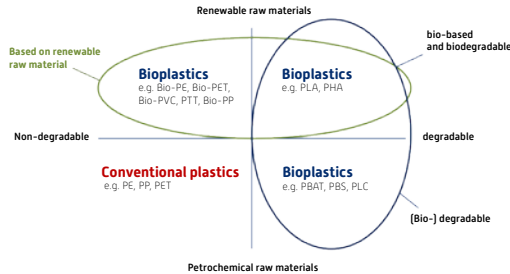


Biodegradability of bioplastics

Correct disposal depends on a number of factors



Unlike conventional plastics, many bioplastics are biodegradable. In other words, there are microorganisms such as bacteria and fungi that can absorb and metabolize these bioplastics as a source of energy. All that remains is CO₂, water, salts and biomass. That said, not every plastic is degradable under the same conditions. Some, for instance, require very high temperatures to degrade. This means that bioplastics should not simply be disposed of in the environment.

“Bioplastics” is a collective term that includes both bio-based plastics and biodegradable plastics, as well as those plastics to which both properties apply.

© Own depiction based on Endres

Biotic and abiotic factors influence the degradation of plastics

The biodegradation of plastics depends on numerous conditions. The most important aspect, apart from the chemical structure, is the immediate environment in which the plastic is located. The degradation of the same plastic in seawater at temperatures close to freezing point, for example, is different from the degradation in soil or in an industrial composting plant at approximately 60°C. In the degradation of some plastics, the cleavage of the polymer chains is predominantly carried out by enzymes of microorganisms, while in others chemical and physical factors such as oxidation or UV radiation can also be important. All factors that influence polymer degradation can accordingly be divided into biotic (living) and abiotic (non-living).

Different disposal routes are suitable for different plastics

In Germany, there are several disposal routes for products made of biodegradable plastics. The appropriate disposal route depends to a large extent on the plastic itself and is determined using certification procedures with corresponding quality seals. The requirements placed on the plastics in these procedures are specified in standards and test programs. It is therefore important to check each product individually to determine how it is

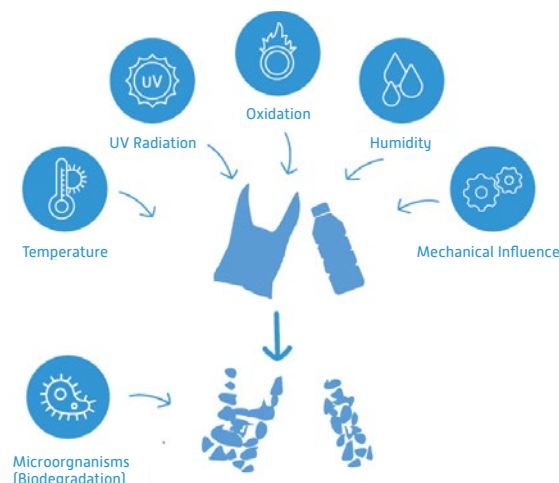
certified and how it is to be disposed of. Products made from certified biodegradable plastics can be given such quality seals, which express the environment in which the plastic is proven to degrade: for example, in industrial composting plants or in home compost. Accordingly, the plastic should also be discarded properly.

„It is not the plastics themselves that are harmful, but the way we humans handle them. Bioplastics must be disposed of properly!”

Prof. Dr. rer. nat. Marc Kreutzbruck,
University of Stuttgart

Fig. 1: Possible factors influencing the biodegradation of plastics, in addition to microorganisms, include temperature, UV radiation and moisture.

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Research on the biodegradability of plastics and optimization opportunities for the environment.

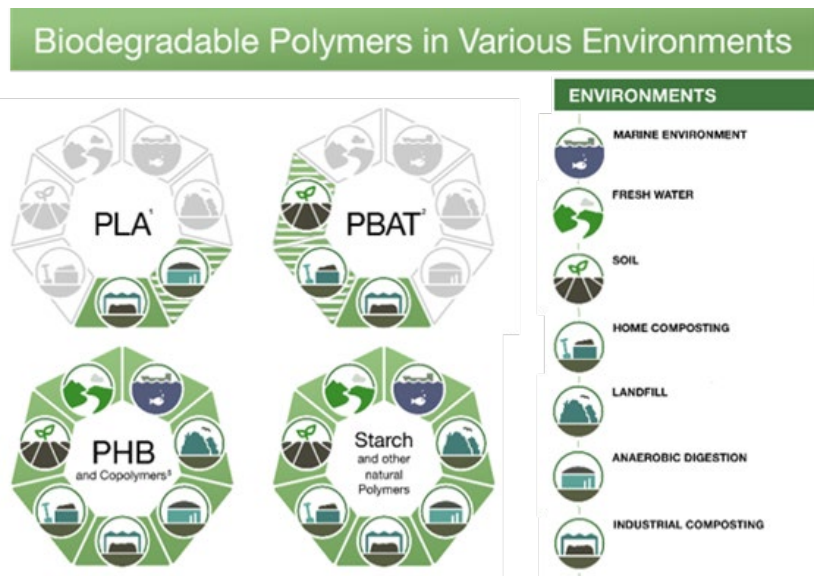
As part of the ENSURE project - „Development of New Plastics for a Clean Environment by Determining of Relevant Entry Points“ - the specific degradation processes of plastics are being investigated. The relevant degradation process-

es are recorded and evaluated under various environmental conditions. This includes studies on the effect of plastic contamination on soil meso- and microfauna as well as on the microbial degradability of plastics.

From these results, recommendations can be derived for a possible optimization of the degradability of plastics.

Fig. 3 (right): Which environments can the different biodegradable plastics degrade in?

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For complete graphic see renewable-carbon.eu/publications/product/biodegradable-polymers-in-various-environments



Some products (e.g. biowaste bags) may often not be disposed of in the organic waste garbage can despite the quality seal. This is due to the fact that many composting plants have excessively short retention times that do not comply with the standard and thus cannot guarantee complete degradation.

The market for biodegradable plastics is growing

At present, biodegradable plastics only have a very small market share (< 1%), which, however, is growing steadily (see Figure 2). Almost 50% of this is accounted for by starch blends, followed by PLA (approx. 25%), PBAT and PBS (17% and 11% respectively). PHA currently makes up less than 5% of the market share. Globally, biodegradable plastics are mainly used in the packaging industry, but also in horticulture and agriculture.

Biodegradable bioplastics 2020 vs. 2025

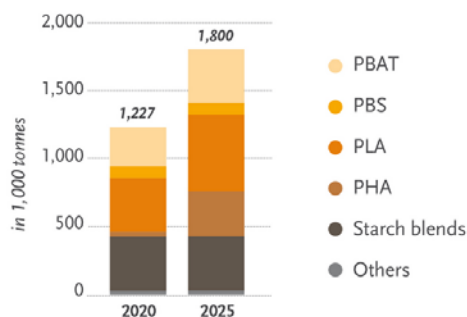


Fig. 2: Biodegradable plastics are forecast to achieve as much as 45% market growth over the next few years.

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Design
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Status
October 2021

www.bmbf-plastik.de/en [@plastik_umwelt](https://twitter.com/plastik_umwelt)

This fact sheet was prepared as part of the research focus „Plastics in the Environment“ (duration 2017-2022), funded by the German Federal Ministry of Education and Research [BMBF]. The authors are solely responsible for the contents of the fact sheet. They do not reflect the official opinion of the BMBF.

Kreutzbruck, Marc; Resch, Julia (2021): Biodegradability of bioplastics: Correct disposal depends on a number of factors. Fact sheet 8 of the BMBF research focus Plastics in the Environment.

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