material, according to this standard, is a thermally treated coal and is available in different particle size ranges.

# 5 Physical properties

## 5.1 Appearance

The product is a brown to black coloured dull granular material with spherical or angular shape, porous structure, and smooth texture.

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.

The particle size distribution shall be described by either:

a) effective size: ($d_{10}$) with a permitted tolerance of ± 5 %;

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

   minimum size: ($d_1$) with a permitted tolerance of ± 5 %;

b) or, by particle size range and by mass of oversize and undersize particles according to application:

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

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

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 450 kg/m$^3$ to 560 kg/m$^3$.

#### 5.3.2 Bulk density packed

The bulk density packed shall be in the range of 460 kg/m$^3$ to 580 kg/m$^3$.

## 6 Chemical properties

### 6.1 Composition of commercial product

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

**Table 1 — Composition of commercial product**

| Parameter | | Content of the commercial product in mass fraction % |
|---|---|---|
| C (water and ash free basis) | min. | 85 |
| Ash | max. | 15 |
| Volatile matter | max. | 5 |

NOTE 1 Values of these parameters do not influence filtration properties, but give information about the source of pyrolyzed coal material.

NOTE 2 Further information is given in A.2.1.

### 6.2 Purity criteria

#### 6.2.1 General

This European Standard specifies the minimum purity requirements for pyrolyzed coal material 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 the relevant authorities.

NOTE 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.

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.

#### 6.2.2 Water-extractable substances

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

**Table 2 — Water-extractable substances**

| Substance | | Limit in the extraction water µg/l |
|---|---|---|
| Arsenic (As) | max. | 10 |
| Cadmium (Cd) | max. | 0,5 |
| Chromium (Cr) | max. | 5 |
| Mercury (Hg) | max. | 0,3 |
| Nickel (Ni) | max. | 5 |
| Lead (Pb) | max. | 5 |
| Antimony (Sb) | max. | 3 |
| Selenium (Se) | max. | 3 |
| Cyanide (CN) | max. | 5 |
| PAH [a] | max. | 0,02 |
| [a] Polycyclic Aromatic Hydrocarbons: the sum of the detected concentrations of fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene. | | |

## 7 Specific properties

Pyrolyzed coal material is not an activated carbon but does show adsorption properties. Under defined conditions, it removes chlorine and ozone as well as organic matter.

## 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 in accordance with EN 12902.

#### 8.2.2 Bulk density loose

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

#### 8.2.3 Bulk density packed

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

#### 8.2.4 Content of carbon

The content of carbon shall be determined in accordance with EN 12902.

#### 8.2.5 Ash

The ash shall be determined in accordance with EN 12902.

#### 8.2.6 Content of volatile matter

The content of volatile matter shall be determined in accordance with EN 12902.

#### 8.2.7 Content of water-extractable substances

The content of water-extractable substances shall be determined in accordance with the method for granular materials given in EN 12902.

## 9 Labelling, transportation and storage

### 9.1 Means of delivery

Pyrolyzed coal material shall be delivered in bags, 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.

### 9.2 Risk and safety labelling in accordance with EU Directives [1)]

At the date of publication of this European Standard, pyrolyzed coal material 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 list 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, pyrolyzed coal material was not a dangerous cargo.

### 9.4 Marking

The marking shall include the following:

— the name "pyrolyzed coal material", trade name and particle size range;

— the net mass or the volume;

1) See [1].

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

— the statement "this product conforms to EN 12907".

### 9.5 Storage

Pyrolyzed coal material can be stored for an unlimited period of time.

# Annex A
(informative)

# General information on pyrolyzed coal material

## A.1 Origin

### A.1.1 Raw material

Natural coal.

### A.1.2 Manufacturing process

Pyrolyzed coal material is produced from natural coal, thermally treated in a special oven, and sieved.

## A.2 Properties

### A.2.1 Chemical composition

The composition depends on the origin of the raw material. Typical values are given in Table A.1 (the important components are given in Clause 6).

