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Trdna alternativna goriva - Metode za pripravo laboratorijskega vzorca

Solid recovered fuels - Methods for the preparation of the laboratory sample

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 the preparation of the laboratory sample

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

Feste Sekundärbrennstoffe - Verfahren zur Herstellung von Laboratoriumsproben

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Foreword

This document (EN 15443:2011) has been prepared by Technical Committee CEN/TC 343 “Solid recovered fuels”, the secretariat of which is held by SFS.

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of an identical text or by endorsement, at the latest by September 2011, and conflicting national standards shall be withdrawn at the latest by September 2011.

This document supersedes CEN/TS 15443:2006.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European Standard is one of series of European Standards dealing with sampling solid recovered fuel.

EN 15442, *Solid recovered fuels — Methods for sampling.*

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

This document differs from CEN/TS 15443:2006 mainly as follows:

a) results of interlaboratory tests supplemented as an informative Annex D;

b) whole document editorially revised.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, 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 (SRF's) are a major source of renewable energy. European Standards are needed for production, trade and use of solid recovered fuels. For sampling and sample preparation of solid recovered fuels the following European Standards can be used:

EN 15442, *Solid recovered fuels — Methods for sampling;*

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

These European Standards 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 prEN 14780 is available [1]. For the characterization of waste EN 15002 is available [2].

