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Plastics — Biobased content —

Part 1: General principles

Plastiques — Teneur biosourcée —

Partie 1: Principes généraux

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

ISO 16620 consists of the following parts, under the general title *Plastics — Biobased content*:

— *Part 1: General principles*

— *Part 2: Determination of biobased carbon content*

— *Part 3: Determination of biobased synthetic polymer content*

The following parts are under preparation:

— *Part 4: Determination of the biobased mass content*

— *Part 5: Declaration of biobased carbon content, biobased synthetic polymer content and biobased mass content*

Introduction

Increased use of biomass resources for manufacturing plastic products is effective in reducing global warming and the depletion of fossil resources.

Current plastic products are composed of biobased synthetic polymers, fossil-based synthetic polymers, natural polymers, and additives that can include biobased materials.

Biobased plastics refer to plastics that contain materials, wholly or partly of biogenic origin.

In this series of International Standards, the biobased content of biobased plastics refers to the amount of the biobased carbon content, the amount of the biobased synthetic polymer content, or the amount of the biobased mass content only.

Plastics — Biobased content —

Part 1: General principles

1 Scope

This part of ISO 16620 specifies the general principles and the calculation methods for determining the amount of biobased content in plastic products. These calculation methods are based on the carbon mass or mass of each constituent present in the plastic products.

This part of ISO 16620 is applicable to plastic products and plastic materials, polymer resins, monomers, or additives, which are made from biobased or fossil-based constituents.

Knowing the biobased content of plastic products is useful when evaluating their environmental impact.

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.

ISO 472, *Plastics — Vocabulary*

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

ISO 16620-3, *Plastics — Biobased content — Part 3: Determination of biobased synthetic polymer content*

ISO 16620-4[1)], *Plastics — Biobased content — Part 4: Determination of the biobased mass content*

3 Terms, definitions, and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

3.1.1
biobased carbon content
amount of carbon derived from biomass present in the product

Note 1 to entry: The biobased carbon content is expressed by a fraction of sample mass, as a fraction of the total carbon content, or as a fraction of the total organic carbon content.

3.1.2
biomass
material of biological origin excluding material embedded in geological formations and/or fossilised

3.1.3
synthetic polymer
polymer obtained through chemical and/or biological industrial processes

1) To be published.

3.1.4
biobased synthetic polymer
polymer obtained through chemical and/or biological industrial process(es), wholly or partly from biomass resources

Note 1 to entry: Natural polymers are not classified as biobased synthetic polymers [see 3.1.7].

3.1.5
biobased synthetic polymer content
m_{BSP}
amount of biobased synthetic polymer present in the product

Note 1 to entry: The amount of biobased synthetic polymer in the product is expressed as a fraction or percent of the mass of biobased synthetic polymer to the total mass of the product.

3.1.6
carbon content
amount of carbon in the constituent, material, or product as a percent of the weight (mass)

3.1.7
natural polymer
polymer obtained from biomass, in which the polymer retains the original chemical structure and composition present in biomass

EXAMPLE Starch, cellulose, lignin, or lignocellulose.

3.1.8
product
resins, material, or objects/articles resulting from a production process

Note 1 to entry: Product can be a material, semi-finished, or final product, for example, polyethylene resin derived from petroleum or biomass, bioPE film, PET resins, PET bottles, monomers, plasticisers.

3.1.9
total carbon
TC
quantity of carbon present in a sample in the form of organic, inorganic, and elemental carbon

3.1.10
total organic carbon
TOC
quantity of carbon that is converted into carbon dioxide by combustion and which is not liberated as carbon dioxide by acid treatment

3.1.11
biobased mass content
m_B
total amount of biobased synthetic polymer, natural polymer, and biobased additives in a product

Note 1 to entry: The total biobased mass content in a product is expressed as a fraction or percentage of the sum of the biobased synthetic polymer, natural polymer, and biobased additives to the total mass of the product.

3.2 Symbols

x_B^{TC} biobased carbon content by total carbon content, expressed as a percentage of the total carbon content

x_B^{TOC} biobased carbon content by total organic carbon content, expressed as a percentage of the total organic carbon content

M_x mass of carbon of constituent *x*

W_x mass of constituent *x*

4 Principle

A plastic product is typically composed of the following six constituents, as shown in Figure 1 a):

a) synthetic polymer(s) composed of biobased synthetic polymer(s) (constituent A) and fossil-based synthetic polymer(s) (constituent B);

b) natural polymer(s) (constituent C);

c) additive(s) composed of biobased organic and/or inorganic additive(s) (constituent D), fossil-based organic additive(s) (constituent E), and inorganic additive(s) (constituent F).

For the purposes of ISO 16620, additives also include fillers.

The biobased content of plastic products can be divided as follows:

1) Biobased carbon content [see Figure 1 b1) and b2) and 5.1 for the calculation method]. Part 2 — Biobased carbon content can be reported as the ratio of biobased carbon to total organic carbon x_B^{TOC} or ratio of biobased carbon to total carbon x_B^{TC} on a mass basis expressed as a percentage. In plastic products, inorganic compounds such as calcium carbonate are added from a cost-performance benefit. Therefore, biobased carbon content calculations, with and without inorganic carbon, have been included. When biobased synthetic polymer and biobased additive are wholly biobased, all carbons in these constituents are biobased carbons [see Figure 1 b1), 5.1.1.1, and 5.1.2.1]. In the case that these are partly biobased, carbons in these constituents are biobased and fossil-based carbons [see Figure 1 b2), 5.1.1.2, and 5.1.2.2].

2) Biobased synthetic polymer content [see Figure 1 c1) and c2) and 5.2 for the calculation method]. Part 3 — This reporting method takes into account the mass of the constituents rather than only the carbon. The biobased synthetic polymer content is calculated as the ratio of the biobased mass in the biobased synthetic polymer to total mass of the product expressed as a percentage. The total mass of product shall also include the mass of inorganic carbon constituents. Manufacturers routinely use the mass content for production purposes and can readily calculate this value. When a biobased synthetic polymer is wholly biobased, the total mass of this constituent is biobased [see Figure 1 c1) and 5.2.1]. When this is partly biobased, part of the mass of this constituent is biobased [see Figure 1 c2) and 5.2.2].

3) Biobased mass content [see Figure 1 d1) and d2) and 5.3 for the calculation method]. Part 4 — This reporting method identifies natural polymer constituents, in addition to biobased synthetic polymer constituents and biobased additives. The biobased mass content is then the ratio of the sum of the mass of natural polymer constituent + biobased synthetic polymer + biobased additives to the total mass of the product. The total mass of the product shall also include the mass of inorganic carbon constituents present in the product. When biobased synthetic polymer and biobased additive are wholly biobased, the total mass of these constituents is biobased [see Figure 1 d1) and 5.3.1]. When these are partly biobased, parts of the mass in these are biobased [see Figure 1 d2) and 5.3.2].