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Solid biofuels — Sample preparation

Biocombustibles solides — Préparation des échantillons

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Foreword

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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).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 238, *Solid biofuels*.

Introduction

Biofuels are a major source of renewable energy. International standards are needed for production, trade and use of solid biofuels. For sampling of solid biofuels, see ISO 18135.

This document can be used in regard to production, controlling and analysis of solid biofuels in general.

This document was developed with significant content from EN 14780:2011.

Solid biofuels — Sample preparation

1 Scope

This document defines methods for reducing combined samples (or increments) to laboratory samples and laboratory samples to sub-samples and general analysis samples and is applicable to solid biofuels.

The methods defined in this document can be used for sample preparation, for example, when the samples are to be tested for calorific value, moisture content, ash content, bulk density, durability, particle size distribution, ash melting behaviour, chemical composition, and impurities.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

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

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified procedure*

ISO 18135, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
nominal top size
aperture size of the sieve through which at least 95 % by mass of the material passes

Note 1 to entry: For pellets (and other long materials), the diameter is used to determine the nominal top size.

Note 2 to entry: Includes additional information not found in ISO 16559.

4 Symbols

M_p moisture loss, in percentage

$m_{sample,1}$ initial mass of the sample, g

$m_{sample,2}$ mass of the sample after pre-drying, g

W width and is at least 2,5 times the nominal top size of the material and should be wide enough for normal oversized material particles to enter the sampling device

5 Principles of correct sample reduction

The main purpose of sample preparation is that a sample is reduced to one or more test portions that are in general smaller than the original sample. The main principle for sample reduction is that the composition of the sample as taken on site shall not be changed during each stage of the sample preparation. Each sub-sample shall be representative of the original sample. To reach this goal, every particle in the sample before sample division shall have an equal probability of being included in the sub-sample following sample division. Two basic methods are used during the sample preparation. These methods are:

— sample division;

— particle size-reduction of the sample.

CAUTION — Avoid loss of moisture and fine particles during milling and other operations.

Because of the risk of changes in the moisture content (loss of moisture), a sub-sample (moisture analysis sample) shall be separated at the earliest possible stage of the sample preparation procedure. As an alternative, a separate moisture analysis sample may be taken. The sample reduction shall be carried out by a procedure that does not conflict with the requirements of ISO 18134-1 or ISO 18134-2.

For materials that have to be examined for moisture content, care should be taken to avoid any significant heat build-up and risk of drying.

6 Apparatus

6.1 Apparatus for sample division

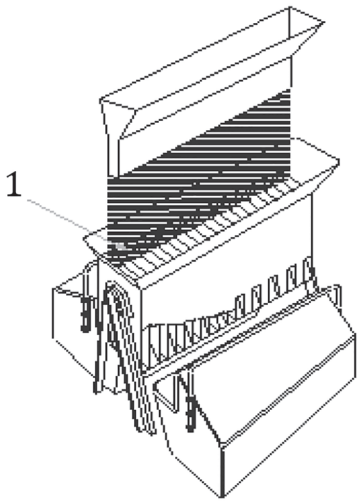
6.1.1 General

Sample division is the process of reducing the mass of the sample without reducing the size of the particles. This subclause gives some suitable apparatus for this purpose. To determine the correct use of each apparatus for different purposes, refer to Clause 8.

If the nominal top size of the sample is not known, a value of this parameter has to be assumed. After the sample reduction, the assumed value should be compared to the actual value to assure that the requirements of the apparatus for sample division and sample size used are met.

6.1.2 Riffle boxes

A riffle box should have an equal number of slots and at least six at each side (preferably more if possible), with adjacent slots directing material into different sub-samples, and the width of the slots shall be at least 2,5 times the nominal top size of the material to be riffled (see Figure 1).



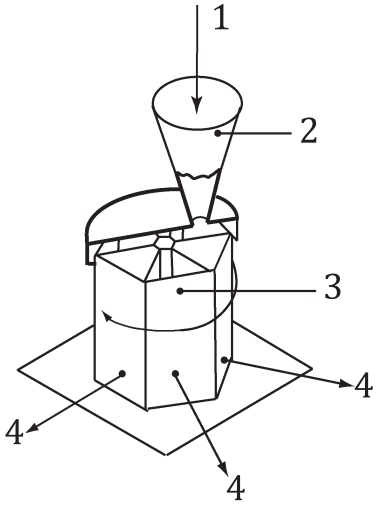
Key

1 width

Figure 1 — Example of a riffle box

6.1.3 Rotary sample dividers

The inner dimensions of the equipment where the sample is fed shall be at least 2,5 times as wide as the nominal top size of the material to be processed and should be large enough to handle normal oversized material particles. The rotary sample divider shall have a feeder device adjusted, so that the number of compartments multiplied by the number of rotations shall not be less than 120 while the sample is being divided. See Figure 2 for an example of a rotating divider.