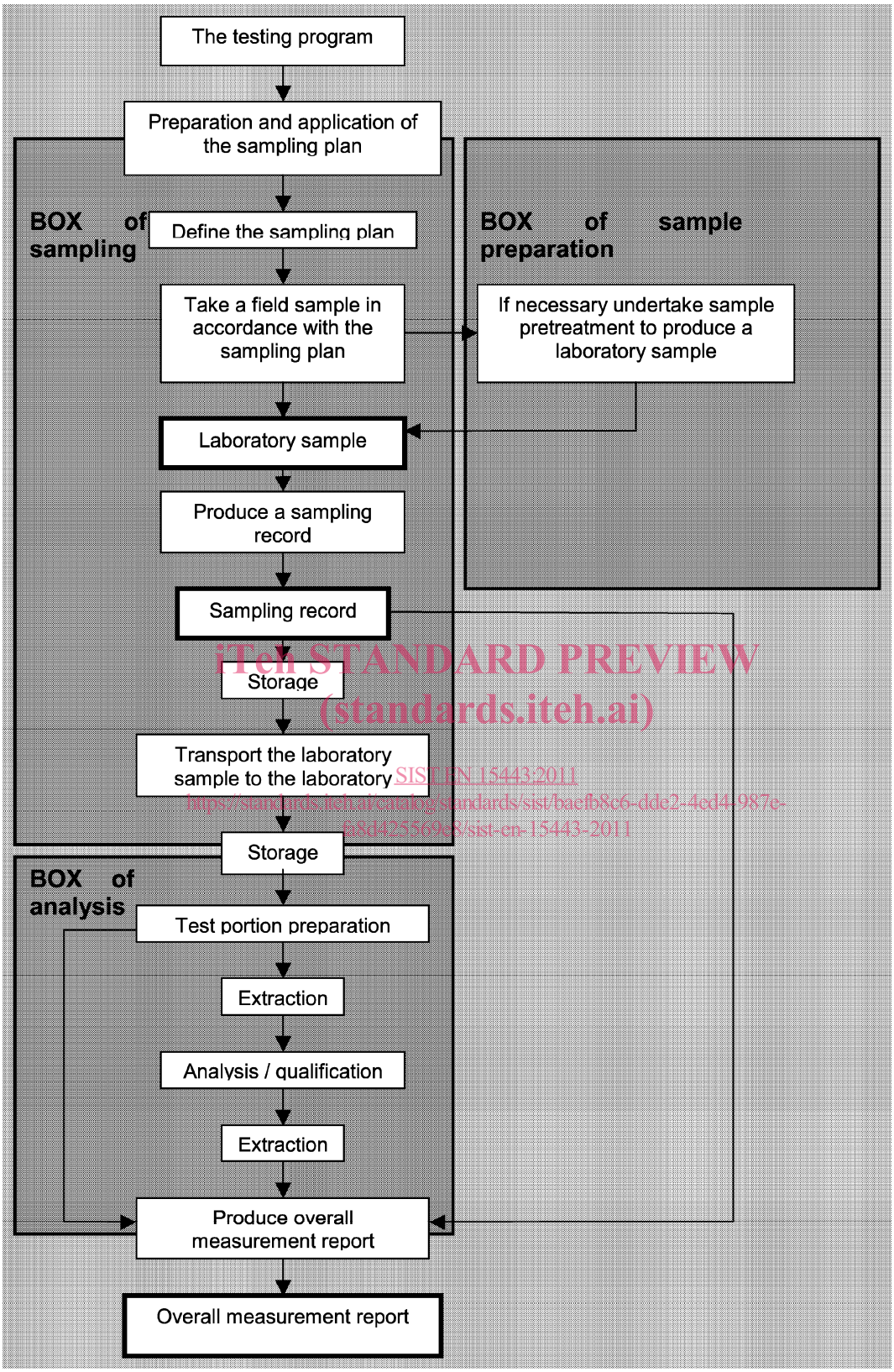

Figure 1 — Links between the essential elements of a testing program

1 Scope

This European Standard specifies methods for reducing combined samples to laboratory samples and laboratory samples to sub-samples and general analysis samples.

The methods described in this European Standard 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.

EN 15297, *Solid biofuels — Determination of minor elements — As, Cd, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Sb, V and Zn*

EN 15357:2011, *Solid recovered fuels — Terminology, definitions and descriptions*

CEN/TS 15414-1:2010, *Solid recovered fuels —Determination of moisture content using the oven dry method — Part 1: Determination of total moisture by a reference method*

CEN/TS 15414-2:2010, *Solid recovered fuels — Determination of moisture content using the oven dry method — Part 2: Determination of total moisture by a simplified method*

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

EN 15415-1[1)], *Solid recovered fuels — Determination of particle size and particle size distribution — Part 1: Screen method for small dimension particles*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15357:2011 and the following apply.

3.1
combined sample
sample consisting of all the increments taken from a lot or a sub-lot

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

3.2
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

3.3
increment
portion of solid recovered fuel extracted in a single operation of the sampling device

[1)] To be published.

3.4
laboratory sample
sample sent to or received by the laboratory

NOTE 1 When the laboratory sample is further prepared (reduced) by subdividing, mixing, grinding, or by combinations of these operations, the result is the test sample. When no preparation of the laboratory sample is required, the laboratory sample is the test sample. A test portion is removed from the test sample for the performance of the test or for analysis.

NOTE 2 The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

NOTE 3 Several laboratory samples may be prepared and sent to different laboratories or to the same laboratory for different purposes. When sent to the same laboratory, the set is generally considered as a single laboratory sample and is documented as a single sample.

3.5
lot
defined quantity of fuel for which the quality is to be determined

3.6
moisture analysis sample
sample taken specifically for the purpose of determining total moisture

3.7
nominal top size
d_{95}
aperture size of the sieve used in EN 15415-1 through which at least 95 % by mass of the material passes

3.8
particle size reduction
reduction of the nominal top size of a sample or sub-sample

3.9
sample
quantity of fuel, representative of a larger mass for which the quality is to be determined

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

3.11
sub-sample
portion of a sample

3.12
test portion
sub-sample of a laboratory sample consisting of the quantity of material required for a single execution of a test method

4 Symbols and abbreviations

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

α is a constant in third power law

d_{95} is the nominal top size in mm

m is the mass of a sample in gram

M is moisture in percent by weight

f is the shape factor

5 Principles of correct sample preparation

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 preparation is that the composition of the sample as taken on site shall not be changed during each step of the sample preparation and that possible requirements of the analysis methods to be performed are obeyed. Each sub-sample shall be representative for the original sample. To reach this goal every particle in the sample before sample preparation shall have an equal probability of being included in the sub-sample retained after sample preparation. Also the loss of moisture and other volatile components shall be minimised if these components are analysed or influence the properties to be analysed.

Two basic methods are used during the sample preparation. These methods are:

— sample 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 sample division 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 sample division 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 unit 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 1 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 2 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 1 — 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 2 — 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 and volatile components such as moisture and mercury during milling and other operations.

If a sub-sample is required for the determination of moisture content, then the sample preparation shall be carried out by a procedure that does not conflict with the requirements of CEN/TS 15414-1, CEN/TS 15414-2 or EN 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 reducing the moisture content by sample preparation operations).

If a sub-sample is required for the determination of mercury content, then the sample preparation shall be carried out by a procedure that does not conflict with the requirements of EN 15297. It is recommended that, if mercury content of the material (as sampled) is to be determined, a separate mercury analysis sample is taken (as there is a risk of reducing the mercury content by sample preparation operations).

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