**Table A.1- Chemical composition**

| Parameter | | Content of the commercial product in mass fraction % |
|---|---|---|
| $SiO_2$ | max. | 2 |
| $Fe_2O_3$ | max. | 2 |
| $Al_2O_3$ | max. | 1 |
| MgO | max. | 0,5 |
| CaO | max. | 5 |
| $K_2O$ | max. | 0,5 |
| $Na_2O$ | max. | 0,5 |

Mineralogical and petrological analyses give additional information. If a change in the production process or raw material leads to significant change in chemical composition or quantities of impurities, this should be notified to the user.

Clause 6.2 specifies the maximum quantities of water-extractable substances, determined according to EN 12902. Metal concentrations decrease over the operational life of a pyrolyzed coal material filter. In the test method, concentrations are determined on the third bed volume of water treated whereas in practice, over many years operation, hundreds of thousands of bed volumes are treated. In addition, when commissioning a pyrolyzed coal material filter it is common practice to divert the filtrate to waste for a sufficient period to ensure that leachable impurity concentrations are acceptably low. In practice, therefore, the concentrations of these substances in water treated using pyrolyzed coal material are substantially lower than the maximum concentrations specified in 6.2.

### A.2.2 Mechanical strength

The mechanical strength of pyrolyzed coal material is low.

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 be used only for comparison of different filter media.

### A.2.3 Examples of particle size

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

**Table A.2 — Examples of particle size range**

| **Particle size range** mm | **Permissible content in mass fraction** [a] % | |
|---|---|---|
| | **Undersize** | **Oversize** |
| 0,6 to 1,6 | 5 | 5 |
| 1,4 to 2,5 | 10 | 10 |
| [a] Generally, the maximum permitted contents of undersize and oversize are mass fraction 5 % for application of the product as a filtration layer in multi media filters and mass fraction 10 % for use in single media filters. | | |

Other size ranges can be specified.

### A.2.4 Density

#### A.2.4.1 Absolute density

The absolute density is generally in the range of 1,65 g/cm$^3$ to 1,90 g/cm$^3$.

#### A.2.4.2 Particle density dry

The particle density dry is generally in the range of 0,85 g/cm$^3$ to 1,10 g/cm$^3$.

#### A.2.4.3 Particle density wet

The particle density wet is generally in the range of 1,25 g/cm$^3$ to 1,60 g/cm$^3$.

### A.2.5 Porosity of particles

The porosity of particles is generally in the range of volume fraction 0,4 to volume fraction 0,5.

## A.3 Use

### A.3.1 Function

Pyrolyzed coal material is used as a filtering material.

### A.3.2 Specific amount

The amount of pyrolyzed coal material used depends on 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

Pyrolyzed coal material is used in open or closed, single or multi-media filters.

### A.3.4 Secondary effects

After filling the filter, pyrolyzed coal material reacts with water forming a weak solution of alkali and alkaline earth metals; the pH can increase to approximately 10. Washing water should be neutralized.

## A.4 Hydraulic characteristics

### A.4.1 Interstitial volume

The interstitial volume is approximately volume fraction 0,4. If used for calculations, the interstitial volume should be measured.

### A.4.2 Headloss during filtration

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

### A.4.3 Expansion during up-flow washing

Expansion during washing depends on flow rate, effective size, density, shape and roughness, and water temperature.

## A.5 Rules for safe handling and use

Pyrolyzed coal material is not a hazardous product:

— 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 skin contact, there is no danger; it is recommended to wash with water.

In case of eye contact, 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 and to discard in a refuse container or repackage.

### A.6.3 Fire

Any extinguishing media can be used; it is recommended to use foam extinguishers.

Self-contained breathing apparatus should be worn because carbon dioxide and carbon monoxide can be produced during combustion.

# Bibliography

[1] 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*

[2] 98/83/EC, *Council Directive of 25th December 1998 on the quality of water intended for human consumption*

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