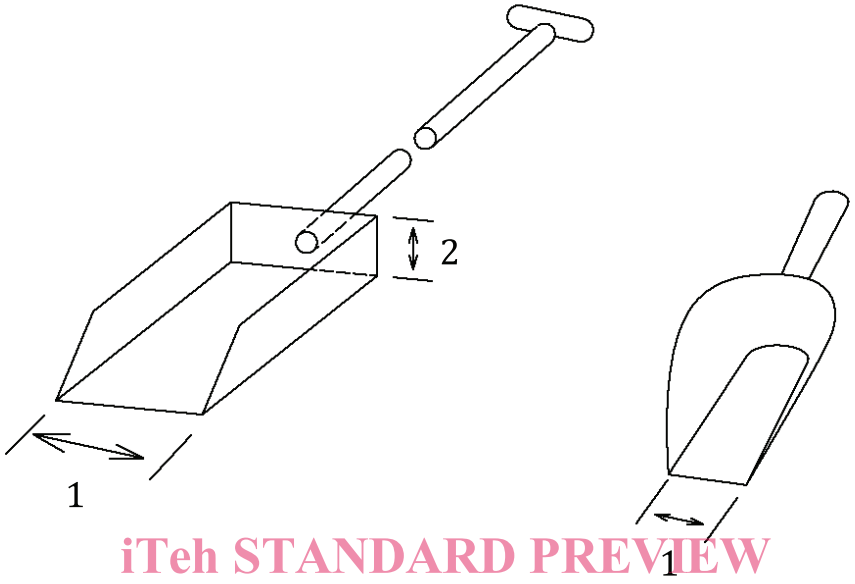
Key

1 feeder
2 funnel
3 rotating receivers
4 divided sample

Figure 2 — Example of a rotary sample divider

6.1.4 Shovels and scoops

A shovel or scoop are tools used for manual sample division. They shall have a flat bottom, with edges raised high enough to prevent particles from rolling off, shall be at least 2,5 times as wide as the nominal top size of the material to be processed, and should be large enough to handle normal oversized material particles. See Figures 3 and 4 for examples of scoops and a shovel, respectively.



