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Trdno alternativno gorivo - Metode za pripravo laboratorijskega vzorca

Solid recovered fuels - Methods for laboratory sample preparation

Feste Sekundärbrennstoffe - Verfahren zur Herstellung von Laboratoriumsproben

Combustibles solides de récupération - Méthodes de préparation des échantillons de laboratoire

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Solid recovered fuels - Methods for laboratory sample preparation

Combustibles solides de récupération - Méthodes de préparation des échantillons de laboratoire

Feste Sekundärbrennstoffe - Verfahren zur Herstellung von Laboratoriumsproben

This Technical Specification (CEN/TS) was approved by CEN on 13 May 2006 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.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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Foreword

This document (CEN/TS 15443:2006) has been prepared by Technical Committee CEN/TC 343 “Solid recovered fuels”, the secretariat of which is held by SFS.

This Technical Specification is one of series of technical specifications dealing with solid recovered fuel.

CEN/TS 15442, *Solid recovered fuels — Methods for sampling*

CEN/TS 15443, *Solid recovered fuels — Methods for laboratory sample preparation*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Specification: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Solid recovered fuels are a major source of renewable energy. Technical Specifications are needed for production, trade and use of solid recovered fuels. For sampling and sample preparation of solid recovered fuels the following Technical Specifications can be used:

CEN/TS 15442, *Solid recovered fuels — Methods for sampling;*

CEN/TS 15443, *Solid recovered fuels — Methods for laboratory sample preparation.*

Current practice and the best available knowledge have been used to write these Technical Specifications. The results of recent sampling experiments may be used to improve the sampling plans.

These Technical Specifications can be used by production and trading of solid recovered fuels. They are also useful for buyers of solid recovered fuels, regulators, controllers and laboratories.

Figure 1 shows the links between the essential elements of a testing program.

The sample preparation technique adopted depends on a combination of different characteristics of the material and circumstances encountered at the sampling location. The determining factors are:

— the type of solid recovered fuel;

— the physical behaviour of the specific solid recovered fuel;

— the (expected) degree of heterogeneity (e.g. monostreams, mixed fuels, blended fuels);

For the sample preparation of solid biofuels a Technical Specification from CEN/TC 335 is available (1). For the characterization of waste a European standard is available from CEN/TC 292 (2).

