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Plastics - Bio-based polymers, plastics, and plastics products - Terminology, characteristics and communication

## EESTI STANDARDI EESSÕNA

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ICS 83.080.01

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English Version

## Plastics - Bio-based polymers, plastics, and plastics products - Terminology, characteristics and communication

Plastiques - Polymères, plastiques et produits en plastique biosourcés - Terminologie, caractéristiques et communication

Kunststoffe - Biobasierte Polymere, Kunststoffe und Kunststoffprodukte - Begriffe, Merkmale und Kommunikation

This European Standard was approved by CEN on 21 January 2019.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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<b>Contents</b>	<b>Page</b>
<b>European foreword</b> .....	<b>3</b>
<b>Introduction</b> .....	<b>4</b>
<b>1 Scope</b> .....	<b>6</b>
<b>2 Normative references</b> .....	<b>6</b>
<b>3 Terms and definitions</b> .....	<b>7</b>
<b>4 Bio-based content and bio-based carbon content determination</b> .....	<b>9</b>
4.1 General .....	9
4.2 Bio-based carbon content .....	9
4.3 Bio-based content .....	9
<b>5 Sustainability aspects</b> .....	<b>9</b>
<b>6 Life Cycle Assessment (LCA)</b> .....	<b>9</b>
<b>7 Declaration tools</b> .....	<b>10</b>
7.1 General .....	10
7.2 Business to business communication .....	10
7.3 Business to consumer communication .....	10
<b>Annex A (informative) Example Data Sheets for the declaration of the characteristics of a bio-based plastic and a bio-based plastics product</b> .....	<b>11</b>
<b>Annex B (informative) Examples of different ways to display information on bio-based plastics products</b> .....	<b>15</b>
<b>Bibliography</b> .....	<b>17</b>

## European foreword

This document (EN 17228:2019) has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by NBN.

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 2019, and conflicting national standards shall be withdrawn at the latest by September 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TR 15932:2010, CEN/TS 16137:2011, CEN/TS 16295:2012, CEN/TS 16398:2012.

This document has been prepared in agreement with the EC Mandate M/430 ("Mandate addressed to CEN for the development of European Standards and CEN workshop agreements for bio-polymers and bio-lubricants in relation to bio-based product aspects"). The mandate M/430 requested the preparation of interim outputs for biopolymers. The interim outputs were: CEN/TS 16137:2011, CEN/TS 16295:2012, CEN/TS 16398:2012, and CEN/TR 15932:2010. The mandate also requested to develop as final output and on the same basis a European Standard for biopolymers. This document represents the final output and will supersede the interim outputs taking into account the standards developed in the meantime by the Technical Committee CEN/TC 411 "Bio-based products".

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

Acknowledging the need for common standards for bioplastics, the European Commission issued mandate M/430 (Mandate Addressed to CEN for the Development of European Standards and CEN Workshop Agreements for Bio-Polymers and Bio-Lubricants in Relation to Bio-Based Product Aspects), resulting in a series of technical specifications developed by CEN/TC 249 on bioplastics. Subsequently the European Commission issued mandate M/492 (Mandate Addressed to CEN, CENELEC and ETSI for the Development of Horizontal European Standards and Other Standardization Deliverables for Bio-Based Products), 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. These standards are horizontal, i.e. they cover all the possible products and sectors and provide a common basis to be implemented in each specific product category.

This European Standard applies the approach developed by CEN/TC 411 for the bio-based plastics considering the main aspects identified by CEN/TC 411 i.e.:

- common terminology;
- bio-based content and bio-based carbon content determination;
- Life Cycle Assessment (LCA);
- sustainability aspects;
- declaration tools.

The terms “biopolymers” and “bioplastics” are commonly used to identify polymers and plastics that are either bio-based, biodegradable, or feature both properties. While these definitions are quite widespread and used by industry, it is recognized that they are susceptible to misunderstanding and thus inappropriate for standardization purposes.

When associated with plastics, the prefix “bio” can be perceived by consumers as an indication of biodegradability or of full natural origin. However, polymers and plastics derived from biomass can be either biodegradable or non-biodegradable. Biodegradability is linked to the structure of the polymer chain; it does not depend on the origin of the raw materials. The process of biodegradation depends on material, on its form (e.g. thickness, shape), and on environmental conditions (e.g. temperature, inoculum, humidity).

In the market today there are different fossil based plastics which are biodegradable according to the relevant standards and there are also plastics which are made from biomass and are highly resistant to biodegradation. One historically relevant example is polycaprolactone (PCL) which is industrially prepared starting from cyclohexanone, a typical petrochemical. The biodegradability of PCL in several environments has been well known since the 1970s. On the other hand, there are different bio-based materials in the market which are not biodegradable according to the relevant standards. For example: polyethylene, can be produced from substances derived from biomass (e.g. sugar cane) but still is recalcitrant to biodegradation.

This is cause of concern as it can be the source of misleading information and confusion across the supply chain and especially for the final consumers. Therefore, when referring to the origin of the feedstock it is essential to use the correct and precise terminology: bio-based polymer/plastics/plastics product instead of biopolymer/bioplastics/bioplastics product.

Polymers derived from biomass have to be distinguished into two groups.

The first group included polymers, which have been synthesized by living organisms (plants, algae, microorganisms) and have been extracted and purified. The initial chemical structure is used (e.g.

thermoplastic starch, polyhydroxyalkanoate) or is slightly modified to obtain specific functionalities (e.g. cellulose acetates).

The second group consists of materials where the chemical structure of the biomass feedstock is not maintained. For example, materials like starch or cellulose are hydrolysed and the generated monomeric sugars are used to produce building blocks (usually by fermentation processes), which can then be polymerised. Examples are lactic acid (to produce poly(lactic acid)) or bio-based succinic acid (used for poly(butylene succinate)). It is also possible to use low-molecular biomass feedstock such as sucrose (for bioethanol and subsequent bio-based polyethylene) or ricinoleic acid from castor oil (for bio-based polyamides). These polymers are bio-based, because the original feedstock comes from agriculture, but they are non-natural polymers, i.e. they are not extracted from a plant or a bacterium, but synthesized using (bio)chemical processes.

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## 1 Scope

This document specifies the vocabulary, methods for characterization, and templates for reporting about bio-based polymers, plastics, and plastics products (including semi-finished plastics products and composites).

In particular this document covers: terminology, bio-based content, bio-based carbon content, Life Cycle Assessment, sustainability aspects, and declaration tools.

Biocompatible polymers and plastics for medical applications covered by specific provisions are out of the scope of this document.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16575, *Bio-based products — Vocabulary*

EN 16640:2017, *Bio-based products — Bio-based carbon content — Determination of the bio-based carbon content using the radiocarbon method*

EN 16785-1:2015, *Bio-based products — Bio-based content — Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis*

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

EN 16848, *Bio-based products — Requirements for Business to Business communication of characteristics using a Data Sheet*

EN 16935, *Bio-based products — Requirements for Business-to-Consumer communication and claims*

EN ISO 14020, *Environmental labels and declarations — General principles (ISO 14020)*

ISO 16620-2:2015, *Plastics — Biobased content — Part 2: Determination of biobased carbon content*

ISO 16620-4, *Plastics — Biobased content — Part 4: Determination of biobased mass content*