CHAMPION

Circular High-performance Aza-Michael Polymers as Innovative materials Originating from Nature

http://www.champion-project.eu

Type of Action: Research & Innovation Action

Feedstock origin: VC1 – lignocellulose

Start date: 01 June 2020

End date: 30 November 2023

BBI JU contribution: €4,847,078.75

Summary

The use of polymers in manufacturing is an essential element of numerous aspects of modern life. They are used to create the high-strength, low-weight plastics for manufacturing many of the consumer goods we take for granted. They are also present in highly resistant coatings for automotive and domestic goods, as well as structural adhesives. All these applications – and many more – are reliant on polymers.

However, many of these polymers rely on non-renewable feedstocks. Once they reach the end-of-life phase, these polymer-based products present a range of environmental issues. The majority are not fit for recycling – ending up being incinerated or in landfill. In addition, some of the chemicals used in their production are toxic. These elements stand in contrast to the EU's green credentials and its ambitions to create a circular economy. It is clear that sustainable bio-based alternatives offer an ideal solution to all these issues.

The objective of the CHAMPION project is to replace these existing materials with bio-based polymers – based on the aza-Michael addition reaction – that are suitable for high-performance applications. The applications will include coatings, textiles, home care (HC) formulation, and structural adhesives. Examples of uses would include kitchen counter coatings, car interior surfaces, laundry detergent and adhesives for industrial composites. The new materials will perform as well as, or better than, existing polymers from non-renewable sources while being circular by design. This will make them superior to current materials by ensuring that they are biodegradable and/or suitable for recycling.

Objectives

The CHAMPION project has the overall objective of identifying and developing bio-based alternatives for use in polymers, avoiding many of the current issues associated with these materials. In addition, it will pursue a number of specific objectives. It will:

- Produce a library of more than 50 novel bio-derivable materials, based on polyesters, pendants and cross-linkers, using the aza-Michael addition reaction for chain extension, modification and curing.
- Increase the environmental and economic

Expected impacts

By achieving its overall objective, the CHAMPION project will reduce the environmental impact of essential polymer production using current methods and materials. In addition to this, it will also make contributions to specific BBI JU KPIs through:

- Potentially creating up to eight new cross-sector interconnections in the bio-based economy. With two producers and four users of bio-based intermediates, four should be in place by the end of the project, while the remainder will be

performance of the targeted polymers by establishing an innovative, cost-effective testing strategy that can rapidly evaluate toxicological safety issues of candidate products.
- Produce at least four bio-derivable materials – one for each application detailed below – on a suitable scale for application testing in an industrial setting.
- Submit four new bio-based aza-Michael-addition polymer candidates with high performance in HC formulation additives, structural adhesives, coatings and automotive interior surfaces to industrial partners for testing.
- Increase overall resource efficiency and reduce greenhouse gas emissions for the targeted applications.
- Validate new and improved processing technologies and evaluate, in industrial-scale production processes, two to three of the most advanced bio-based polyester candidates in potential environmental, social and economic terms. These will be benchmarked against the conventional petrochemical-based alternatives.
- Communicate with key audiences and stakeholders and gather feedback from policymakers and market actors along the entire value chain in order to undertake the market analysis.

established between different end-user sectors later.
- Establishing four new value chains, one for each application. This will connect the bio-based intermediaries with the formulators and industrial end-users.
- Validating new bio-based materials. Between four and twelve of the most promising candidates will have been identified by prior screening. These will then be subject to advanced performance testing, as chosen by the potential end-users for each application.
- Validating a range of new and improved processing technology and increasing their technology readiness level to level 5. This will also examine the chemical recycling of aza-Michael reaction bio-derived polymers for the first time.

In addition, the CHAMPION project will bring specific environmental benefits. The products it delivers will be designed with three end-of-life options planned from the outset. The first is recovery and chemical recycling, the second is a controlled energy recovery system that also reduces environmental release. The third is a biodegradation safety net, guaranteeing that losses to the environment will not persist, as is the case for current materials. These will prevent the major existing impacts seen with petrochemical-based products.

Consortium

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- Stichting Wageningen Research (Netherlands)
- BioDetection Systems BV (Netherlands)
- Teknologian Tutkimuskeskus VTT Oy (Finland)
- Process Design Center BV (Netherlands)
- Organic Waste Systems NV (Belgium)
- Circa Sustainable Chemicals Ltd (UK)
- Unilever UK Central Resources Ltd (UK)
- Nova-Institut für Politische und Ökologische Innovation GmbH (Germany)
- Ava Biochem BSL AG (Switzerland)
- Stahl International BV (Netherlands)
- Orineo BV (Belgium)
- SQ Consult BV (Netherlands)
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Project coordination

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