SLOVENSKI STANDARD
SIST EN 16785-1:2016

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Bioizdelki - Biodelež - 1. del: Ugotavljanje biodeleža v izdelkih z radiooglјično analizo in elementno analizo

Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis

Biobasierte Produkte - Biobasierter Gehalt - Teil 1: Bestimmung des biobasierten Gehalts unter Verwendung der Radiokarbon- und Elementaranalyse

Produits biosourcés - Teneur biosourcée - Partie 1: Détermination de la teneur biosourcée par une analyse au radiocarbone et une analyse élémentaire

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Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 16785-1:2015) has been prepared by Technical Committee CEN/TC 411 “Bio-based products”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

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.

EN 16785 consists of the following parts:

— EN 16785-1, *Bio-based products — Bio-based content — Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis (the present document)*

— EN 16785-2, *Bio-based products — Bio-based content — Part 2: Determination of the bio-based content using the material balance method*

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

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Bio-based products from forestry and agriculture have a long history of application, such as paper, board and various chemicals and materials. The last decades have seen the emergence of new bio-based products in the market. Some of the reasons for the increased interest lie in the bio-based products' benefits in relation to the depletion of fossil resources and climate change. Bio-based products may also provide additional product functionalities. This has triggered a wave of innovation with the development of knowledge and technologies allowing new transformation processes and product development.

Acknowledging the need for common standards for bio-based products, the European Commission issued Mandate M/492 [1)], resulting in a series of standards developed by CEN/TC 411, with a focus on bio-based products other than food, feed and biomass for energy applications.

The standards of CEN/TC 411 "Bio-based products" provide a common basis on the following aspects:

— Common terminology;

— Bio-based content determination;

— Life Cycle Assessment (LCA);

— Sustainability aspects;

— Declaration tools.

It is important to understand what the term bio-based product covers and how it is being used. The term 'bio-based' means 'derived from biomass'. Bio-based products (bottles, insulation materials, wood and wood products, paper solvents, chemical intermediates, composite materials, etc.) are products which are wholly or partly derived from biomass. It is essential to characterize the amount of biomass contained in the product by, for instance, its bio-based content or bio-based carbon content.

The bio-based content of a product does not provide information on its environmental impact or sustainability, which may be assessed through LCA and sustainability criteria. In addition, transparent and unambiguous communication within bio-based value chains is facilitated by a harmonized framework for certification and declaration.

The purpose of this European Standard is to provide a method of determining the bio-based content of solid, liquid and gaseous products using the radiocarbon analysis and elemental analysis.

Element carbon, C, has an isotope, ^{14}C, which allows for a clear distinction between carbon based substances in present living organisms and carbon based substances from fossil sources. Due to its radioactive decay, it is almost absent from fossil products older than 20 000 years to 30 000 years. Consequently, if the ^{14}C is present in chemicals, then it originates from recent atmospheric CO_2.The ^{14}C content may thus be considered as a tracer of chemicals recently synthesized from atmospheric CO_2 particularly of recently produced products, and it is used in CEN/TS 16640 for determining the bio-based carbon content.

The applied approach for carbon to determine the bio-based content of a sample based on isotopic measurements, cannot be used for other elements, such as oxygen, nitrogen or hydrogen.

However the content of each element can be determined by an elemental analysis which leads to the total content of each element. It does not differentiate the element according to its origin from bio-

1) A mandate is a standardization task embedded in European trade laws. Mandate M/492 is addressed to the European Standardization bodies, CEN, CENELEC and ETSI, for the development of horizontal European Standards for bio-based products.

based resources or fossil resources. Therefore, the combination of the ^{14}C content determination and an elemental analysis does not give the bio-based content of a sample. To circumvent this difficulty, the method as given in this European Standard is proposed consisting in a statement from the manufacturer, whose values have to be validated by the combined results of the radiocarbon and the elemental analysis.

1 Scope

This part of EN 16785 specifies a method of determining the bio-based content in products, based on the radiocarbon analysis and elemental analysis.

As a direct analytical determination is not feasible, this method consists in requiring from the producer or his representative some data given in a statement, and comparing these data with the results of the radiocarbon and elemental analysis.

This European Standard is applicable to any solid, liquid and gaseous product containing carbon, provided that a statement is available about the elemental composition and the bio-based content of the product(s).

This method is not needed for the determination of the bio-based content in natural products wholly derived from biomass.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16575:2014, *Bio-based products —Vocabulary*

CEN/TS 16640:2014, *Bio-based products — Determination of the bio based carbon content of products using the radiocarbon method*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16575:2014 and CEN/TS 16640:2014 apply.

4 Symbols and abbreviations

4.1 Symbols

^{14}C	carbon isotope with an atomic mass of 14
C	symbol for element carbon
H	symbol for element hydrogen
N	symbol for element nitrogen
O	symbol for element oxygen
m_B	bio-based content, expressed as a percentage of the total mass of sample
x_B	bio-based carbon content, expressed as a percentage of the total mass of the sample
x^{TC}	total carbon content, expressed as a percentage of the total mass of the sample
x^{TH}	total hydrogen content, expressed as a percentage of the total mass of the sample
x^{TN}	total nitrogen content, expressed as a percentage of the total mass of the sample
x^{TO}	total oxygen content, expressed as a percentage of the total mass of the sample
W	mass of a sample, expressed in grams

4.2 Abbreviations

CL confidence level

TC total carbon

TH total hydrogen

TN total nitrogen

TO total oxygen

5 Principle

5.1 Product groups

For the purpose of this European Standard, two groups of products are distinguished depending on whether they are obtained by chemical synthesis (Group I) or without chemical synthesis (Group II).

