



**SLOVENSKI STANDARD
SIST-TS CEN/TS 15440:2007**

01-marec-2007

Trda goriva - Metoda za določitev vsebnosti biomase

Solid recovered fuels - Method for the determination of biomass content

Feste Sekundärbrennstoffe - Verfahren zur Bestimmung des Gehaltes an Biomasse

Combustibles solides de récupération - Méthode de détermination de la teneur en biomasse

ITEH STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: CEN/TS 15440:2006

[SIST-TS CEN/TS 15440:2007](https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007)

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007>

ICS:

75.160.10 Trda goriva Solid fuels

SIST-TS CEN/TS 15440:2007 en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST-TS CEN/TS 15440:2007

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007>

English Version

Solid recovered fuels - Method for the determination of biomass content

Combustibles solides de récupération - Méthode de détermination de la teneur en biomasse

Feste Sekundärbrennstoffe - Verfahren zur Bestimmung des Gehaltes an Biomasse

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.

CEN members are the national standards bodies of 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.

[SIST-TS CEN/TS 15440:2007](https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007)

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents		Page
Foreword.....		3
Introduction		4
1 Scope		5
2 Normative references		5
3 Terms and definitions		6
4 Symbols and abbreviations		8
5 Principle		8
6 Selection of method for determination of biomass content		8
Annex A (normative) Materials considered as CO₂-neutral		11
Annex B (normative) Determination of biomass content using the selective dissolution method		12
Annex C (normative) Determination of biomass content using the manual sorting method		17
Annex D (normative) Determination of the biomass content in percent by calorific value		25
Annex E (normative) Determination of the total carbon content of the biomass and non-biomass fraction by selective dissolution		29
Annex F (informative) Determination of biomass content using reductionistic method		34
Annex G (informative) Limitations on the determination methods		39
Bibliography	https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007	42

Foreword

This document (CEN/TS 15440:2006) 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 Technical Specification is one of a series of technical specifications dealing with solid recovered fuels.

Solid recovered fuels are defined in the EU Commission Mandate M/325 to CEN. The mandate makes reference to Directive 2001/77/EC, 2000/76/EC and Commission Decision 2000/532/EC. In the Mandate M/325 solid recovered fuels are defined as fuels prepared from non hazardous waste to be utilised for energy recovery in waste incineration or co-incineration plants regulated under Community environmental legislation.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this 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 the United Kingdom.

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

[SIST-TS CEN/TS 15440:2007](https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007)

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007>

Introduction

This Technical Specification specifies the methods used for the determination of biomass (as defined in 3.3) content in solid recovered fuels. The RES-E directive [1] aims to promote electricity produced from renewable resources, including e.g. the biomass fraction present in solid waste. This Technical Specification specifies two normative methods and one informative method for the determination of biomass content in solid recovered fuels, including the method of selective dissolution in sulphuric acid, the manual sorting method and the informative reductionistic method. The reductionistic method is for internal control and specific agreements only, see Annex F. The two latter methods are both based on the first one, the selective dissolution method. As the selective dissolution method is not applicable to some materials usually or possibly present in SRF, the limitations of this method have to be considered (see Annex G), and attention needs to be paid to possible misuse in SRF mixtures of unknown origin.

NOTE An alternative method could be the C-14 method to determine the biomass content expressed in percentage by carbon content. The method is currently in its early stages of development, but in the future it may be used as an alternative method to determine the biomass content expressed in percentage by carbon content.

This Technical Specification is primarily geared toward laboratories, producers, suppliers and purchasers of solid recovered fuels, but is also useful for the authorities and inspection organizations.

CEN/TR 14980 shows that biogenic/biodegradable fractions can be estimated using the methods described in this Technical Specification. The fraction of biomass (biodegradable/biogenic fractions) can be expressed:

— by weight;

— by energy content (net or gross calorific value);

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-fadff90475e4/sist-ts-cen-ts-15440-2007>

— by carbon content.

1 Scope

This Technical Specification specifies two normative methods and one informative method for the determination of the biodegradable/biogenic fraction in solid recovered fuel. The methods are the selective dissolution in sulphuric acid, the manual sorting method and the informative reductionistic method. The methods estimate the biodegradable/biogenic content of solid recovered fuels by determination of the biomass content.

