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**Solid biofuels — Determination  
of moisture content — Oven dry  
method —**

**Part 2:  
Total moisture — Simplified method**

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*Biocarburants solides — Dosage de la teneur en humidité — Méthode  
de séchage à l'étuve —  
Partie 2: Humidité totale — Méthode simplifiée*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

The committee responsible for this document is ISO/TC 238, *Solid biofuels*.

ISO 18134 consists of the following parts under the general title *Solid biofuels — Methods for the determination of moisture content — Oven dry method*:

- *Part 1: Total moisture — Reference method*
- *Part 2: Total moisture — Simplified method*
- *Part 3: Moisture in general analysis sample*

# Solid biofuels — Determination of moisture content — Oven dry method —

## Part 2: Total moisture — Simplified method

### 1 Scope

This part of ISO 18134 describes the method of determining the total moisture content of a test sample of solid biofuels by drying in an oven and may be used when the highest precision is not needed, e.g. for routine production control on site. The method described in this International Standard is applicable to all solid biofuels. The moisture content of solid biofuels (as received) is always reported based on the total mass of the test sample (wet basis).

NOTE The term moisture content, when used with biomass materials, can be misleading since untreated biomass frequently contains varying amounts of volatile compounds (extractives) which might evaporate when determining moisture content by oven drying (see References [2] and [3]).

### 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.

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*

EN 14780<sup>1)</sup>, *Solid biofuels — Sample preparation*

EN 14778<sup>2)</sup>, *Solid biofuels — Sampling*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16559 and the following apply.

#### 3.1

##### **nominal top size**

aperture of the sieve where at least 95 % by mass of the material passes

[SOURCE: ISO 16559]

#### 3.2

##### **test sample**

original sample sent to the laboratory for analysis

[SOURCE: ISO 16559]

1) To be replaced by ISO 14780.

2) To be replaced by ISO 18135.

### 3.3 test portion

sample extracted from the test sample and used during the analysis

[SOURCE: ISO 16559]

## 4 Principle

The test portion of solid biofuel shall be dried at a temperature of 105 °C in air atmosphere until constant mass is achieved and the percentage moisture shall be calculated from the loss in mass of the test portion.

The difference with this procedure compared to the reference method ISO 18134-1 is that the effect due to buoyancy is neglected in this method. The weight of a tray when still hot is less than the weight of the cold tray due to buoyancy. The magnitude of the buoyancy effect depends of the size and the weight of the tray.

## 5 Apparatus

**5.1 Drying oven**, capable of being controlled at a temperature within the range of  $(105 \pm 2)$  °C and in which the air atmosphere changes between three to five times per hour. The air velocity shall be such that the test portion particles are not dislodged from their tray.

**5.2 Dishes and trays**, of non-corrodible and heat-resistant material and of such dimension that they will hold the total test portion in the proportion of not exceeding 1 g of material per cm<sup>2</sup>. The surface of the trays shall be such that the possibility to adsorption/absorption is minimized (very clean and even surface).

**5.3 Balance**, capable of reading to the nearest 0,1 g.

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## 6 Sample preparation

### 6.1 Sample reduction

Test samples for the determination of total moisture content shall be obtained in accordance with ISO 18135 and shall be received in the laboratory in sealed air-tight containers or bags. A test portion shall be prepared in accordance with ISO 14780 and the nominal top size reduced to below 31,5 mm.

### 6.2 Drying of test portion

The necessary drying time of the test portion depends, among other things, on the particle size of the test sample material. In order to reduce the necessary drying time, the particle size of the material may be reduced to below 31,5 mm by cutting up the material provided that the cutting procedure does not change the moisture content of the material. To ensure minimal loss of moisture from the sample, the size reduction of the sample should be conducted as quickly as possible in accordance with ISO 14780, while avoiding air ventilation as much as possible. Visibly wet samples cannot be cut up without loss of moisture and shall therefore be pre-dried.

