

SMARTCASE - Sustainable Michael-Addition Resin Technology for coatings, Adhesives, Sealants and Elastomers

Publieke samenvatting / Public summary

Aanleiding

Thermoset materials find use in almost all industrial sectors, especially where lightweight, stiffness, resistance and dimensional stability are key performance requirements. However, traditional thermosets suffer from several drawbacks: they are made of fossil-based non-reversible polymers and toxic monomers; more importantly, thermosetting materials are virtually neither recyclable nor reprocessable, due to their crosslinked microstructure. Currently, most thermoset materials are incinerated or accumulated in landfills at the end of their life. Landfill waste degrades to liquids known as landfill leachates that lead to health and environmental problems. A significant part of these wastes originate from thermoset materials used in paints, coatings, sealants and adhesives applied as a thin film to all sorts of surfaces. These unrecyclable materials contribute to nano- and microplastic formation. Despite many efforts in the past years in this context, substantial further developments are required. Production of thermosets from biobased feedstocks using safe and sustainable-by-design approaches is therefore crucial to address the well-being of people and to have a healthy planet.

Doelstelling

SMARTCASE aims to develop safe and circular carbohydrate-derived reactive polyester resins for coatings, adhesives, sealants and elastomers (CASE) for the building and interior sectors. The new

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Algemene informatie / General information

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two-component ('2K') formulations are designed to replace currently used fossil-based epoxy and urethane resins by biobased and GHS-label-friendly alternatives. This not only improves the safety of workers and end-users of these materials, but also reduces the dependency on fossil resources and facilitates the transition towards abundantly available biobased raw materials. A new class of biobased polyesters resins and thermosets will be designed in SMARTCASE using safe and sustainable by design approaches allowing for more sustainable and feasible end-of-life options. Biobased polyesters in general meet the requirements of circularity, as they can be efficiently recycled back to their monomers at end-of-life. Accordingly, the recycling and degradation behavior of the developed formulations under thermal, mechanical and chemical conditions and their biodegradation will be studied. Hence, the output of the project contributes to the main goals of the NGF BioBased Circular program.

Korte omschrijving

- Pretreatment of feedstocks such as cellulose, needed to properly convert C5/C6 sugars to diacid and diol monomers for polyesters, and investigation of the potential of new biomass feedstocks for synthesizing platform chemicals
- Synthesis and characterization of polyester-based Michael donors and Michael acceptors
- Lab-scale preparation of biobased thermoset formulations using polyester-based Michael donors and acceptors
- Study of end-of-life solutions (e.g. chemical hydrolysis, reprocessing/ recycling using heat as stimulus) for the developed formulations
- 4 • Large-scale production of the best thermoset formulations for each of the targeted resin applications
- Evaluation of resin performance by industrial end-users in their own applications
- Techno-economic assessment of all main value chains targeted in SMARTCASE
- Determining the life-cycle benefits of the new formulations compared to existing reactive resin systems
- Organizing a stakeholder workshop as well as devising and executing a strategy for disseminating results

Resultaat

The project follows a value-cycle approach with a multi-disciplinary and balanced consortium of industrial representatives from every part of the value chain, from carbohydrate feedstock suppliers to resin formulators and end users. This enables a system innovation instead of a (single) product innovation. The following results are expected within 10 years (mostly by the end of the project):

- Sustainable feedstock platform for novel biobased (BB) platform chemicals
- Access to novel monomers and building blocks
- Access to safe and novel polyester-based resin components
- Access to high performance, safe and circular thermoset formulations
- Scale-up of the best thermoset formulations
- Validated performance of novel thermoset formulations in industrial applications
- Sustainable and circular-by-design thermoset formulations with defined end-of-life solutions
- Data on LCA, TEA, toxicity and sustainability
- Engaged stakeholders and effective dissemination of project outcomes

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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