

BIOWAVE

Publieke samenvatting / Public summary

Aanleiding

The necessity to move away from fossil feedstocks is essential in the transition to a sustainable and circular society. While renewable energy generation can be efficiently de-carbonized, carbon will remain a crucial constituent of most of our chemicals and materials. This carbon should increasingly be renewable, i.e. coming from biomass, CO₂ or recycle-streams. The efficient conversion of carbon-rich feedstocks to new functional materials and products is, therefore, of great importance, as is the overall circularity of these products (designed for circularity). Biobased polyesters, in general, are compatible with the requirements of circularity, as they can be efficiently recycled back to their monomers at end-of-life. In addition, increasing concerns on the effects of littering, ecological persistence and (eco)toxicity of e.g. micro-/nano plastics, requires the development of materials that do not accumulate in nature, and break down into readily biodegradable non-toxic, nature identical substances. Hence, there is a need for new safe and circular biobased materials that can be sustainably produced from biomass by green and efficient technologies.

Doelstelling

The objective of BioWAVE is to develop new safe and circular by design materials and formulations based on (bio)degradable polyesters, consisting of natural, safe, and biodegradable building blocks obtained from 2nd generation feedstocks. This project focusses especially on the use of the C3 and C4 building blocks, malonic acid and malic acid, respectively. These building blocks will be used for

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Algemene informatie / General information

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Stichting Wageningen Research

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the development of a range of innovative biobased polyesters for applications in waterborne systems like coatings, inks and adhesives. Currently, these monomers are under-explored as building blocks for polyesters, mostly due to lack of economically feasible production routes. However, recent developments in thermochemical and biotechnological conversion of carbohydrates show that especially these C3 and C4 building blocks can be efficiently and selectively produced from sugars. Hence, BioWAVE aims to explore their potential as safe and sustainable building blocks for circular by design materials.

Korte omschrijving

- Development of novel (bio)degradable polyesters from C3, C4 building blocks, specifically tailored for use in waterborne polymer applications. Where necessary, secondary building blocks will be designed and synthesized from the primary ones to broaden the scope of potential applications and enhance the overall viability of the primary materials. The most promising polyesters obtained in this project will be scaled up (approx. 2 kg) to have sufficient material for application testing.
- Application testing & degradation study
- processing/formulation of biobased polyesters into products that can be tested by the endusers that are part of the consortium
- evaluation of recycling potential and chemical degradation
- Basic Techno-Economic Assessment (TEA)

Resultaat

BioWAVE aims to achieve the following key results at the end of the project:

- Novel (bio)degradable polyesters based on primary C3 and C4 building blocks have been synthesized and characterized and were made available for waterborne formulations.
- Primary building blocks were converted into secondary building blocks, enabling the fine-tuning of polyester properties to better match the requirements of the intended applications.
- The technical performance of the new products was evaluated through application testing.

End-of-life solutions (e.g., chemical recycling, degradation behavior, stability testing, etc.) were

studied, and the safety of the resulting polymers and oligomers was assessed through toxicity testing. - Basic TEA was performed.

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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