european bioplastics

FACT SHEET

European Bioplastics

What are bioplastics?

Material types, terminology, and labels – an introduction

Bioplastics are a large family of different materials

Bioplastics are not just one single substance, they comprise of a whole family of materials with differing properties and applications. According to European Bioplastics, a plastic material is defined as a bioplastic if it is either biobased, biodegradable, or features both properties.

Bioplastics are biobased, biodegradable, or both.

Biobased: The term 'biobased' means that the material or product is (partly) derived from biomass (plants). Biomass used for bioplastics stems from e.g. corn, sugarcane, or cellulose.

Biodegradable: Biodegradation is a chemical process during which microorganisms that are available in the environment convert materials into natural substances such as water, car bon dioxide, and compost (artificial additives are not needed). The process of biodegradation depends on the surrounding environmental conditions (e.g. location or temperature), on the material and on the application.

'Biobased' does not equal 'biodegradable'

The property of biodegradation does not depend on the resource basis of a material but is rather linked to its chemical structure. In other words, 100 percent biobased plastics may be non-biodegradable, and 100 percent fossil based plastics can biodegrade.

Benefits of bioplastics

In search of new material solutions and keeping an eye on the goal of sustainable production and consumption, bioplastics have several advantages. The use of renewable resources to produce bioplastics is the key for:

- increasing resource efficiency by the means of:
  - the resources being cultivated on an (at least) annual basis;
  - the principle of cascade use, as biomass can first be used for materials and then for energy generation;
- a reduction of the carbon footprint and GHG emissions of materials and products;
- saving fossil resources by substituting them step by step.

In short, contrary to conventional fossil-based plastics, bioplastics are (partly) biobased, biodegradable, or both.

Material types – three main groups

The family of bioplastics is divided into three main groups:

1. biobased or partly biobased, non-biodegradable plastics such as biobased PE, PP, or PET (so-called drop-ins) and biobased technical performance polymers such as PTT or TPC-ET;
2. plastics that are both biobased and biodegradable, such as PLA and PHA or PBS;
3. plastics that are based on fossil resources and are biodegradable, such as PBAT.

The potential of bioplastics will shape the future of the plastics industry.

The graph 'material coordinate system of bioplastics' below depicts common types of bioplastics and how they are classified according to their biodegradability and biobased content.

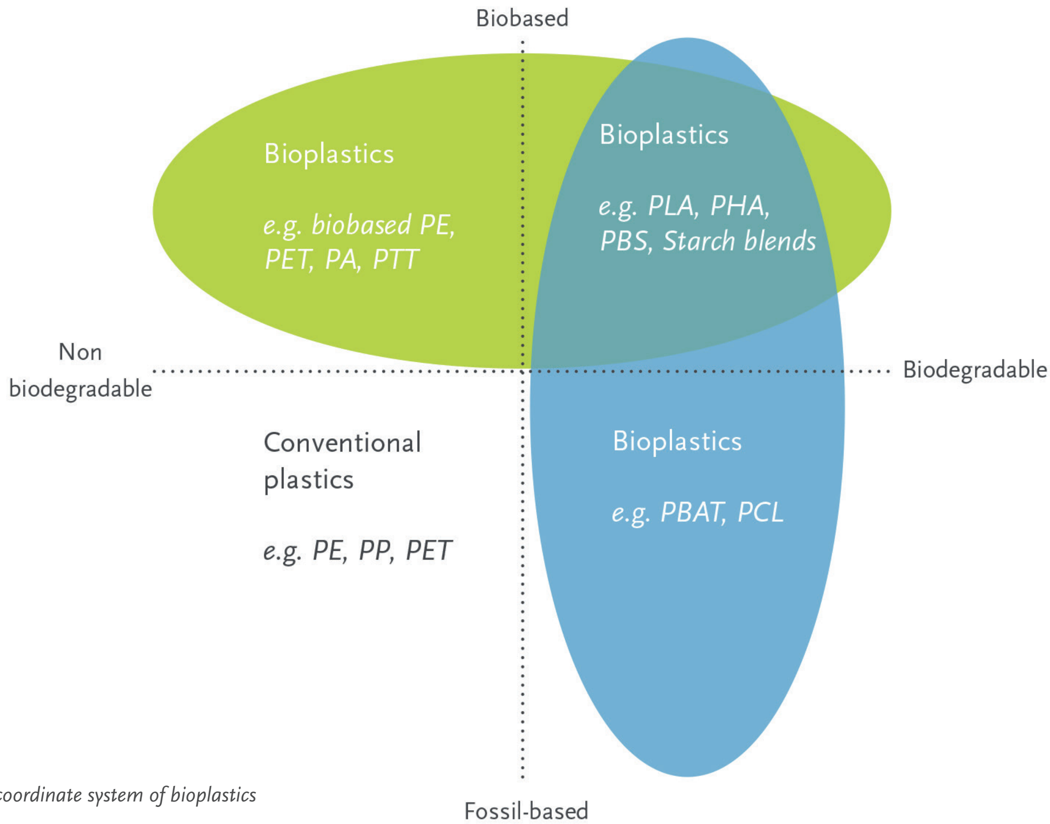
Examples of established bioplastic materials

Biobased, non-biodegradable polyolefines and PET ('drop-in' solutions)

Commodity plastics like PE, PP and PVC can also be made from renewable resources – most commonly from bioethanol. Bio-PE is already being produced on a large scale (200,000 tons p.a. by Braskem, Brazil; further projects planned by Dow Chemicals). Bio-PP and Bio-PVC are soon to follow that trend. The partially biobased polyester PET is used for both, technical applications and packaging (mainly for beverage bottles, e.g. the 'Plant bottle' by Coca-Cola). As the value-added chain only requires adaptation at the outset, while the properties of the products remain identical to their fossil versions, they are also referred to as 'drop-in' bioplastics. Accordingly, the period from development to commercialisation of these materials is considerably shorter.

