Biodegradable Polymers in Various Environments

According to Established Standards & Certification Schemes

Update 2024

NOTES

- proven biodegradability
- proven biodegradability for certain grades
- biodegradability not proven

The biodegradability of plastics derived from these biodegradable polymers can only be guaranteed if all additives and (organic) fillers are biodegradable, too. Dying and finishing of cellulosic fibres, for example, may prevent their biodegradation in the environment.

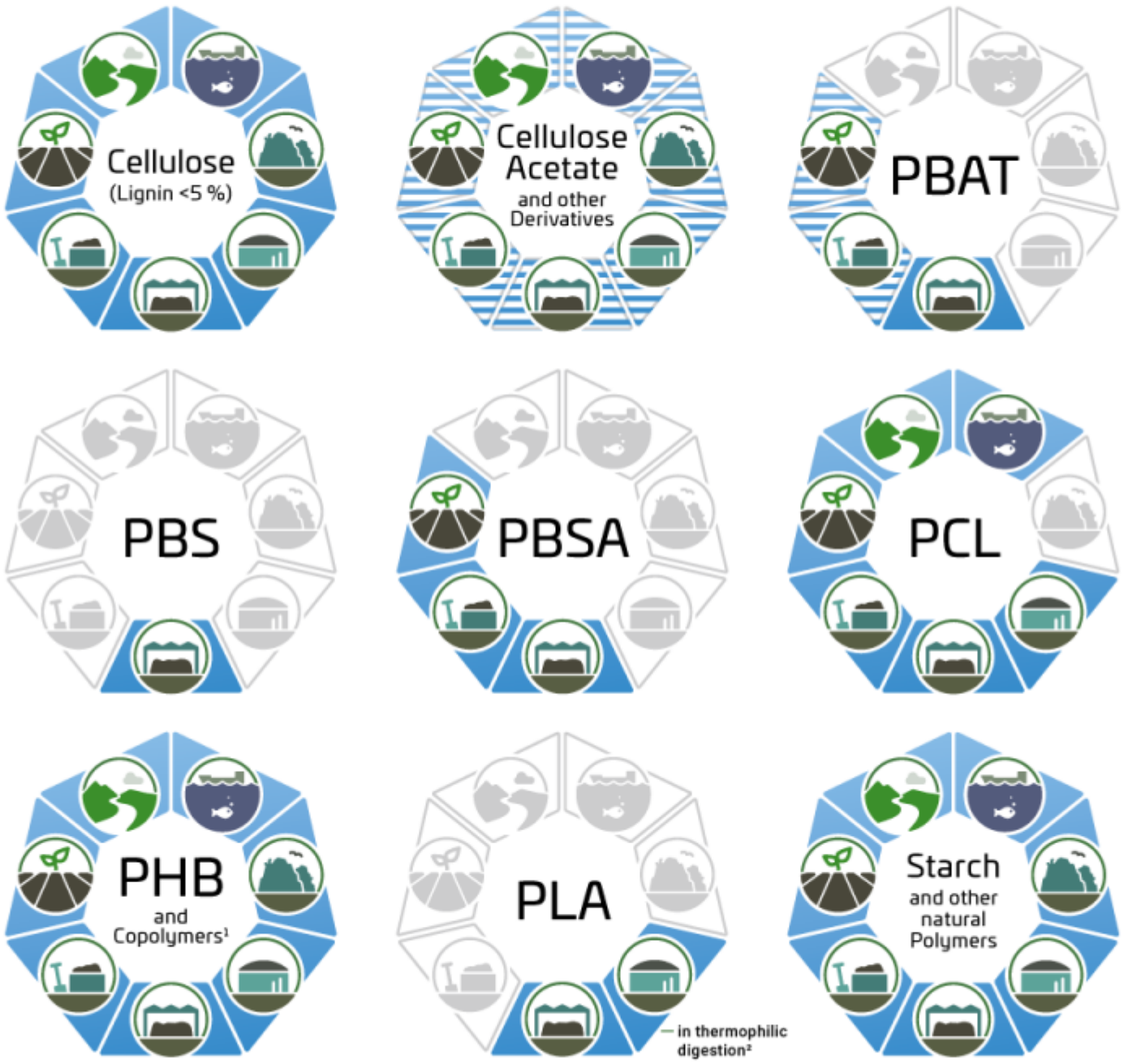
Biodegradation depends on the complex biogeochemical conditions at each testing site (e.g. temperature, available nutrients and oxygen, microbial activity, etc.). Therefore, these generalised claims about biodegradability can only serve as approximations and need to be confirmed by standardised testing under lab conditions. In-situ behaviour can vary, depending on the mentioned conditions, size of the plastic, grade of the polymer and other factors. For instance, biodegradation testing is often performed after milling, showing the inherent nature of the material to biodegrade. In reality, the same level of biodegradation will be obtained, be it possibly within a different timeframe.

