

FACT SHEET

European Bioplastics

Bioplastics - Industry standards & labels

Relevant standards and labels for bio-based and biodegradable plastics

What are standards and why are they important?

Standardisation is an effort by industrial stakeholders to define generally accepted criteria and guidelines for the description of products, services, and processes. The aim is to ease competition and commercial growth by overcoming barriers that result from unclear or inconsistent specifications and communication, to introduce benchmarks for desirable quality requirements, and to prevent fraudulent market behaviour. Adherence to standards is usually voluntary, which means that it is up to individual market participants to seek compliance with a standard or not¹.

There are two different types of evaluation systems, which are both commonly called standards: On the one hand, test methods describe methodological criteria and typically lay out the procedures that need to be followed. On the other hand, there are specifications, which have a normative function and define a set of pass and fail criteria as the requirements that need to be met in order for a product or material to be compliant with the standard. While these two types are often complementary, it is the latter 'specification' type of standard that ultimately defines compliance criteria. Compliance with test methods alone cannot substantiate claims to conformity with hard-and-fast industry standards in the absence of pass/fail criteria.

While there is no comprehensive EU legislation specifically harmonising standards for environmental and product marketing claims, the European Commission as well as national governments, ministries, and independent standardisation institutes have issued a multitude of standards that can serve as a basis for evaluating claims for bioplastics² and other bio-based products.

The key standardisation bodies creating standards are ISO (International Organization for Standardization), CEN (European Committee for Standardisation) and ASTM (American Society for Testing and Materials). In addition, there are many national standardisation organisations, often mirroring the activities of the international committees. The harmonisation of standards on a supranational level, for example on the EU-level through CEN, certainly has added value insofar as standards should apply equally across participants in the same market.



¹ In the latter case, self-declaration is possible, e.g. according to the specifications in ISO 14021. On request, these claims shall be proven by means of test reports.

² Bioplastics are a broad family of materials that are either bio-based, biodegradable, or both.

Standard based labels are an easy way to clearly communicate conformity with a set of defined criteria. They are often understood – and indeed intended – to claim superiority for the labelled product over unlabelled products. An accepted standard will be used for the certification of certain properties and the according label or logo will be awarded for easy identification. This paper will introduce the existent labels alongside the corresponding standard.

Relevant standards and labels for bio-based plastics

Determination of the bio-based content

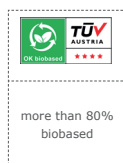
Working Group 3 of the Technical Committee (TC) 411 of CEN has developed different standards for the measurement of the renewable content of bio-based materials, including bioplastics³.

The European norm **EN 16640** „Bio-based products – Determination of the bio-based carbon content of products using the radiocarbon method“, describes how to measure the carbon isotope ¹⁴C (radiocarbon method). Depending on the measured amount of bio-based carbon, according certifications can be carried out and the corresponding label(s) can be awarded.⁴

In addition, the standard **EN 16785-1** „Bio-based products – Bio-based content – Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis“ accounts for other bio-based elements in a polymer through elemental analysis.

Part two of this standard **EN 16785-2** „Bio-based products – Bio-based content – Part 2: Determination of the bio-based content using the material balance method“, describes a material balance method to determine the renewable content of a bio-based product.

Labels referring to the bio-based content of plastics are for example DIN-Geprüft bio-based, OK bio-based (both offering different labels reflecting the product's share of bio-based content), and the new logo by Nederlandse Norm (NEN), based on EN 16785-1.



biobased %

CEN/TC 249 WG 9 developed EN 17228 “Plastics – Bio-based polymers, plastics, and plastic products - Terminology, characteristics and communication” adopting the horizontal standards of CEN/TC 411 for bio-based plastics and polymers. It includes all relevant topics regarding terminology, bio-based content, Life Cycle Assessment, sustainability, and communication. This standard was published in 2019.

Sustainability and Life Cycle Assessment (LCA)

The two standards **ISO 14040** “Environmental management - Life cycle assessment - Principles and framework” and **ISO 14044** “Environmental management - Life cycle assessment - Requirements and guidelines” describe the principles of life cycle assessment.

At European level, CEN/TC 411 Working Group 4 has developed the standard **EN 16760** “Bio-based products - Life Cycle Assessment”, which provides specific LCA requirements and guidance for bio-based products based on the ISO 14040 series.

Furthermore, standard **EN 16751** was developed to standardise sustainability criteria of bio-based products. However, it does not include any thresholds or limits and is not suitable for making claims on the sustainability of products or operations.

