GO!PHA
Oudebrugsteeg 9
1012JN Amsterdam
The Netherlands

2324 Hampton Way
NC 27587 Wake Forest
United States

E-mail: gopha@gopha.org
Website: www.gopha.org

PHA Biopolymers:
Natural, Renewable, Recyclable, Circular & Plastic Free

The problem with plastics

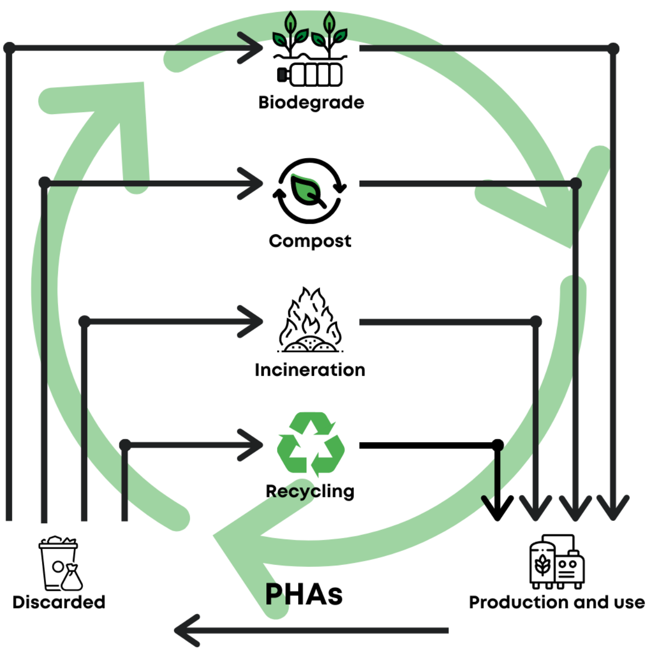
At an increasingly alarming speed, humanity is confronted with the issues that arise from the continuous development of synthetic materials based on fossil-feedstocks. Climate change, ocean-plastics pollution and fossil-based resource depletion all pose different threats to our way of existence and that of natural ecosystems.

Till 2015 more than 8.3 billion tons of plastics have been produced[1], of which approximately half was produced in the last two decades. It is estimated that more than 80% of all plastics ever produced have ended up in landfills or in our environment, contributing heavily to value destruction, and pollution.

Circular and sustainable approach with a natural biopolymer: PolyHydroxyAlkanoate[2](PHA)

PHA[2] is a versatile class of natural biopolymers and similarly to cellulose (from wood), these polymers occur in nature. Microorganisms produce a wide range of PHAs by consuming natural feedstocks, such as sugars, vegetable oils and even CO_2 and biogas, and convert these into PHAs, which have very similar functional properties to fossil-based plastics, except they are compatible with nature.

Microorganisms biosynthesize PHAs as part of the metabolism. They also consume **PHAs thus making them biodegradable. Hence PHA materials are home and industrially compostable and biodegradable in marine, freshwater and in soil.**



PHAs offer a natural solution to our need for plastic-like materials and deserve a prominent role in our future regenerative, renewable, bio-based and circular product ecosystems.