Biobased, non-biodegradable technical/performance polymers

This large group comprises many specific polymers such as biobased polyamides (PA), polyesters (e.g. PTT, PBT), polyurethanes (PUR) and polyepoxides. Their use is most



Graph: Material coordinate system of bioplastics diverse. Some typical technical applications are textile fibres (seat covers, carpets), automotive applications like foams for seating, casings, cables, hoses, and covers – to name but a few. Usually, their operating life lasts several years. Therefore, they are referred to as durables, and biodegradability is not a sought-after property.

Biobased, biodegradable plastics

This group includes starch blends made of thermo-plastically modified starch and other biodegradable polymers as well as polyesters such as polylactic acid (PLA) or polyhydroxyalkanoate (PHA). Unlike cellulose materials (regenerate-cellulose or cellulose-acetate), they have been available on an industrial scale only for the past few years. So far, they have primarily been used for short-lived products such as packaging[1], yet this large innovative area of the plastics industry continues to grow due to the introduction of new biobased monomers such as succinic acid, butanediol, propane diol, or fatty acid derivatives.

Several materials in this group, primarily PLA, are striking a new path – away from biodegradation and towards end-of-life solutions such as recycling. The renewable basis of these materials is now at the focus of attention and technical development. Pilot projects aim to establish recycling processes and streams.

This dynamic development proves that bioplastics have the potential to shape the plastics industry, and to produce new innovative and competitive materials.

Biodegradable, fossil-based plastics

They are a comparatively small group and are mainly used in combination with starch or other bioplastics because they improve the application-specific performance of the latter by their biodegradability and mechanical properties. These biodegradable plastics are currently still made in petrochemical production processes. However, partially biobased versions of these materials are already being developed and will be available in the near future.

Standards, certifications, and labels

How can one measure the biobased content of bioplastics? Which standard, methodology, term, and labels should be applied? There is still a lot of confusion in the international market, because standardisation processes have proceeded at a differing pace around the globe.

Below, the status quo in Europe will be outlined and relevant independent third party labels for bioplastics are listed. However, the list does not reflect specific recommendations of European Bioplastics.

Quelle: European Bioplastics/Zabel

[1] *European Bioplastics Fact Sheet „Packaging", Download: www.european-bioplastics.org/multimedia*

Biobased

Companies with biobased bioplastics can either indicate the 'biobased carbon content' or the 'biobased mass content' of their products. As these units of measurement differ, the typical numeric percentage value will differ, too, and must be taken into account, especially when drawing comparisons.

A well-established methodology to measure the biobased carbon content in materials or products is the 14C-method (EU standard: CEN/TS 16137, corresponding US-standard: ASTM 6866). Certification schemes and derived product labels based on the European and the U.S. standard are available – for example by the Belgian certifier Vinçotte or German certifier DIN CERTCO.

A material or product can also be specified as biobased by indicating its biobased mass content. This method is complementary to the 14C-method and takes chemical elements other than the biobased carbon into account, such as oxygen, nitrogen, and hydrogen. The French Association Chimie du Végétal (ACDV) has introduced a corresponding certification scheme and the European Committee for Standardization (CEN) is currently developing a standard for this particular method.

Biodegradable

The term 'biodegradability' is only unambiguous, if environment and time are specified.

It is misleading to merely claim biodegradability without any standard specification. If a material or product is advertised to be biodegradable, further information about the timeframe, the level of biodegradation, and the required surrounding conditions should be provided, too.

Wherever possible, European Bioplastics recommends to focus on the more specific claim of compostability[2], and to back it up with corresponding standard references (ISO 17088, EN 13432 / 14995 or ASTM 6400 or 6868), a certification, and an according label (seedling label via Vinçotte or DIN CERTCO, OK compost label via Vinçotte).

If a product is specified to be compostable, the claim is not only unambiguous (i.e. to be treated in an industrial compost plant), but there is another big benefit: It differentiates itself from products marketed to be 'oxo-biodegradable' or similar claims. Products marketed as oxo-biodegradable do not fulfil the requirements of EN 13432 on industrial compostability, and are therefore not allowed to carry the seedling label.

You might also be interested in the following publications:

- Environmental Communications Guide
- Bioplastics facts and figures

http://en.european-bioplastics.org/multimedia/

[2] *Compostability in this context refers to industrial compostability according to the European Norm EN 13432. The norm defines clear requirements and conditions for industrial composting, e.g. the timeframe. After successful certification products adhering to this standard may be distinguished by the seedling.*

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January 2016