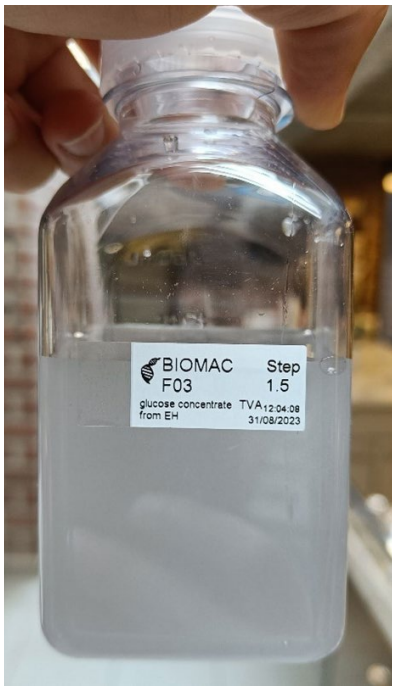
Bio-based Sun visors for cars - BIOMAC Test case #1

The BIOMAC Project is developing 5 new prototypes of bio-based products (test-cases).
This test case is about the development of a bio-based sun car visor that is not only environmentally friendly, but also cost-effective and high performing, providing a functional solution for car owners . DIAD Group as the end-user of the sun car visor was supported by the partners Luleå University of Technology, Aristotle University of Thessaloniki, Bio-base Europe Pilot Plant, Leibniz Institute for Agricultural Engineering and Bioeconomy, Luxembourg Institute of Science and Technology, Fraunhofer-Wiki, AIMEN Technology Center during the prototype development.

These bio-based sun car visors offer a sustainable alternative to traditional petroleum-based visors, reducing the environmental impact of the automotive industry. By utilizing forest industry residues, BIOMAC is able to create innovative products, that contribute to a more sustainable future.

Biomass fractionation, pretreatment and purification

Miscanthus Cellulose cake after 1st pretreatment.



Sawdust_Glucose concentrate.

Sawdust (woody residues) and Miscanthus (energy crop) were pretreated and then fractionated into cellulose, hemicellulose and lignin.
Overall, fractionating sawdust and miscanthus into their constituent components allows for the efficient utilization of these biomass resources, making them an attractive option for sustainable material production and reducing reliance on fossil fuels. This process also helps to reduce waste generation and environmental impact associated with the disposal of agricultural residues.

The cellulose fraction can be further processed into sugars with enzymatic hydrolysis, while the hemicellulose fraction can be converted into bio-based chemicals. The lignin fraction can be used as a renewable source of energy or as a precursor for various high-value products in the chemical industry.

The cellulose fraction was enzymatically hydrolyzed and the resulting glucose was purified and concentrated to a glucose stream. This glucose stream can be further processed by fermentation to produce a variety of products such as succinic acid or can be converted to sugar alcohols, such as sorbitol, via catalytic hydrogenation. The concentrated glucose can also be used as a high-value ingredient in food and beverage products, or as a feedstock for the production of bio-based materials.

Overall, enzymatic hydrolysis of cellulose to produce glucose is a key step in the conversion of biomass into valuable products and is an important process in the sustainable production of biochemicals, such as for the biobased plastic industry.

Conversion

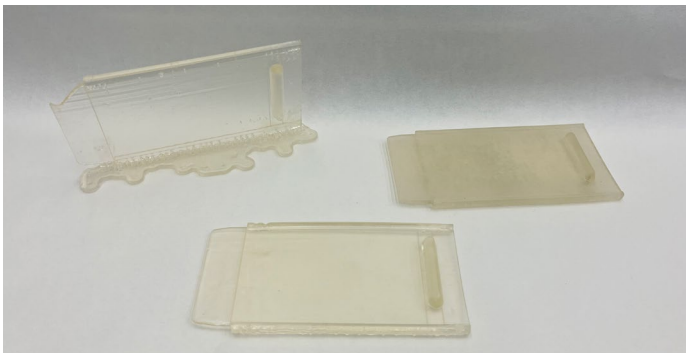
Sorbitol from the catalytic hydrogenation (PL3) of glucose hydrolysates.

Sugars streams went through two different processes: Fermentation (PL 7) and hydrogenation (PL 3). The fermentation of sugars followed by downstream processing (DSP) resulted in the successful production of Succinic acid (SA). The catalytic hydrogenation of glucose with Ru/C catalysts under optimized conditions led to kg-scale sorbitol-rich products (Figure on the left) developed by Aristotle University of Thessaloniki (PL3).
The bio-based monomers succinic acid and sorbitol coming from PL7 and PL3 were used in combination with other commercial bio-based monomers were used as starting materials for polyester resins with a bio-based content up to 100%.

In a next step, these resins were formulated (mixed) with (bio-based) reactive diluents and photo initiators to create materials that can be employed in UV-curing addtive manufacturing processes, such as SLA, DLP or 2PP-printing. A set of 30 resin formulations with a overall bio-based content up to 85% were prepared and evaluated on their printing performance and thermomechanical properties of the printed parts. The most promissing candidates have been selected for the realization of the final product. In PL10, mechanical defibrillation of Miscanthus biomass led to the production of nanofibrillated cellulose (NFC) (PL10) in batches of 1-5 kgs.

The final product

Finally, these resins were utilized (PL15) for the 3d printing of the Sun visors. Tests showed that in the end, biobased resins can be successfully used, high-precision 3d fabrication can be achieved and that also larger pieces can be realized.



Prototypes of 3D-printed sunvisors by BIOMAC.

Sunvisors currently in use in modern cars.

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PARTNERS

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