There is a number of certification schemes to prove the sustainability of biomass used in a product, for example ISCC PLUS, RSB (Roundtable on Sustainable Biomaterials), or REDcert. However, these schemes are not based on a standard but on the provisions of the EU Directive 2009/28/EC (Renewable Energy Directive).



Biodegradation

Biodegradation is a chemical process in which materials are metabolised into water, carbon dioxide, and biomass with the help of microorganisms. The process of biodegradation depends on the environmental conditions, which influence it (e.g. temperature, in-culum, humidity, etc.), and on the material or application itself. To claim a product's biodegradability, the ambient conditions have to be specified and a timeframe for biodegradation must be set in order to make claims measurable and comparable. This is regulated in the applicable standards.

³ Corresponding international standards have been published in the ISO 16620 series.

⁴ The US standard ASTM D6866 “Standard Test Methods for Determining the Bio-based Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis” is also based on the radiocarbon method and has been used for bio-based content certification in Europe in the past years. The certification logo based on this standard in the US is the USDA BioPreferred label.

ISO 14067 is a standard on the “Carbon Footprint of Products”, providing detailed information on how to measure and report the carbon footprint of products. Focussing on bio-based plastics products, the series **ISO 22526** “Carbon and environmental footprint of biobased plastics”, has been developed with three parts already published and one more still under development.

Relevant standards for biodegradable plastics

Standards for industrial composting and anaerobic digestion

The harmonised European standard **EN 13432** “Requirements for packaging recoverable through composting and biodegradation” requires at least 90% disintegration after twelve weeks, 90% biodegradation⁵ (CO₂ evolution) in six months, and includes tests on ecotoxicity and heavy metal content. It is the standard for biodegradable packaging designed for treatment in industrial composting facilities and anaerobic digestion.

Standard **EN 14995** describes the same requirements and tests as EN 13432, while applying not only to packaging but plastics in general. The same holds for **ISO 18606** “Packaging and the environment – Organic Recycling” and **ISO 17088** “Specifications for compostable plastics”^{6, 7}.

Labels for industrially compostable products are, for example, the Seedling logo, OK Compost industrial, and DIN-Geprüft Industrial Compostable, as well as the ‘compostabile’ logo of Consorzio Italiano Compostatori (CIC)⁸.



compostabile



Standards for home composting⁹

For several years, there has been no international standard specifying the conditions for home composting of biodegradable plastics. In 2022, CEN/TC 261 SC 4 WG 2 finalised the standard on home compostable carrier bags “Packaging - Requirements and test scheme for carrier bags suitable for treatment in well-managed home composting installations”. Additionally, there are several national standards, such as the Australian norm **AS 5810** “Biodegradable plastics – biodegradable plastics suitable for home composting”. Belgian certifier Vinçotte (now TÜV AUSTRIA Belgium) had developed the OK compost home certification scheme, requiring at least 90% degradation in 12 months at ambient temperature. Based on this scheme, the French standard **NFT 51-800** “Plastics – Specifications for plastics suitable for home composting” was developed, specifying the very same requirements for certification. Labels proving home compostability are OK compost HOME and DIN-Geprüft home compostable.



Biodegradability in soil

The certification scheme “Bio products – degradation in soil” developed by TÜV AUSTRIA Belgium (former Vinçotte) is based on EN13432/EN14995 (Standards for the industrial composting of packaging/plastics) and adapted for the degradation in soil. The test demands at least 90% biodegradation in two years at ambient temperatures.¹⁰

The standard **EN 17033** “Biodegradable mulch films for use in agriculture and horticulture – Requirements and test methods” (published in 2018) specifies the requirements for biodegradable films, manufactured from thermoplastic materials, to be used for mulching applications in agriculture and horticulture, which are not intended to be removed from the field. A degradation of at least 90% in two years at preferably 25°C is required.

The label OK biodegradable SOIL is certified by TÜV AUSTRIA Belgium in case a product meets the requirement of their certification scheme. DIN CERTCO awards DIN-Geprüft biodegradable in soil in accordance with EN17033.



Standards for oxo-degradable plastics

Oxo-degradable plastics are made of conventional plastics (e.g. PE or PP) supplemented with additives in order to mimic biodegradation. They cannot be considered as bioplastics and have failed to prove proper biodegradability in any environment. The standards that are claimed to confirm the biodegradability of such products, most notably the US standard ASTM D6954, do not provide pass/fail criteria, leaving these misleading claims wholly unsubstantiated. Recently, also the test method described in ASTM D5511 has been used increasingly to prove alleged biodegradability of oxo-degradable or similar materials.