This Technical Specification is not applicable to:

- pure fractions of waste, products and by-products classified as CO₂-neutral biomass according to Annex G;
- charcoal, peat and solid fossil fuels like hard coal, coke, brown coal and lignite and to mixtures of these and solid recovered fuels;
- solid recovered fuels that contain more than 10 % of natural and/or synthetic rubber residues;
- solid recovered fuels that contain a combination of more than 5 % by weight of:
 - nylon, polyurethane or other polymers containing molecular amino groups;
 - biodegradable plastics of fossil origin;
- solid recovered fuels that contain a combination of more than 5 % by weight of:
 - wool or viscose;
 - non-biodegradable plastics of biogenic origin;
 - oil or fat present as a constituent of biomass.

NOTE In typical municipal and assimilated waste the content of nylon, polyurethane, biodegradable plastics of fossil origin, wool, viscose, non-biodegradable plastics of biogenic origin and oil/fat present is rather small and the error is negligible.

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 13965-1:2004, *Characterization of waste — Terminology — Part 1: Material related terms and definitions*

EN 13965-2:2004, *Characterisation of waste — Terminology — Part 2: Management related terms and definitions*

CEN/TS 15400, *Solid recovered fuels — Methods for the determination of calorific value*

CEN/TS 15403, *Solid recovered fuels — Methods for the determination of ash content*

CEN/TS 15407, *Solid recovered fuels — Methods for the determination of carbon (C), hydrogen (H) and nitrogen (N) content*

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 15442, *Solid recovered fuels — Methods for sampling*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13965-1:2004, EN 13965-2:2004 and the following apply.

NOTE Definitions for the terms in bold are given in EN 13965.

3.1

ash content

inorganic mass remaining after complete combustion of a **solid recovered fuel** under specified conditions expressed as a percentage of the mass of the **dry matter** in the **solid recovered fuel**

[CEN/TS 15357:2006]

3.2

biodegradable

material capable of undergoing biological anaerobic or aerobic decomposition under conditions naturally occurring in the biosphere

3.3

biomass

material of biological origin excluding material embedded in geological formation or transformed to fossil

NOTE This definition is very close to the definition in CEN/TC 335 "Solid biofuels" with the only difference that coal found on the surface of the earth is clearly excluded. For further clarification, definitions on fossil and geological formation:

fossil

remains or traces of a plant or animal life embedded in geological formation from a previous geological period and transformed to a stable material for the conditions of its present location

geological formation

material formed by consecutive natural depositions of different materials in a certain geological period

3.4

biogenic

produced in natural processes by living organisms but not fossilised or derived from fossil resources

3.5

calorific value

calculated value of the specific energy of combustion for unit mass of a solid recovered fuel burned in oxygen in calorimetric bomb under such conditions that it can be either expressed as gross calorific value or net calorific value

3.6

gross calorific value

absolute value of the specific energy of combustion for unit mass of a **solid recovered fuel** burned in oxygen in calorimetric bomb under the conditions specified

NOTE 1 The result of combustion are assumed to consist of gaseous oxygen, nitrogen, carbon dioxide and sulphur dioxide, of liquid water [in equilibrium with its vapour] saturated with carbon dioxide under conditions of the bomb reaction, and of solid ash, all at the reference temperature and at constant volume.

NOTE 2 The old term for gross calorific value is higher heating value.

3.7

increment

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

[CEN/TS 15357:2006]

3.8

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

[CEN/TS 14588:2003]

3.9

total moisture

moisture in a **solid recovered fuel** removable under specific conditions

NOTE the old term for total moisture is moisture content.

3.10

net calorific value

calculated value of the specific energy of combustion for unit mass of a solid recovered fuel burned in oxygen in calorimetric bomb under such conditions that all the water remains as water vapour at 0,1 MPa

[CEN/TS 15357:2006]

[SIST-TS CEN/TS 15440:2007](https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-0-2007)

<https://standards.iteh.ai/catalog/standards/sist/7fac14af-8817-4d92-ab6c-0-2007>

NOTE The old term for net calorific value is lower heating value.

3.11

nominal top size

aperture size of the sieve used for determining the **particle size distribution** of **solid recovered fuels** through which at least 95 % by mass of the material passes

[CEN/TS 15357:2006]

3.12

sample

quantity of material, representative of a larger quantity for which the property is to be determined

3.13

sample preparation

all the actions taken to obtain representative **analyses samples** or **test portions** from the original **sample**

3.14

sub-sample

sample obtained by procedures in which the items of interest are randomly distributed in parts of equal or unequal size

NOTE 1 A sub-sample may be:

- a) a portion of the **sample** obtained by selection or division;
- b) the final **sample** of multistage sample-preparation.

NOTE 2 The definition for sub-sample is adopted from EN 15002.

4 Symbols and abbreviations

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

d is on a dry basis;

SRF is Solid Recovered Fuel;

TC is total carbon;

In this document it is chosen to list the symbols in the Annex where they are required.