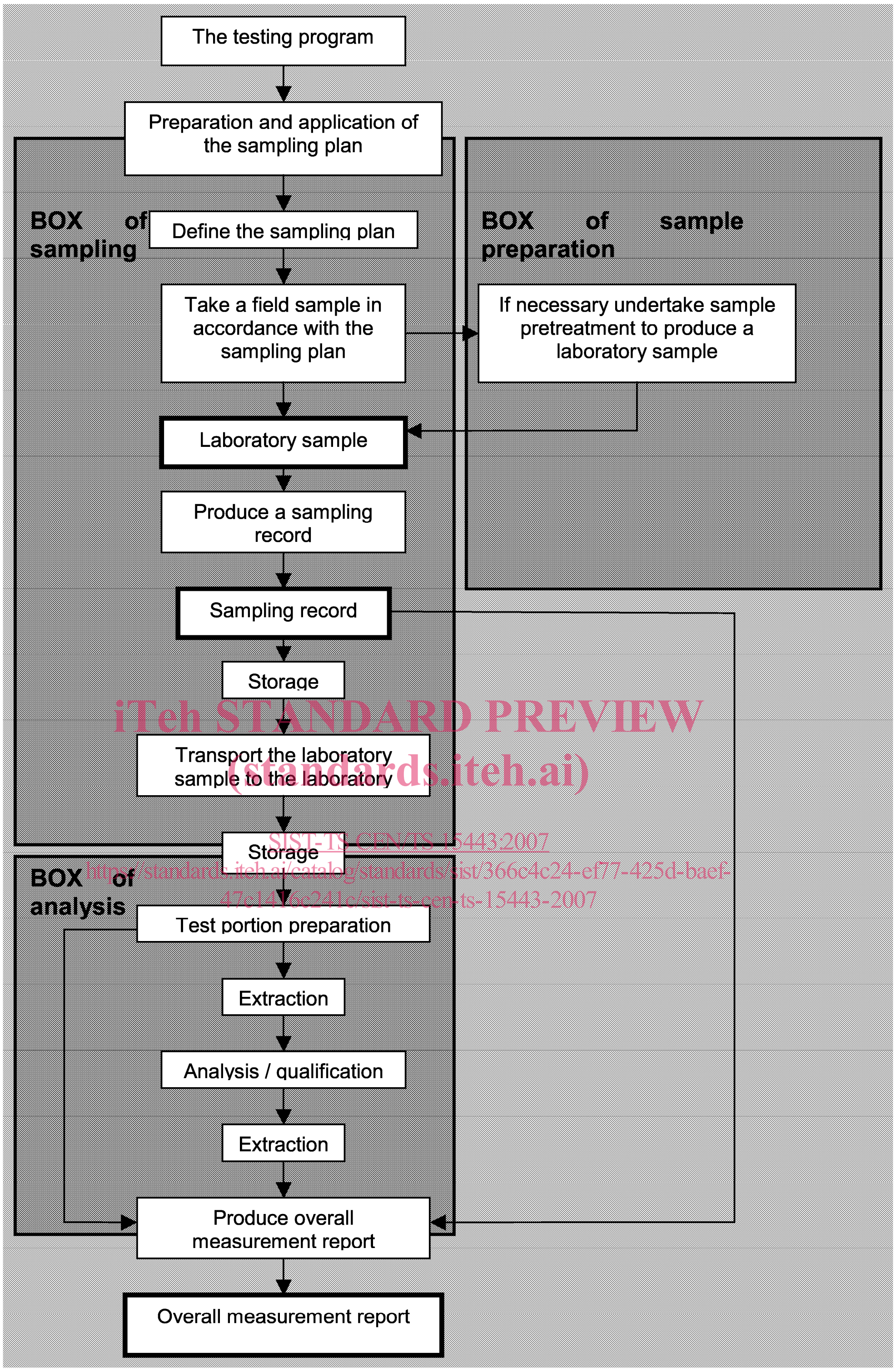


Figure 1 — Links between the essential elements of a testing program

1 Scope

This Technical Specification describes methods for reducing combined samples to laboratory samples and laboratory samples to sub-samples and general analysis samples, and is applicable to solid recovered fuels that are either:

- fine and regularly-shaped particulate materials, particle sizes up to about 10 mm that can be sampled using a scoop or pipe, for example: soft and hard pellets;
- coarse or irregularly-shaped particulate materials, particle sizes up to about 200 mm that can be sampled using a shovel, for example: fluff, chips and chunks;
- large pieces with nominal top size above 200 mm.

The methods described in this Technical Specification may be used for sample preparation, for example, when the samples are to be tested for bulk density, biomass determination, durability, particle size distribution, moisture content, ash content, ash melting behaviour, calorific value, chemical composition, and impurities. The methods are not intended to be applied to the very large samples required for the testing of bridging properties.

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.

CEN/TS 15357:2006, *Solid recovered fuels — Terminology, definitions and descriptions*

CEN/TS 15414-1, *Solid recovered fuels —Determination of moisture content using the oven dry method — Part 1: Determination of total moisture by a reference method*

CEN/TS 15414-2, *Solid recovered fuels — Determination of moisture content using the oven dry method — Part 2: Determination of total moisture by a simplified method*

CEN/TS 15414-3, *Solid recovered fuels —Determination of moisture content using the oven dry method — Part 3: Moisture in general analysis sample*

CEN/TS 15415, *Solid recovered fuels — Determination of particle size and distribution by screen method*

CEN/TS 15442, *Solid recovered fuels — Methods of sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TS 15357:2006 and the following apply.

3.1
lot
defined quantity of fuel for which the quality is to be determined

3.2
increment
portion of solid recovered fuel extracted in a single operation of the sampling device

3.3
sample
quantity of fuel, representative of a larger mass for which the quality is to be determined

3.4
combined sample
sample consisting of all the increments taken from a lot or a sub-lot

NOTE The increments may be reduced by division before being added to the combined sample.

3.5
moisture analysis sample
sample taken specifically for the purpose of determining total moisture

3.6
sub-sample
portion of a sample

3.7
laboratory sample
combined sample or a sub-sample of a combined sample or an increment or a sub-sample of an increment sent to a laboratory

3.8
general analysis sample
sub-sample of a laboratory sample having a nominal top size of 1 mm or less and used for a number of chemical and physical analyses

3.9
test portion
sub-sample of a laboratory sample consisting of the quantity of material required for a single execution of a test method

3.10
mass-reduction
reduction of the mass of a sample or sub-sample

3.11
size-reduction
reduction of the nominal top size of a sample or sub-sample

3.12
nominal top size
d_{95}
aperture size of the sieve used in CEN/TS 15415 through which at least 95 % by mass of the material passes

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviated terms apply.

d_{95} is the nominal top size in mm

m is the mass of a sample

M is moisture in percent by weight

s is the shape factor

α is a constant in third power law

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 step of the sample preparation. Each sub-sample shall be representative for the original sample. To reach this goal every particle in the sample before mass-reduction shall have an equal probability of being included in the sub-sample retained after mass-reduction during a mass-reduction step. Two basic methods are used during the sample preparation. These methods are:

— mass-reduction of the sample by division;

— particle size-reduction of the sample.

For granular materials, generally the principle of the third-power law is accepted and shall be respected at each mass-reduction step. The equation for this third power law is shown in Equation 1:

$$m > \alpha \times {d_{95}}^3 \quad (1)$$

where

m is the mass retained after each mass-reduction step in g;

d_{95} is the nominal top size in mm;

α is a constant over the whole sample preparation procedure for a particular material in g/mm^3.