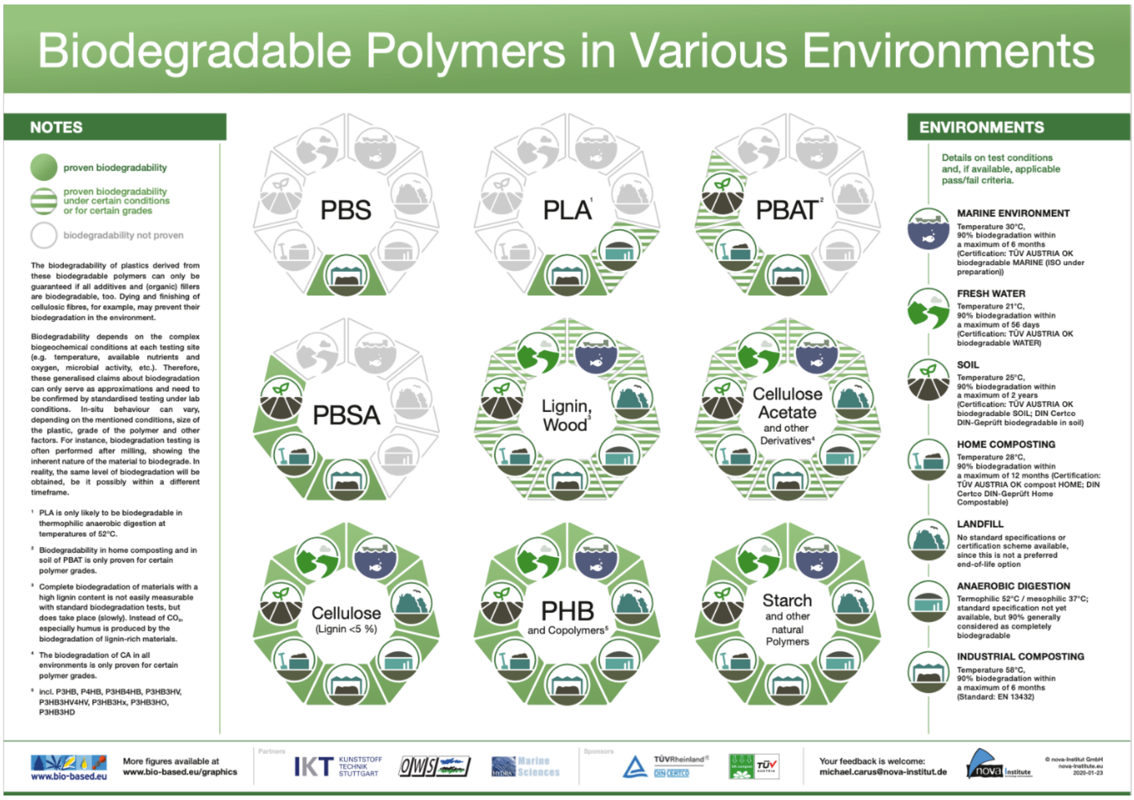
---

[1] *https://advances.sciencemag.org/content/3/7/e1700782*

[2] *PHA is a large family of materials, in this context we refer to PHB and its copolymers (P3HB, P4HB, PHBV, PHBH, P3HB4HB, P3HB3HV, P3HB3HV4HV, P3HB3Hx, P3HB3HO, P3HB3HD)*

PHAs offer maximum flexibility on all end-of-life options[4]

PHAs fit in all end-of-life ecosystems including recycling. Due to their natural occurrence, these PHA materials are also fully compatible with nature, meaning that they are home compostable and biodegradable even in marine conditions[3]. Their biodegradability in various environments is compared to other materials in the below image.



PHA production with renewable and recycled feedstocks

There are many types of bacteria that produce PHA in nature, by consuming different types of carbon-rich feedstocks. As such, PHA producing bacteria are found near carbon rich sources, such as palm trees and rice paddies.

Today, almost any carbon-rich feedstock can be used to produce PHA-materials, providing a unique opportunity to close the loop for organic and synthetic virgin and recycled feedstocks, such as: biogas from organic waste, synthetic gas from landfills and pyrolysis plants, vegetable oils, used cooking oils and even CO2.

PHA production mimics natural ecosystems

PHA production happens via fermentation, the same process to make cheese and beer. In this process the natural ecosystem is replicated and optimized for consistency, quality and safety.

In the fermentation process PHA producing bacteria consume the carbon-rich feedstock and synthesize PHA molecules biologically, this is therefore a totally different process than producing fossil-based polymers, which are chemically synthesized. These PHA molecules have exactly the same chemical structure as they appear in nature. After fermentation, the PHA materials are harvested from the bacteria, washed and purified for physical transformation into consumer products.

---

[3] *https://www.nature.com/articles/s41428-020-00396-5*

[4] *Bioplastics Magazine (03/20) Vol.15 : What about recycling of PHA-polymers?*