5 Principle

The determination of the biomass content is based on the selective dissolution of biomass in solid recovered fuel. The selective dissolution method involves the treatment with concentrated sulphuric acid topped with hydrogen peroxide. The biomass content gives an estimation of the content of the biodegradable/biogenic fraction in solid recovered fuel. See also CEN/TR 14980 [6].

6 Selection of method for determination of biomass content

6.1 General

Three different dimensions are used to express the biomass content. Depending on the purpose of the use of the results one of three dimensions shall be chosen. The three dimensions are:

- a) biomass in percent by weight;
- b) biomass in percent by calorific value;
- c) biomass in percent by total carbon content.

6.1.1 Determining biomass content by weight

When determining the biomass content by weight two different methods are available. Selection of these methods is described in 6.3.

6.1.2 Determining biomass content by calorific value

When determining the biomass content by calorific value, the following five steps shall be taken:

- 1) prepare two test portions: test portion A and test portion B;
- 2) apply the selective dissolution method described in Annex B to test portion A. Take care that sufficient residue is produced to allow the next step;
- 3) determine ash content according to CEN/TS 15403 and calorific value according to CEN/TS 15400 of the residue of test portion A;
- 4) determine ash content and calorific value of test portion B;

- 5) calculate the biomass content of test portion A expressed as a percentage of the calorific value as described in Annex D.

6.1.3 Determining biomass content by total carbon content

When determining the biomass content by total carbon content, the following steps shall be taken:

- 1) prepare three test portions: test portion A, test portion B and test portion C;
- 2) apply the selective dissolution method described in Annex B to test portions A and B;
- 3) if necessary determine the total carbon content of the ash of test portion A;
- 4) determine ash content and total carbon content of the residue of test portion C;
- 5) prepare test portion D with sufficient mass in order to produce sufficient residue for step 7;
- 6) produce a residue of test portion D with the first part of the selective dissolution method, as described in D.4;
- 7) determine ash content and total carbon content of the residue of test portion D;
- 8) calculate the biomass content of test portion A expressed as a percentage of the total carbon content as described in Annex E.

NOTE Annex G contains useful information about accuracy and sensitivity of the given methods for determining the biomass content.

iTech STANDARD PREVIEW
(standards.iteh.ai)

