



SLOVENSKI STANDARD
SIST-TS CEN/TS 15296:2006

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Solid Biofuels - Calculation of analyses to different bases

Feste Biobrennstoffe - Analysenberechnung auf unterschiedliche Bezugsbasen

Biocombustibles solides - Calcul des analyses selon différentes bases

Ta slovenski standard je istoveten z: CEN/TS 15296:2006

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ICS:

75.160.10 Trda goriva Solid fuels

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TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
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CEN/TS 15296

March 2006

ICS 75.160.10

English Version

Solid Biofuels - Calculation of analyses to different bases

Biocombustibles solides - Calcul des analyses selon
différentes bases

Feste Biobrennstoffe - Analysenberechnung auf
unterschiedliche Bezugsbasen

This Technical Specification (CEN/TS) was approved by CEN on 22 November 2005 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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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This Technical Specification (CEN/TS 15296:2006) has been prepared by Technical Committee CEN/TC 335 “Solid biofuels”, the secretariat of which is held by SIS.

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 United Kingdom.

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Introduction

In the CEN Technical Specifications covering the analysis of solid biofuels it is general specified that the determination should be carried out on the air-dried (moist) general analysis test sample, prepared according to CEN/TS 14780. However, in making use of these analyses, it is necessary to express the results on dry basis and sometimes also on some other basis. The bases in common use for solid biofuels are "air-dried" (sometimes stated as "as determined"), "as received" (sometimes stated "as sampled" or "as delivered"), "dry" and "dry, ash free".

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1 Scope

This Technical Specification gives formulae, which allow analytical data relating to solid biofuels to be expressed on the various different bases in common use. Consideration is given to corrections that may be applied to certain determined values for solid biofuels prior to their calculation to other bases.

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 14774, Parts 1-3, *Solid biofuels — Methods for the determination of moisture content – Oven dry method*

CEN/TS 14775, *Solid biofuels — Methods for the determination of ash content*

CEN/TS 14918, *Solid Biofuels — Methods for the determination of calorific value.*

CEN/TS 15104, *Solid biofuels — Determination of total content of carbon, hydrogen and nitrogen — Instrumental methods*

prCEN/TS 15289, *Solid biofuels — Determination of total content of sulphur and chlorine*

3 Symbols

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The symbols employed in the subsequent clauses are as follows, with the suffixes "ad" (air-dried), "ar" (as received), "d" (dry), "daf" (dry, ash free) where appropriate:

<i>A</i>	ash (percentage by mass) according to CEN/TS 14775
<i>C</i>	total carbon content (percentage by mass) according to CEN/TS 15104
<i>Cl</i>	total chlorine content (percentage by mass) according to prCEN/TS 15289
<i>q_{p,net}</i>	net calorific value at constant pressure (J/g) according to CEN/TS 14918
<i>H</i>	total hydrogen content (percentage by mass) according to CEN/TS 15104
<i>M</i>	moisture content (percentage by mass) according to CEN/TS 14774
<i>N</i>	total nitrogen content (percentage by mass) according to CEN/TS 15104
<i>O</i>	total oxygen content (percentage by mass)
<i>S</i>	total sulphur content (percentage by mass) according to prCEN/TS 15289

4 Principle

In order to convert an analytical result expressed on one basis to another basis, it is multiplied by the appropriate formula (see Table 1) after insertion of the requisite numerical values.

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5 Calculations for solid biofuels analyses

5.1 General

Most analytical values on a particular basis may be converted to any other basis by multiplying it by the appropriate formula given in Table 1, after insertion of the numerical values for the symbols. However, for some parameters there is a direct involvement of the moisture content. In these cases a correction as specified in 5.2 of the air-dried result shall be carried out before calculation to dry basis or dry, ash free basis. Also if a result for these parameters expressed on a dry or a dry, ash free basis is to be recalculated to a moist basis, the corrections stated in 5.2 shall be added back to the actual moist basis after applying the appropriate formula from the table.

5.2 Extra calculations for hydrogen, oxygen and net calorific value

5.2.1 Hydrogen

The hydrogen content determined on the air-dried basis (H_{ad} , as analysed) includes both the hydrogen content of the combustible part of the solid biofuel as well as the hydrogen present in the sample as moisture (total hydrogen content). Before calculation to any other basis the determined hydrogen content, H_{ad} , shall be corrected of the moisture bound hydrogen by calculation to dry basis, H_d :

$$H_d = (H_{ad} - M_{ad} / 8.937) \times \frac{100}{(100 - M_{ad})} \quad (1)$$

This hydrogen content, related to the combustible part of the solid biofuel, may be converted to any other basis using the formulas in Table 1.

5.2.2 Oxygen

The oxygen content related to the combustible part of the solid biofuel can be calculated by difference on the dry basis using the formula:

$$O_d = 100 - C_d - H_d - N_d - S_d - Cl_d - A_d \quad (2)$$

NOTE If high precision is required, the values of S_d and Cl_d should be corrected for eventual remaining contents of sulphur and chlorine in the ash (A_d).

5.2.3 Net calorific value

The net calorific value at constant pressure reported on the as received basis ($q_{p,net,ar}$) includes a correction for the heat of vaporization for the actual water content:

$$q_{p,net,ar} = q_{p,net,d} \times \frac{100 - M}{100} - 24,43 \times M_{ar} \quad (3)$$

The conversion to dry basis can be calculated using the following formula:

$$q_{p,net,d} = (q_{p,net,ar} + 24,43 \times M_{ar}) \times \frac{100}{100 - M_{ar}} \quad (4)$$

Conversion to any other moisture basis (M) can be calculated using formula (5):

$$q_{p,\text{net},m} = q_{p,\text{net},d} \times \frac{100 - M}{100} - 24,43 \times M \quad (5)$$

where

on the dry basis, $M = 0$; on the air-dry basis, $M = M_{\text{ad}}$; and on the as received (as sampled, as received or as fired) basis $M = M_{\text{ar}}$

Conversion of $q_{p,\text{net},d}$ to dry, and ash-free basis can be calculated using the formulae in Table 1:

$$q_{p,\text{net},\text{daf}} = q_{p,\text{net},d} \times \frac{100}{100 - A_d} \quad (6)$$

or vice versa dry, and ash-free to dry basis:

$$q_{p,\text{net},d} = q_{p,\text{net},\text{daf}} \times \frac{100 - A_d}{100}$$

5.3 General formulae for the calculation to other bases

After applying eventual corrections according to 5.2, analytical values on a particular basis may be converted to any other basis by multiplying it by the appropriate formula given in Table 1, after insertion of the numerical values for the symbols.

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