⁵ Complete biodegradation of the plastic material has occurred when 90% or more of the original material has been converted to CO₂. The remaining share is converted into water and biomass, which no longer contains any plastic.

⁶ The US standard ASTM D6400 “Specification for Labelling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities” is the US standard with clear pass/fail criteria. The corresponding label is the BPI Compostable in Industrial Facilities.

⁷ The Australian standard AS 4736 “Biodegradable Plastics suitable for Composting and other microbial Treatment” additionally includes the so-called earthworm test. The Seedling Australia logo is certified according to this standard.

⁸ The logo of CIC is awarded foremost on national level in Italy.

⁹ Home composting should only be considered as complementary to industrial composting. The latter represents the circular type of composting, generating secondary products and raw materials such as organic fertiliser or bio-waste as feedstock for industrial products. For more information please see the EUBP Position paper „Home composting of compostable bioplastics” at www.european-bioplastics.org.

¹⁰ In the USA, the standard ASTM 5988 describes a test method for determining the aerobic biodegradation of plastic materials in soil, without giving pass/fail criteria.

Biodegradability in marine environments

Currently, there is no standard providing clear pass/fail criteria for the degradation of plastics in sea water. The US standard **ASTM D7081** “Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment” has been withdrawn in 2014 without replacement.

However, the test methods that were referred to are still in place, but do not offer any pass/fail criteria: **ASTM D6691** “Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium or Natural Sea Water Inoculum”, **ASTM D6692** “Standard Test method for Determining the Biodegradability of Radiolabelled Polymeric Plastic Materials in Seawater” and **ASTM D7473** “Standard Test Method for Weight Attrition of Plastic Materials in the Marine Environment by Open System Aquarium Incubations”. Other relevant standards are **OECD 306** “Biodegradability in sea water” and **ISO 16221** “Water quality – Guidance for determination of biodegradability in the marine environment”.

On ISO-level, standardisation efforts for the requirements for biodegradation of plastics in marine environments are well underway. **ISO 18830** and **ISO 19679**, for example, are two standards on the test methods for determining the aerobic biodegradation of non-floating plastic materials in a seawater/sediment interface, both of which have been published in 2016 and are also eligible on CEN-level. **ISO 22404** for the determination of aerobic biodegradation of non-floating materials in marine sediments has been published in 2019. The standard **ISO 22766** for the disintegration test of plastic materials in marine habitats under real field conditions has been published in 2020. **ISO 22403** includes test methods and requirements of the inherent aerobic biodegradability and environmental safety.

However, these standards are predominantly only guidelines and do not provide clear requirements for conditions and timeframes. Research and development is on-going to create harmonised standards for marine biodegradation, which are needed before relevant products can be introduced to the market. With research underway and standards and certified products likely to see the light of day in the near future, questions concerning the limitations for this technology need to be answered: In which context and for which products does this technology make sense and how can it complement a circular economy? Once these questions have been answered, sound communication and advertising rules need to be defined.

TÜV AUSTRIA Belgium has developed a certification scheme based on ASTM D7081, which demands a biodegradation of at least 90% in 6 months. The corresponding label is OK biodegradable MARINE. However, the certification scheme makes a clear distinction between the certification of the claim and the authorisation to communicate about it.



Bioplastics – Communication standards

The CEN/TC 411 Working Group 5 has developed standards for the communication of bio-based products: **EN 16848** “Bio-based products - Requirements for Business-to-Business communication of characteristics using a Data Sheet”, published in 2016, and **EN 16935** “Bio-based products - Requirements for Business-to-Consumer communication and claims”, published in 2017.

The **ISO 14020** series on “Environmental labels and declaration” is the main international guideline for “green claims”. Three different types of environmental labels and declarations are promoted in these standards. **ISO 14021** covers self-declared environmental claims, **ISO 14024** to environmental labelling, and **ISO 14025** to environmental declaration.

Also relevant in this field of standards is **ISO 14063** on “Environmental management – Environmental communication”, focussing on setting up communication procedures in companies and containing a general guidance on the basics of environmental communication. **ISO 14067** (see Sustainability and Life Cycle Assessment) also provides general guidelines on how to use carbon footprint claims correctly.

Conclusion

Bioplastics are not one single material but a large family of plastic materials, most of them very new innovative materials, with different properties and functionalities. Such grade of variety and complexity is not always easy to explain. In terms of the circular economy, these standards offer a first basis for assessing bioplastics and providing sound communication on corresponding claims - a prerequisite for successful market performance.