Group I products are obtained by chemical or biological reaction(s).

Group II products are obtained by mixing Group I products without chemical or biological reaction.

Natural products (5.4) can be used to produce Group I products or as constituent(s) of Group II products.

5.2 Group I products

This method, supported by rules described in Clause 6, consists in:

a) the determination of the bio-based carbon content and elemental composition of the product by using the radiocarbon analysis and elemental analysis respectively (7.3), and

b) the comparison between:

   1) the data of the statement (7.1) comprising the composition and the origin (bio-based and/or fossil resources) of the product, and

   2) the data resulting from the radiocarbon analysis and elemental analysis of the product (7.3).

5.3 Group II products

This method consists in:

a) the determination of the bio-based carbon content of the product by using the radiocarbon analysis (8.3), and

b) the comparison between:

   1) the data of the statement (8.1) comprising the composition and the origin (bio-based and/or fossil resources) of the product, and

   2) the data resulting from the radiocarbon analysis of the product (8.3).

NOTE The “statement” in the sense of this document is not to be confused with the “declaration” of the bio-based content resulting of this method.

5.4 Natural products

It is not needed to apply this method for the determination of the bio-based content in natural products wholly derived from biomass [e.g. wood (including pulp), flax, hemp, bamboo, sisal, coconut, rice].

The bio-based content of a natural product/constituent of a product is equal to 100 %.

The bio-based carbon content of a natural product/constituent of a product, expressed as a percentage of the total carbon content is equal to 100 %.

6 Rules for allocation of elements

NOTE 1 According to the current state of the art, it is not possible by isotopic measurements to establish a distinction between elements originating from biomass and elements originating from non-biomass, for elements such as oxygen, hydrogen or nitrogen.

For a product/constituent of a product obtained by chemical synthesis (Group I), the following rule shall be applied:

a) if the reactants are exclusively derived from biomass, the bio-based content of the product/constituent of the product is 100 %;

b) if none of the reactants is derived from biomass, the bio-based content of the product/constituent of the product is 0 %, and

c) if the reactants are derived from both biomass and non-biomass, the following convention applies:

If oxygen (O) and/or hydrogen (H) and/or nitrogen (N) element(s) is(are) bound to a carbon structure derived from biomass, its(their) fraction is(are) considered to be part(s) of the bio-based content.

NOTE 2 Element(s) other than C, H, O and N elements are not considered in this European Standard.

7 Group I products

7.1 Statement

The statement to be provided with the product as an input for the determination of its bio-based content shall include:

a) information related to the relevant chemical reaction(s) and the raw materials/chemicals from which the product is made;

b) a complete elemental composition of the product (x^{TC}_1, x^{TH}_1, x^{TO}_1 and x^{TN}_1), and

c) the bio-based carbon content (x_{B1}), and bio-based content (m_{B1}), of the product, obtained by calculation, following the rules defined in Clause 6.

For products which contain water, the bio-based content (m_{B1}) is expressed by mass of dry matter.

EXAMPLE Bio-ethyl acetate obtained by esterification between bio-ethanol from fermentation of sugar and acetic acid from fossil resources. See Table 1.

Table 1 — Example of calculation for bio-ethyl acetate

Fraction	C %	H %	O %	Total %
Fossil fraction (from acetic acid)	27,3	3,4	18,2	48,9
Bio-based fraction (from ethanol)	27,2	5,7	18,2	51,1
Total	54,5	9,1	36,4	100,0
x^{TC}_{1} = 54,5 % x^{TH}_{1} = 9,1 % x^{TO}_{1} = 36,4 %		x_{B1} = 27,2 % m_{B1} = 51,1 %		

7.2 Sampling

The samples shall be representative of the product under consideration.

If available, product sampling procedures for the determination of the bio-based carbon content and elemental composition shall be used and the details shall be documented.

A list of suitable standardized sampling methods is given in Annex A.

7.3 Determination of the bio-based carbon content and elemental composition

7.3.1 Procedure

Determine the bio-based carbon content of the sample according to CEN/TS 16640.

Express the bio-based carbon content (x_{B2}), as a percentage of the total mass of the sample.

Determine the contents of total carbon (x^{TC}_{2}), hydrogen (x^{TH}_{2}), oxygen (x^{TO}_{2}) and/or nitrogen (x^{TN}_{2}) of the sample according to suitable standard analytical methods. If other element(s) is(are) present, its(their) content(s) may be also determined.

For determining the total carbon content, test methods as described in ISO 10694 [1], ISO 8245 [2], EN 13137 [3], EN 16449 [4], ISO 17247 [5], ISO 15350 [6], ISO 609 [7], ASTM D5291-02 [8] or ASTM E1019-11 [9] may be used, as applicable.

The oxygen content shall be obtained by analysis and not by calculation [i.e. by subtraction of the C, H and N contents from the total content (100 %)].

Express the contents of total carbon (x^{TC}_{2}), hydrogen (x^{TH}_{2}), oxygen (x^{TO}_{2}) and/or nitrogen (x^{TN}_{2}) as percentages of the total mass of the sample.

For the validation (7.4), use the test results expressed by mass of dry matter.

7.3.2 Variability of test results

The results obtained by the analytical methods can differ from the stated values for the following reasons:

a) the composition of the product can present variability due to its natural origin;

EXAMPLE Natural fatty acids used in the production of fatty acid esters.

b) the production process can be, to a certain extent, a cause of variability of the composition of the final product, and