6.2 Mixtures of SRF and materials of fossil origin

SIST-TS CEN/TS 15440:2007

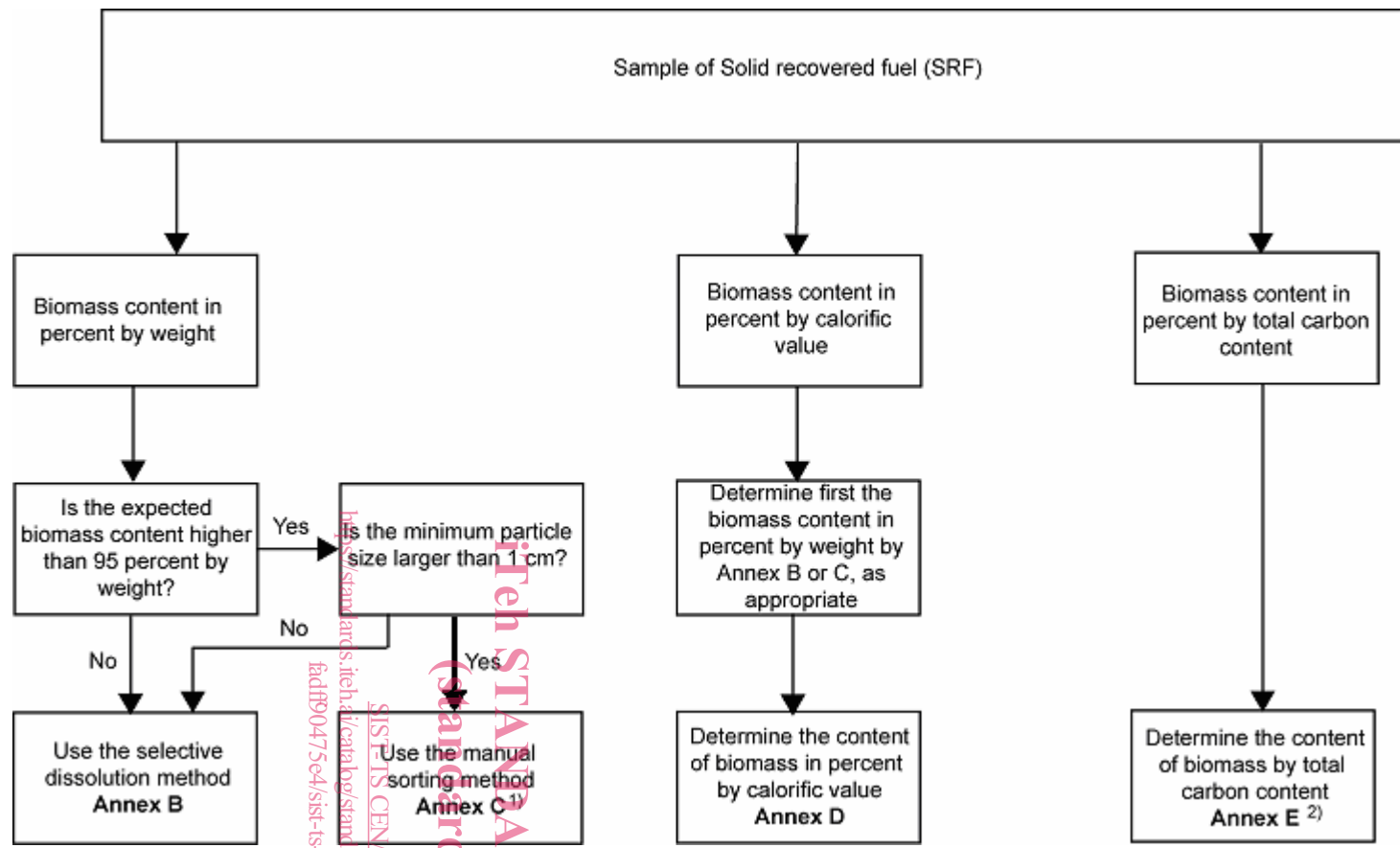
In case of a mixture between solid fossil fuels and solid recovered fuels, the biomass content shall be determined before they are mixed, and/or duly documented. Materials of fossil origin can wrongly be detected as biomass. Materials like lignite and peat could be added in order to obtain an increase in the values for biomass content of a solid recovered fuel. This obviously interferes with the results and leads to results that are no longer valid. For more information see the technical specifications on quality assurance (see CEN/TS 15358).

6.3 Method selection

Figure 1 shows which methods for the determination of the biomass content shall be used and how they shall be selected depending on the dimension of the biomass content. This dimension shall be expressed in percentage by weight, in percentage by calorific value or in percentage by total carbon content. In Annex G information can be found, where explanatory remarks on precision are given regarding the functioning of the methods described in this Technical Specification.

If the expected biomass content is larger than 95 % by weight and it is only possible to determine with the selective dissolution method in Annex B, Annex B shall be used but for some materials the accuracy might decline.

For SRFs exceeding a biomass content by weight of 95 % it is assumed that biomass content in percent by weight equals the biomass content in percent by total carbon content.



- 1) SRFs which are comminuted in the production process can be sampled and analysed before comminution in case the nominal top size puts the type of SRF out of the scope of the manual determination method.
- 2) For SRFs exceeding a biomass content by weight of 95 % it is assumed that biomass content in percent by weight equals the biomass content in percent by total carbon content.

Figure 1 — Selection of suitable methods for biomass determination

Annex A (normative)

Materials considered as CO₂-neutral

The text in this annex is obtained from Commission Decision 2004/156/EC of 29/01/2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European parliament and of the Council Annex I paragraph 9 under 1. *Plants and parts of plants*, inter alia or 2. *Biomass wastes, products and by-products*, inter alia.

The exemplary but not exhaustive list below contains a number of materials, which are considered biomass for the application of this Technical Specification and shall be weighted with an emission factor of 0 [t CO₂/TJ or t or m³]. Peat and fossil fractions of the materials listed below shall not be considered biomass.

a) Plants and parts of plants, inter alia:

- straw;
- hay and grass;
- leaves, wood, roots, stumps, bark;
- crops, e.g. maize and triticale.

b) Biomass wastes, products and by-products, inter alia:

- industrial waste wood (waste wood from woodworking and wood processing operations and waste wood from operations in the wood materials industry);
- used wood (used products made from wood, wood materials) and products and by-products from wood processing operations;
- wood-based waste from the pulp and paper industries, e.g. black liquor;
- forestry residues;
- animal, fish and food meal, fat, oil and tallow;
- primary residues from the food and beverage production;
- manure;
- agricultural plant residues;
- sewage sludge;
- biogas produced by digestion, fermentation or gasification of biomass;
- harbour sludge and other waterbody sludges and sediments;
- landfill gas.