Key

1 width
2 height

Figure 3 — Example of scoops

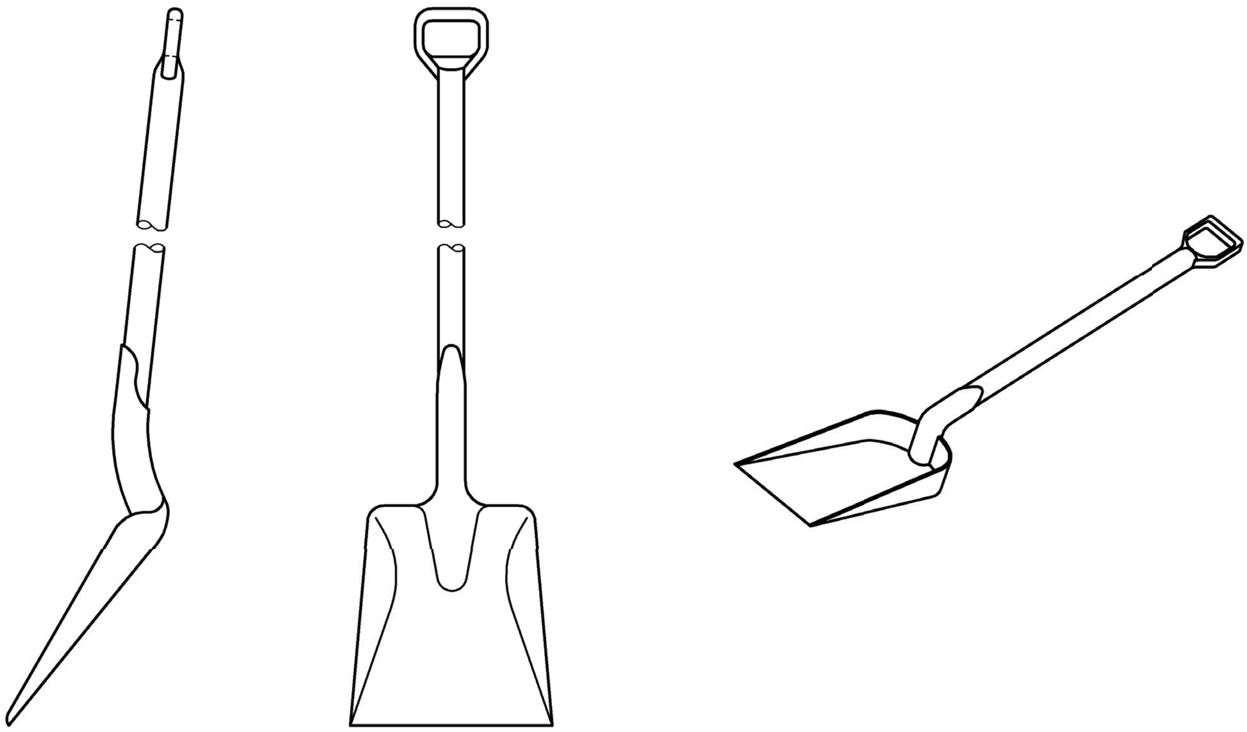


Figure 4 — Example of a shovel

6.2 Apparatus for particle size-reduction

CAUTION — When analysing metals (major or minor elements), take care that there is no contamination from the sample preparation or reduction equipment.

6.2.1 Coarse cutting mill or wood crusher

Coarse cutting mills can be used for cutting materials into lengths of about 10 mm to 30 mm (depending on the biofuel and the analyses to be performed). Drying of the material during coarse cutting shall be avoided by limiting heat production and air flow through the material. The equipment shall be designed so that it does not lose dust or contaminate the material with pieces of metal, and shall be easy to clean.

NOTE To prevent moisture losses during particle size reduction, a cutting mill or crushing mill with as low a cutting or crushing speed as possible is preferred.

6.2.2 Cutting mill

Cutting mills can be used for reducing the nominal top size of materials used as biofuels from about 10 mm to 30 mm down to about 1 mm or less (depending on the biofuel and the analyses to be performed). The mill shall be provided with screens of various aperture sizes covering this range, including an appropriate sieve to control the nominal top size of the material produced. Other apparatus may be used provided that they are designed so that they do not get blocked with the material that is being processed. Avoid the use of cutting mills whose cutting faces contain significant quantities of an element that is to be determined in the analysis.

NOTE Cross beater mills can be used without any excessive dusting, when fitted with dust filters (like a filter sock) between the mill and the receiving container. They are suitable for final grinding of hard, wood type materials after the pre-grinding with cutting type mills.

6.2.3 Axe

An axe is used for cutting wood logs or coarse material down to a maximum 30 mm thickness or suitable size to be processed in a cutting mill provided with a 30 mm sieve.

6.2.4 Hand saw

A hand saw is used to saw off wood logs or coarse material down to a maximum 30 mm thickness or suitable size to be processed in a cutting mill provided with a 30 mm sieve.

A chain saw may contaminate the sample by chain oil and should therefore not be used. A saw machine should not be used for size reduction to avoid the risk of losing moisture in the sample as a result of heat caused by friction.

6.2.5 Sieves

A wire-mesh sieve with an aperture size of 1 mm, in accordance with ISO 3310-1, is recommended to check the nominal top size of general analysis samples. A wire-mesh sieve with an aperture size of 0,25 mm will be recommended if sub-samples with this nominal top size are required.

6.2.6 Balance

A balance is required that is capable of determining the mass of samples to an accuracy of 0,1 % of the sample mass, and the mass of sub-samples to an accuracy of 0,1 % of the sub-sample mass.

7 Sample reduction — General principles

For every sample division stage to be carried out, it is important that a sufficient mass of material is retained, otherwise the sub-samples produced or the test portions to be taken may not be representative of the original sample. Due to various shape and size of different solid biofuels, different methods for determination of minimum sample masses have to be applied. Table 2 gives a guideline for minimum masses to be retained after each sample division stage, depending on the nominal top size of the material.

Regarding pellets, the pellets diameter shall be considered the nominal top size and the opening of the equipment shall be large enough for the longest pellets to pass through.

In addition to the minimum masses stated in Table 2, the mass after sample division shall be sufficiently large for the actual test or tests to be performed. Table 1 gives a guideline for the selection of the method to be applied to determinate the minimum sample mass to be retained after each sample division stage. Supplementary requirements concerning the masses of the test portions are given in international standards for test methods of solid biofuels.

Table 1 — Guideline to choose a method to determine the minimum masses to be retained during sample division stages

	1	2	3	4
Material	Bulk material of less than or equal to 100 mm nominal top size as defined in ISO 16559	Large pieces >100 mm material, e.g. wood logs or briquettes	Straw-like material with a low bulk density (≤BD 200 kg/m^3) and lengths >31,5 mm	Irregular/mixed materials, e.g. hogfuels, logging residues, bark
Method for determination of minimum sample mass	Calculate the minimum sample mass according to Table 2	Number of pieces should be stated, e.g. 10 pieces randomly collected	Minimum sample mass should be defined, e.g. 500 g	To be determined according to fuel type

