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Bioplastics from microalgae

Through the targeted production via microalgae as well as a tailor-made modification, the biopolymer PHB is to be enabled for processing and use in the consumer goods sector.

Biobased and biodegradable polymers such as polyhydroxybutyrate (PHB) can contribute to sustainability and resource conservation by not only being produced by bacteria, but also being completely biodegradable under difficult boundary conditions.

By using cyanobacteria (microalgae), PHB can be formed via material conversion processes as an energy store from biomass accumulated by oxygenic photosynthesis. At the University of Tübingen, a research group led by Prof. Forchhammer was able to modify these microalgae in such a way that a yield of up to 80 % of PHB and its derivatives can now be achieved. For the production process, the microalgae only require nutrients, CO_2 and light, whereby the light is introduced directly within a reactor for the first time, thus offering an advantage in scaling up production compared to typical tubular reactors. Through processing in the form of centrifugation and removal of cell debris, the PHB is finally made accessible.

Thanks to the biodegradability of PHB, closed product cycles can be created (cradle-to-cradle principle) and thus special ecological requirements can be met. This property is very helpful for products that inevitably end up in the environment, as in agriculture, for example. The application of PHB in the form of nonwovens can also increase the microbial attack potential as a result of the increased surface area. Due to their permeability,

nonwovens can be used in particular for products such as plant pots, but also for filters and some packaging.

Fig. 1: 3D-molded PHB nonwoven from a meltblown process in use as a flower pot.

Despite these advantages, biopolymers such as PHB are rarely suitable for industrial applications in their pure form. This is where the joint research project of the Institute of Polymer Technology, the German Institutes for Fiber and Textile Research and the company novis GmbH comes in. The aim is to create novel and cost-effective production conditions for PHB using genetically modified microalgae.

Furthermore, the produced PHB is to be processed into a processable bioplastic by the IKT and afterwards into three-dimensional prototypes for the first time by the DITF using the meltblown process.

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http://www.ikt.uni-stuttgart.de, http://www.uni-stuttgart.de, https://www.novis.me and https://www.ditf.de

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