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Trdna alternativna goriva - Določevanje vlage z metodo sušenja v sušilni komori - 1. del: Določevanje skupne vlage z referenčno metodo

Solid recovered fuels - Determination of moisture content using the oven dry method - Part 1: Determination of total moisture by a reference method

Feste Sekundärbrennstoffe - Bestimmung des Wassergehaltes unter Verwendung des Verfahrens der Ofentrocknung - Teil 1: Bestimmung des Gesamtgehaltes an Wasser mittels Referenzverfahren

Combustibles solides de récupération - Détermination de l'humidité par la méthode de séchage à l'étuve - Partie 1 : Détermination de l'humidité totale par une méthode de référence

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English Version

Solid recovered fuels - Determination of moisture content using the oven dry method - Part 1: Determination of total moisture by a reference method

Combustibles solides de récupération - Détermination de l'humidité par la méthode de séchage à l'étuve - Partie 1 : Détermination de l'humidité totale par une méthode de référence

Feste Sekundärbrennstoffe - Bestimmung des Wassergehaltes unter Verwendung des Verfahrens der Ofentrocknung - Teil 1: Bestimmung des Gesamtgehaltes an Wasser mittels Referenzverfahren

This Technical Specification (CEN/TS) was approved by CEN on 27 March 2010 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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Foreword

This document (CEN/TS 15414-1:2010) has been prepared by Technical Committee CEN/TC 343 “Solid recovered fuels”, the secretariat of which is held by SFS.

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 CEN/TS 15414-1:2006.

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1 Scope

This Technical Specification specifies a method for the determination of total moisture content of solid recovered fuels by drying a sample in an oven. This method is suitable for use if a high precision of the determination of moisture content is required. It is applicable to all solid recovered fuels.

NOTE 1 The total moisture content of solid recovered fuels is not an absolute value and therefore standardised conditions for its determination are indispensable to enable comparative determinations.

NOTE 2 The term moisture content when used with recovered materials can be misleading since solid recovered materials, e.g. biomass, frequently contains varying amounts of volatile compounds (extractives) which can evaporate when determining moisture content by oven drying.

NOTE 3 This Technical Specification is based on prEN 14774-1 [1].

2 Normative references

The following referenced documents are indispensable for the application of this Technical Specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 15357, *Solid recovered fuels — Terminology, definitions and descriptions*

prEN 15442, *Solid recovered fuels — Methods for sampling*

prEN 15443, *Solid recovered fuels — Methods for the preparation of the laboratory sample*

3 Terms and definitions

For the purposes of this Technical Specification, the terms and definitions given in prEN 15357 apply.

4 Principle

The sample of recovered fuel is dried at a temperature of 105 °C in air atmosphere until constant mass is reached. The percentage of moisture is calculated from the loss in mass of the sample. The method includes a procedure for the correction of buoyancy effects.

5 Apparatus

5.1 Drying oven, capable of being controlled at (105 ± 2) °C (see declaration of the manufacturer) and in which the air atmosphere changes between three and five times per hour. The air velocity shall be such that the sample particles are not dislodged from their dish or tray (5.2).

5.2 Dishes or trays of non-corrodible and heat-resistant material and of such dimensions that they are able to hold the total sample in the proportion of about 1 g of sample per 100 mm^2 of surface area of the dish or tray respectively of about 0,5 g per 100 mm^2 for samples with very low bulk density of less than 100 kg/m^3. The surface of the dish or tray shall be such that the possibility to adsorption/absorption is minimised (very clean and even surface).

5.3 Balance, capable of weighing the sample and dish or tray (5.2), as received, to the nearest 0,1 g.

6 Sampling and sample preparation

6.1 The sample shall be taken and prepared in accordance with prEN 15442 and prEN 15443. It shall be delivered into the laboratory in sealed water resistant and airtight containers or bags.

NOTE Precautions should be carried out to ensure that the moisture content remains constant during preparation of the sample. Coarse materials, for example, small wood and chunk wood, should be prepared by using equipment appropriate for the fuel type, e.g. slow rotation grinder, shredder, to a thickness of maximum 30 mm for the test material.

6.2 The sample shall be weighed immediately after the sample preparation. The sample mass shall be at least 300 g but preferably greater than 500 g.

NOTE 1 Solid recovered fuels are heterogeneous materials in many cases. Therefore, a sample size of minimum 300 g is necessary to obtain representative test portions.

NOTE 2 For large particle size samples with a nominal top size of 100 mm, a sample mass of 1 kg to 2 kg should be preferred.

6.3 During the course of its preparation, the sample may be pre-dried (see prEN 15443); in this case the total moisture content shall be calculated using Equation (2) (see 8.2).