If the particle size of the test sample is above 31,5 mm and reduction is not possible, larger test sample sizes and longer drying times shall be used. Deviations from the established procedures shall be documented on the test report.

**WARNING — Dried solid biofuels are hygroscopic. Precautions shall be taken to ensure that moisture is not lost during preparation of the test portion. Significant losses of moisture from test portion will occur after a few minutes in room atmosphere.**

### 6.3 Size of test portion

The mass of the test portion shall have a minimum mass of 300 g.

NOTE For fine particulate solid biofuels (e.g. sawdust and fuel powder), the test portion can be reduced to 200 g or 100 g, respectively, if using a balance capable of reading to the nearest 0,01 g.

## 7 Procedure

### 7.1 Handling of test portion

Weigh an empty and clean drying tray to the nearest 0,1 g.

Transfer the test portion from the package (container or bag) in which it is delivered to the empty and clean drying tray and spread the material evenly, not to exceed 1 cm<sup>2</sup> of surface area per 1 g of material. In case moisture remains on the inside surfaces of the package, shake the package to allow the material to re-absorb the moisture prior to emptying the package.

### 7.2 Weight of test portion

Weigh the tray with the test portion to the nearest 0,1 g before heating.

NOTE 1 Do not use larger dimension of the drying tray than necessary in relation to the size of the test portion due to buoyancy when hot weighing is undertaken (see ISO 18134-1).

Thereafter, place the tray in the temperature controlled oven at  $(105 \pm 2)$  °C. Heat the tray until constant mass has been achieved. Constant mass is defined as a change not exceeding 0,2 % absolute of the initial mass of the test portion during a heating period of 60 min. The drying time required will depend on particle size of the material, rate of atmospheric change in the oven, and thickness of the layer of material.

Remove the tray from the oven and weigh when still hot to the nearest 0,1 g within 10 s to 15 s in order to avoid absorption of moisture. Use heat-insulating material on the balance pan to avoid direct contact with the hot tray.

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

Do not overload the drying oven. The space above the trays and between the trays shall allow free flow of air and moisture.

To prevent unnecessary losses of volatile compounds, generally, the drying time should not exceed 24 h.

The moisture content determination shall be conducted in duplicate.

## 8 Calculation

The moisture content,  $M_{ar}$ , of the test portion, *as received*, shall be reported on a wet basis and expressed as a percentage by mass and shall be calculated in accordance with Formula (1):

$$M_{ar} = \frac{(m_2 - m_3)}{(m_2 - m_1)} \times 100 \quad (1)$$

where

$m_1$  is the mass of the empty drying container, in g;

$m_2$  is the mass of the drying container and test portion before drying, in g;

$m_3$  is the mass of the drying container and test portion after drying (weigh when still hot), in g.

The result shall be calculated to two decimal places and the mean value of both determinations is to be rounded to the nearest 0,1 % for reporting.

## 9 Performance characteristics

Because of the varying nature of the solid biofuels covered by this part of ISO 18134, it is not possible to give a precision statement (repeatability or reproducibility) for this test method.

## 10 Test report

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The test report shall include at least the following information:

- a) identification of the laboratory performing the test and the date of the test;
- b) identification of product (or sample) tested;  
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- c) reference to this part of ISO 18134, i.e. ISO 18134-2;
- d) results of the test on wet basis;
- e) any unusual features noted during the determination which might affect the result;
- f) any deviation from this part of ISO 18134 or operations regarded as optional.



## Bibliography

- [1] ISO 16993, *Solid biofuels — Conversion of analytical results from one basis to another*
- [2] SAMUELSSON R., BURVALL J., JIRJIS R. Comparison of different methods for the determination of moisture content in biomass. *Biomass Bioenergy*. 2006, **30** pp. 929–934
- [3] SAMUELSSON R., NILSSON C., BURVALL J. Sampling and GC-MS as a method for analysis of volatile organic compounds (VOC) emitted during oven drying of biomass materials. *Biomass Bioenergy*. 2006, **30** pp. 923–928

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