

CircuPHApp - Application focused design of circular PHA materials and production processes

Publieke samenvatting / Public summary

Aanleiding

This project aids the transition from fossil-based plastics that contribute to (micro)plastic pollution towards biobased polymers that do not accumulate in nature. To this end, polyhydroxyalkanoates (PHAs) are considered to be the most promising class of biobased and biodegradable polyesters. In the past decade it has been demonstrated that mixed culture PHAs can be produced from second generation feedstocks and that they are biodegradable in virtually any natural environment. Still, to unlock their full potential three main challenges exist. First, it is not yet clear which applications have the best fit with the unique properties of this new type of PHA. The second challenge is that the conversion of second generation feedstocks to high quality polymer building blocks is highly complex. Finally, it is unclear how mixed-culture PHAs can be most optimally integrated in the circular design of products. This project aims to overcome these challenges with a multidisciplinary industry driven consortium that will establish four new value circles, thereby effectively establishing the position of mixed culture PHBVs in the biobased and circular landscape as well as in society.

Doelstelling

The CircuPHApp project creates 4 new value circles for PHA. The project will show that PHBV and PH-X produced using mixed bacteria cultures and heterogeneous feedstocks can be processed into a diverse set of applications. Each application will

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Algemene informatie / General information

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follow a unique EOL route, thereby demonstrating the versatility of mixed culture PHAs. The project will investigate and develop new innovative routes to optimize heterogeneous second generation feedstock towards specific biopolymer functionalities with controlled quality. This will allow targeted fermentation into PHA polyesters. These will be modified and subsequently processed into applications for packaging (paper coatings), agriculture (plant propagation products), aquaculture (ecosystem restoration objects) and building (facade panels). Development of these value circles will be executed via a 'circular by design' principle in which functionality during use and EOL are considered equally important, demonstration of products in the value circles is foreseen at a multi-kg scale. A circularity analysis and an implementation plan will support the project results and increase the overall impact and market uptake of the project.

Korte omschrijving

All activities in CircuPHApp are centered around the development of new value circles for mixed culture PHA based products. These start with the procurement of suitable feedstock for fermentation using waste and side streams, and drawing up specifications for the prototypes. Relations between feedstock composition, PHA production process parameters and polymer characteristics will be investigated in detail. Using the right polymer for the right application, compound formulation and extensive characterization will lead to the prototype development of four new circular and sustainable products. Field tests will show the functional performance of the products in a realistic environment, disintegration tests and microbial recycling will show their behavior in end-of-life processes. Using advanced models, relevant indicators for sustainability and circularity will be calculated and compared against their fossil based counterparts. Finally, comprehensive plans for implementation, communication and marketing will show the coherence and economic feasibility of the value circles.

Resultaat

The CircuPHApp project will drive advancement of the biobased economy in the Netherlands by establishing new value circles for products in various industrial sectors, including semi-finished products for industrial use. Prototypes will be developed and tested together with innovation-focused customers using 3 different valorization strategies. These products will generate incentives for new products using this unique class of materials, first at project partners and later at other companies active in the sector. The project will underline the potential of PHAs in products that currently contribute to (micro) plastic pollution and for which biodegradation is a clear advantage. Furthermore, the results will generate market demand and show the commercial feasibility of these products. The project will ensure that the Netherlands remains at the forefront in the production of circular, biobased and biodegradable polyesters and products made from second generation feedstock. Consequently, driven by the uptake by industry, end-users and consumers, the value circles established in this project will grow thereby phasing out fossil feedstock and mitigating plastic pollution.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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