7 Procedure

7.1 Weigh an empty clean dish or tray (5.2) to the nearest 0,1 g, transfer the sample from the container or bag to the dish or tray and spread the sample evenly, allowing about 1 g of sample to 100 mm^2 of surface area of the dish or tray respectively of about 0,5 g of sample per 100 mm^2 in the case that the bulk density of the sample is less than 100 kg/m^3. Weigh an identical empty clean dish or tray (reference dish respectively tray) to the nearest 0,1 g. In case of moisture left on the inner surfaces of the bag or container, this amount of moisture shall be included in the calculation of the moisture content. Dry the sample packing (container, bag etc.) in the drying oven (5.1) and weigh the packing before and after drying. If the packing material cannot resist a temperature of 105 °C, it shall be allowed to dry at room temperature by placing it open in the laboratory.

NOTE 1 A reference dish respectively reference tray is included in the procedure for a correction of buoyancy. To avoid absorption of moisture from the atmosphere, the dish or tray (5.2) with the dried sample is reweighed when still hot. The mass of a dish or tray when still hot is, due to buoyancy, less than the mass of the cold dish or tray. The magnitude of the buoyancy effect depends on the size and the mass of the dish or tray.

NOTE 2 Several dishes or trays can be handled at the same time.

7.2 Weigh the dish or tray (5.2) together with the sample. Place the loaded dish or tray together with the reference tray in the drying oven (5.1) controlled at (105 ± 2) °C. Heat the dish or tray (5.2) until constant mass is reached as specified in 7.3.

Do not overload the drying oven (5.1).

NOTE There should be enough empty room over the sample layer and also between the dishes or trays.

WARNING — For some materials present in solid recovered fuels there can be a risk of self-ignition when drying at 105 °C.

7.3 Solid recovered fuels are hygroscopic and therefore the loaded dish or tray (5.2) together with the reference dish or tray shall be re-weighed to the nearest 0,1 g when still hot within 10 s to 15 s to avoid absorption of moisture. Use heat-insulating material on the balance pan to protect it from direct contact with the hot dish/tray. Mass constancy is reached if the change of mass not exceeds 0,2 % of the total loss in mass during a further period of heating at (105 ± 2) °C over a duration of 60 min. The drying time required depends on the particle size of the sample, the rate of atmosphere change in the drying oven (5.1), the thickness of the sample layer etc.

NOTE 1 Generally the drying time should not exceed 24 h to prevent unnecessary losses of volatile compounds.

NOTE 2 The required drying time should be determined in pre-tests on similar fuel types with comparable particle size.

8 Calculation

8.1 General

The total moisture content shall be calculated on wet basis using Equation (1) as given in 8.2. The relationship between total moisture on wet basis to that on dry basis is given by the Equations (3) and (4) (see 8.3). The test result shall be reported related on wet or dry basis.

The result for each individual determination shall be calculated to two decimal places and the mean value of the individual results shall be calculated and rounded to the nearest 0,1 %. The mean value shall be recorded in the test report.

8.2 Moisture content on wet basis

The moisture content, M_{ar}, in the solid recovered fuel, as received, expressed as mass fraction in percent, shall be calculated using Equation (1):

$$M_{ar} = \frac{(m_2 - m_3) - (m_4 - m_5) + m_6}{(m_2 - m_1) + m_6} \times 100 \qquad (1)$$

where

m_1 is the mass of the empty dish or tray (5.2), in grams;

m_2 is the mass of the loaded dish or tray (5.2) before drying, in grams;

m_3 is the mass of the loaded dish or tray (5.2) after drying, in grams;

m_4 is the mass of the reference dish or tray (5.2) before drying (mass at room temperature), in grams;

m_5 is the mass of the reference dish or tray (5.2) after drying (mass when still hot), in grams;

m_6 is the mass of moisture associated with the packing, in grams.

If the sample was pre-dried before this moisture determination (see 6.3), calculate the total moisture, M_T, expressed as a percentage by mass, using Equation (2):

$$M_T = M_p + M_r \times \left(1 - \frac{M_p}{100}\right) \qquad (2)$$

where

M_p is the loss of moisture caused by pre-drying of the original sample, in percent by mass;

M_r is the residual moisture determined in the pre-dried sample by this procedure, in percent by mass.

8.3 Moisture content on dry basis

The relation between moisture on dry basis, U_d, or wet basis, M_{ar}, expressed as mass fraction in percent, shall be calculated using the Equations (3) and (4):

$$U_d = \frac{M_{ar}}{100 - M_{ar}} \times 100 \quad (3)$$

$$M_{ar} = \frac{U_d}{100 + U_d} \times 100 \quad (4)$$

9 Precision

Because of the varying nature of the solid recovered fuels covered by this Technical Specification, at the present time it is not possible to give a precision statement (repeatability or reproducibility) for this test method.

10 Test report

The test report shall include at least the following information:

a) name of the testing laboratory;

b) date of the test;

c) identification of the product or sample tested;

d) reference to this Technical Specification, i.e. CEN/TS 15414-1;

e) any deviation from this Technical Specification;

f) test results and basis of calculation, e.g. wet basis or dry basis, according to Clause 8;

g) any unusual features observed during the test procedure which may have affected the test results.