SLOWER BIODEGRADING POLYMERS

The polymers shown in the poster are rapidly biodegraded in the labelled environments, within the time frame of the corresponding standards or certificates. Some biopolymers, such as PBS or PLA in soil and also lignin/wood for virtually all environments, also biodegrade, but (much) more slowly. Full biodegradation can take several years to decades to be achieved. In addition, for some applications with a use phase in a certain environment (e.g. geotextiles), too rapid biodegradation is not desired, as their function should first be given for a few years. However, for these cases no standards exist so far.

1 incl. P3HB, P4HB, P3HB4HB, P3HB3HV, P3HB3HV4HV, P3HB3Hx, P3HB3HO, P3HB3HD

2 PLA is likely to be biodegradable in thermophilic anaerobic digestion at temperatures of 52°C within the time frame mentioned in standards. This does not apply to mesophilic digestion.



ENVIRONMENTS

IMPORTANT TEST CONDITIONS, CERTIFICATION SCHEMES AND STANDARDS

For more details, refer to the original documents.

MARINE ENVIRONMENT

Temperature 30°C, 90 % biodegradation within a maximum of 6 months. Certification: TÜV AUSTRIA OK biodegradable MARINE and DIN CERTCO DINplus biodegradable in marine environment, the latter is based on ISO 22403, the standard giving requirements for marine biodegradability.

FRESH WATER

Temperature 21°C, 90 % biodegradation within a maximum of 56 days. Certification: TÜV AUSTRIA OK biodegradable WATER. Research on standards (especially on requirements) is on-going.

SOIL

Temperature 25°C, 90 % biodegradation within a maximum of 2 years. Certification: TÜV AUSTRIA OK biodegradable SOIL and DIN CERTCO DIN-Geprüft Biodegradable in Soil. DIN-Geprüft Biodegradable in Soil is based on the European standard EN 17033 dedicated to mulch films but can be used for other products as well.

HOME COMPOSTING

Temperature 28°C, 90 % biodegradation within a maximum of 12 months. Certification: TÜV AUSTRIA OK compost HOME and DIN CERTCO DIN-Geprüft Home Compostable.

LANDFILL

No European standard specifications or certification scheme available since this is not a preferred end-of-life option for biodegradable waste.

ANAEROBIC DIGESTION

Thermophilic 52°C / Mesophilic 37°C

A specific European standard or certification scheme for anaerobic digestion is not yet available. Anaerobic digestion in a biogas plant is mentioned in EN 13432 and EN 14995: 50 % biodegradation within two months, usually followed by aerobic digestion.

INDUSTRIAL COMPOSTING

Temperature 58°C, 90 % biodegradation within a maximum of 6 months. Certification: TÜV AUSTRIA OK compost INDUSTRIAL, DIN CERTCO DIN-Geprüft Industrial Compostable and both "Seedling". EN 13432 and EN 14995 are the European reference standards and the basis of these certification schemes.

RENEWABLE CARBON

More figures available at www.renewable-carbon.eu/graphics

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