The value and dimension of constant α is fixed by the nominal particle size, d_{95}, and the sample size, *m*, of the sample before sample preparation.

EXAMPLE

A sample of 10 kg of SRF fluff has d_{95} of 50 mm. For the analysis is a test portion of 5 g required.

The third power law results in α = 10 000 g divided by 50 mm to the third power. The value of α is now 0,08 g/mm^3. Using this value in Equation 1 for a reduced sample size results in a nominal top size for the particles in the test portion of 3,97 mm (cube root of 5,0 g divided by 0,08 g/mm^3). Below in the table are shown the figures.

m **in g**	α **in g/mm^3**	d_{95} **in mm**
10 000	0,08	50
5	0,08	3,97

Table 5a shows the resulting reduction factors for the minimum (sub-)sample size, if a certain reduction of the nominal top size is chosen and the third-power law is respected. The reduction factor of the nominal top size can be calculated by dividing the current nominal top size by the proposed nominal top size after size reduction.

Table 5b shows the resulting reduction factors for the minimum nominal top size, if a certain reduction of the (sub-)sample size is chosen and the third-power law is respected. The reduction factor of the minimum (sub-)sample size can be calculated by dividing the current minimum (sub-)sample size by the proposed minimum (sub-)sample top size after size reduction.

Equation 1 can be used to calculate the exact values for each specific situation.

Table 5a – Common values for desired reduction factor minimum (sub-)sample size

Chosen reduction factor of the nominal top size	Resulting reduction factor for the minimum (sub-)sample size
1,5	3,4
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1 000
20	8 000
30	27 000

Table 5b – Common values for desired reduction factor nominal top size

Desired reduction factor for the minimum (sub-)sample size	Necessary reduction factor of the nominal top size
2	1,3
3	1,4
4	1,6
5	1,7
10	2,2
20	2,7
50	3,7
80	4,3
100	4,6
200	5,8
500	7,9
1 000	10,0

For SRF, however, many materials turn out to be far from granular. For example in fluff the particles turn out to be predominantly flat. Therefore for solid recovered fuels a correction can made for non-granular materials.

Care is needed to avoid loss of fine particles during milling and other operations.

If a sub-sample is required for the determination of moisture content, then the sample reduction shall be carried out by a procedure that does not conflict with the requirements of CEN/TS 15414-1, CEN/TS 15414-2 or CEN/TS 15414-3. It is recommended that, if moisture content of the material (as sampled) is to be determined, a separate moisture analysis sample is taken (as there is a risk of changing the moisture content by sample reduction operations).

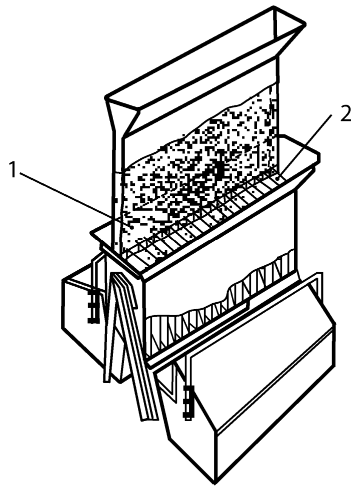
For materials that have to be examined for moisture content, care shall be taken for any significant heat build-up and risk of drying.

6 Apparatus

6.1 Apparatus for mass-reduction

6.1.1 Riffle boxes

A riffle box shall have at least 16 slots, 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 2).



Key

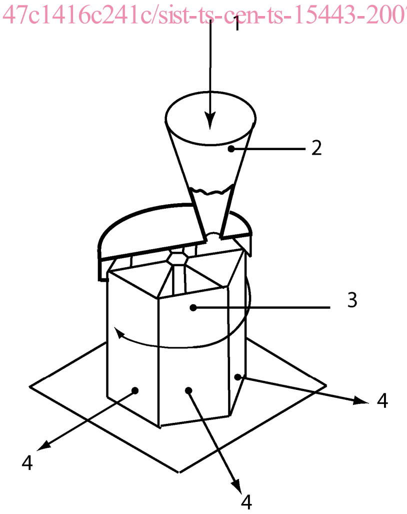
1 sample
2 slot, width is at least 2,5 times the nominal top size of the material

Figure 2 — Example of a riffle box

6.1.2 Rotary sample dividers

A rotary sample divider shall have a feeder device adjusted so that the divider rotates at least 20 times while the sample is being divided. See Figure 3 for an example of a rotating divider.

The manufacturer's manual shall always be followed. The inner dimensions of the equipment where the sample is feed shall be at least 2,5 times as wide as the nominal top size of the material to be processed.



Key

1 feeder
2 funnel
3 rotating receiver
4 divided sample

Figure 3 — Example of a rotary sample divider