Integration of Bio-Conversion and Separation Technology for the production and application of platform chemicals from 2nd generation biomass

Results in Brief

Biowaste used as a source of industrial chemicals

White biotechnology uses biological processes or organisms to produce industrially relevant products more sustainably. New technology to cost-effectively produce platform chemicals from biowaste will elevate the global position of the EU chemical industry.

The first generation of white biotechnology relied on biomass feedstock of pure sugar and starch, thereby creating competition with food crops. The second generation, however, has focused on the recovery of such molecules from biowaste.

The EU-funded project BIOCONSEPT (Integration of bio-conversion and separation technology for the production and application of platform chemicals from 2nd generation biomass) was established to demonstrate the technical and economic feasibility of second-generation white biotechnology at the industrial scale.
Project partners comprised 15 small and medium-sized enterprises (SMEs), 10 large industrial stakeholders, and 5 research and technology organisations from 11 countries. Together, the partners have been opening up new markets for the EU's well-established chemical and agro-food industries and growing biotechnology sector. The target was platform chemicals that can be converted to multiple end products.

Pilot plants were set up for the pre-treatment, fractionation and purification of second-generation lignocellulosic (wood) feedstocks and non-edible oils and fats. Conversion to platform chemicals required robust enzymes, microbes or catalysts suited to the more complex second-generation feedstocks. During the last period, scientists finalised development of appropriate conversion systems.

An important pillar of BIOCONSEPT was the integration of conversion and separation processes. Groundwork laid in the first reporting period led to proof-of-principle validation of combinations of conversion and separation or purification steps to obtain the desired platform chemicals directly from the fermenter.

Conceptual process designs for all platform chemicals were used to conduct the first round of techno-economic modelling and sustainability assessments. Outcomes led to improved processes and technologies with a focus on the demonstrators.

In parallel, consortium members evaluated the quality and quantities required by the platform chemicals to produce polymers and plasticisers. Products have been tested for their targeted applications with promising results.

Large-scale demonstrations were conducted for two selected product chains, 2,5-furandicarboxylic acid (FDCA) and epoxides, using second-generation biomass, integrated processes, and improved separation and extraction technologies. The reduced cost of the products and their enhanced sustainability will help to increase the competitiveness of the European chemical industry and reduce its environmental impact.

BIOCONSEPT was an important bridge between the use of first generation feedstocks, which may be in competition with the food chain, and the utilisation of waste streams as third generation feedstocks in future. Moreover, the use of renewable biomass will help to significantly reduce greenhouse gas emissions and waste generation, while providing a more secure supply of feedstocks, energy and water.

Keywords
White technology, biowaste, BIOCONSEPT, 2,5-furandicarboxylic acid (FDCA) and epoxides

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