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PHA's: the natural materials of the future

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Polyhydroxyalkanoates or PHA's are a series of natural bio-benign materials that have appeared in nature for over 3 billion years, similar to other natural materials like wood, other cellulose based materials, proteins and starch.

PHA's were first discovered in 1888 and first isolated and characterized in 1925. In the 1960's researchers discovered that micro-organisms produce them from sugars, starches, cellulosic materials and vegetable oils and that the materials were part of the metabolism in plants, animals and humans providing energy and nutrition.

A large variety of micro-organisms (Pseudomonas Putida, Ralstona Eutropha, a.o.) make different types of PHA materials comprising more than 150 different building blocks or monomers depending on the available nutrition in their environment. However, the molecular weight of these PHA materials occurring in nature is too low to use them for applications where petroleum plastics are used.

During the last 20-30 years dozens of initiatives from all over the world have been started to make PHA materials useful for durable and structural applications as an alternative to the chemically synthesized polymers and by mimicking nature in a consistent way.

A large variety of suitable micro-organisms are being used to convert many different feedstock sources, like gas, liquid or solid waste streams. After-use value chains are being created for several waste streams this way, resulting in a contribution to the circular economy.

Today there are 9 different PHA material families, which all have different properties, so they can cover a broad range of applications for durable, structural and one-time-use articles.

PHA materials can substitute petroleum plastics for one-time-use applications that often by design or improper waste management end up in the environment (e.g. micro-beads in cosmetic products or drinking straws). Biodegradation of PHA materials in all environments (compost, soil, water) is comparable to or faster than cellulose (i.e. paper).

PHA materials can partly substitute any of the traditional fossil-based polymer families, so the accessible market for PHA materials is very large. Depending on type and grade, PHA materials can be used for injection molding, extrusion, thermoforming, foam, non-wovens, fibers, 3D- printing, paper and fertilizer coating, glues, adhesives, as additive for reinforcement or plasticization or as building block for thermosets in paints and foams. Also, their use in medical applications like sutures and wound closures is already commercial, since the material is bioresorbable. •

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Global Organization for PHA

The Global Organization for PHA is a member-driven, non-profit initiative to accelerate the development of the PHA-platform industry. Polyhydroxyalkanoate polymers (PHAs) provide a unique opportunity as a solution for reducing greenhouse gases and environmental plastics pollution, and establishing a circular economy, by offering a range of sustainable, high-quality and natural products and materials based on renewable feedstocks and offering diverse end-of-life options.
GO!PHA provides a platform for creating and sharing experiences and knowledge and to facilitate joint development initiatives.

Become a member or sponsor to start sharing, contributing and collaborating to accelerate the PHA-platform industry.

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