

# WHEN PLASTIC DUCKS ARE MADE FROM PLANT RESIDUES

BioConSepT – a novel way of using natural residues for green products and chemicals

## The project: Demonstrating second generation white biotechnology processes

Second generation biomass – agro-food residues, wood residues and non-edible oils and fats – could deliver the raw material for the plastics of the future, without taking material from the food chain.

The BioConSepT project focuses on producers and users of bioplastic materials in industry and consumer-oriented businesses. The EUR 13 million EU-funded project contributes to the ongoing ‘food or fuel’ debate: agro-food residue streams, wood residues and non-edible fats and oils replace edible biomass which competes with the food chain. These inedible feedstocks are considered to be the future ingredients for many applications of bioplastics in industrial and consumer products.

BioConSepT aims to demonstrate the technical feasibility of white biotech processes for the conversion of second generation biomass into platform chemicals, which are 30% cheaper and 30% more sustainable than existing chemical routes or first generation processes. The project uses lignocellulose and inedible oils and fats as cheap, abundantly available feedstocks, which cannot be used as food.

The main achievements expected for BioConSepT are:

- To develop the robust enzymes and microorganisms suited to the more dirty second generation feedstocks;
- To reduce equipment costs and the number of process steps by the integration of bioconversion and highly selective separation technologies;
- To facilitate easy integration in existing production chains by deploying combinations of bio- and chemical conversions and by proving the suitability of the produced platform chemicals for biobased polymers, resins, plasticisers, solvents and surfactants;
- To realise the first demonstration of integrated production chains from second generation feedstocks to platform chemicals at an industrially relevant scale.

## The product: Biobased chemicals, bioplastic applications, novel technologies

The markets for itaconic and succinic acid are expected to grow rapidly until 2020, replacing oil-based chemicals by bulk applications like biobased plastics (rubbers, polyamides, polyesters).

Others like  $\alpha$ - and  $\omega$ -dicarboxylic acids from natural fatty acids have a similar potential, especially for the production of commercial plastics like polyesters, polyamides or polyurethanes. The furane dicarboxylic acid (FDCA) market is currently small because of high prices. But FDCA has huge potential as a replacement for terephthalic acid, which is used for the production of PET plastic materials. A prerequisite for the use of these platform chemicals in bulk markets is to be competitive with oil-based or glucose-based alternatives.

## The end users: Industry supply chain and private users

BioConSepT focuses on producers and users of bioplastic materials in industry, but also consumer-oriented businesses.

The main target groups of the project are technology suppliers, engineering companies and producers of production chains from second generation feedstocks to end-products, which aim at a 30% cheaper and 30% more sustainable production. It is expected that both, SMEs and large companies will contribute and benefit from the transition to bioplastics.

The inventors: Research and technology organisations, industry, SMEs

An experienced consortium of five research and technology organisations (RTOs), ten large industrial companies and 16 small and medium-sized enterprises (SMEs).

The project is led by TNO – Netherlands Organisation for Applied Scientific Research, Delft, The Netherlands.

## Development stage: Proof of principle, upscaling

BioConSepT will bring novel technologies from laboratory to pilot scale by high-level applied research, including



upscale process development of the usage of feedstock by fragmentation and fermentation.

In a detailed market report on the relevant platform chemicals the BioConSepT team learned what the market potential of the individual platform chemicals will be. Project partner Pöyry organised four conceptual process design workshops where BioConSepT scientists discussed and defined process chains. Data and calculated balances were further used as input for life cycle assessments carried out by partner QNorm. Upcoming research results will be published soon.

### **Policy impact: Lead Markets Initiative, Environmental Technology Plan, Knowledge Based Bioeconomy Strategy and HORIZON 2020**

BioConSepT contributes to realising the objectives of environmental and industrial European policy initiatives, such as the Lead Market Initiative in Biobased Products (LMI), the Environmental Technology Action Plan (ETAP) and the EU Strategy for Key Enabling Technologies (KET). The EU funded project aims at enhancing the competitiveness and sustainability of European industries by substituting limited fossil resources with renewable resources and integrating cleaner bioprocesses into the production chain. In addition, the use of second generation biomass in integrated processes, with new separation and product removal features, reduces process and product costs and enhances the competitiveness of the chemical industry.

The Knowledge Based BioEconomy (KBBE) is a key element in the EU strategy under HORIZON 2020, which as well as enhancing competitiveness, also addresses the need to reduce the dependence of Europe on raw materials and energy from regions outside Europe. The reduced use of primary raw materials and sourcing energy from renewables contributes to clean and environmentally friendly processes and products and a significant reduction in the emission of greenhouse gasses.

### **Next steps: Novel microorganisms, new equipment, new processes**

In the near future the core activities in BioConSepT promise

inventions in the following areas:

- Novel microorganisms and enzymes improving the production of biobased platform chemicals from second generation feedstocks;
- Novel equipment and processes for conversion of second generation feedstocks;
- Processes and equipment integrating conversion and separation;
- Novel equipment and processes for cost-effective and energy efficient separation and purification of platform chemicals, and novel applications and products derived from the platform chemicals.



#### **BioConSepT**

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