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English Version

Bio-based products - Overview of methods to determine the bio-based content

Produits biosourcés - Vue d'ensemble des méthodes pour déterminer la teneur biosourcée

Biobasierte Produkte - Überblick über verfügbare und mögliche Methoden und Techniken zur Bestimmung des gesamten biobasierten Gehaltes von Produkten

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Ref. No. CEN/TR 16721:2014 E

Contents

Page

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Foreword

This document (CEN/TR 16721:2014) has been prepared by Technical Committee CEN/TC 411 “Bio-based products”, the secretariat of which is held by NEN.

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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, et cetera.) 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 Technical Report is provide an overview of methods for the determination of the bio-based content of solid, liquid and gaseous products.

The ability to determine the bio-based content of a product is an obvious prerequisite for developing the market for bio-based products. Currently, the bio-based content is usually derived from the determination of the bio-based carbon content by means of ^{14}C measurement (as described in ASTM D6866-12 [1]).This methodology is used because ^{14}C is measurable.

However, results based on the ^{14}C methodology are expressed as a fraction of bio-based carbon on the total (organic) carbon content of the sample. In some cases the bio-based content of a product can differ substantially from the bio-based carbon content. For example, for products in which a fraction of the raw materials has been replaced by bio-based materials/constituents containing other elements such as oxygen, nitrogen or hydrogen (e.g. carbohydrate-based products), the bio-based carbon content may be substantially lower than the fraction of the product that is derived from biomass. This Technical Report describes three different methodologies to determine the bio-based content in a product and proposes the development of standards.

It should be noted that the quantification of the bio-based content is not a measure of sustainability of a bio-based product.

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

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1 Scope

This Technical Report gives an overview of methods which can be used for the determination of the bio-based content of solid, liquid and gaseous products. It describes more specifically:

a) a method using the radiocarbon analysis and elemental analysis: this method is based on a statement and a verification of the composition of the products;

b) methods based on measurement of stable isotopic ratio; and

c) a method based on the material balance.

This Technical Report gives guidance on the applicability of the different methods.

This Technical Report also gives recommendations for the further development of European Standards for the determination of the bio-based content.

2 Terms and definitions

For the purposes of this document, the terms and definitions given in FprEN 16575:2014 [2] and the following apply.

2.1
formulated product
product obtained by mixing of different constituents

2.2
material balance
comparison of physical quantities of inputs, outputs and inventory changes in a quantity centre over a specified time period

[SOURCE: ISO 14051:2011, 3.1]

3 Method using the radiocarbon analysis and elemental analysis

3.1 Background

Element carbon, C, has an isotope, ^{14}C, which allows for a clear distinction between carbon based substances derived from biomass and carbon based substances from fossil sources. The ^{14}C present in chemicals originates from recent atmospheric CO_2. Due to its radioactive decay, it is almost absent from fossil products older than 20 000 years to 30 000 years. The ^{14}C content may thus be considered as a tracer of chemicals recently synthesized from atmospheric CO_2 and particularly of recently produced products.

The approach based on isotopic measurements to determine the bio-based content of a sample can be used for carbon but not 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, but does not differentiate the elements according to their origin from bio-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 3.2 is proposed.

NOTE The bio-based content of a product can be derived from the bio-based carbon content if the composition of the biomass used is unchanged. Even for derivatives the bio-based carbon content can be used if the chemistry behind the conversion is well known and constant.

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