SUCCESS STORY

CEST
Centre of electrochemical and surface technology

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REPLACING FOSSIL RESOURCES BY WASTE – CIRCULAR ECONOMY IN CHEMICAL INDUSTRY

WE DEVELOPED NOVEL BIO/ELECTROCHEMICAL PROCESSSES THAT CAN CONVERT WASTE OR BIOMASS SUBSTRATES IN VALUE ADDED CHEMICALS. THEREBY FOSSIL RESOURCES CAN BE REPLACED IN CHEMICAL INDUSTRY.

Despite great efforts to replace fossil resources in chemical industry, crude oil and gas remain the main resources for producing all our everyday chemical products and materials. To finally replace fossil resources, two challenges have to be solved. Firstly, suitable alternative resources to replace oil and gas have to be found and secondly, novel and innovative processes must be developed that can convert those crude resources into value added chemical products.

Concerning alternative resources, the optimal choice are waste substrates, as utilization of wastes is highly beneficial from a circular economy point of view. Different types of waste are potentially available, such as: food waste, plastic waste or waste biomass (wood residues, straw). The challenge when converting wastes, is their highly variable chemical composition. At the same time this is a great chance, as by conversion of these very different wastes, a large variety of chemical products can be obtained. Another obstacle for the widespread conversion of waste substrates into chemicals, is that each waste type would require an individually designed process, to obtain the desired chemical product.

Together with our industrial and academic partners, we at CEST, we are pioneering a very specific process class, that is highly flexible and can convert many different waste types into a great array of products. This process class are bio-electrochemical processes. As the name suggests, it combines biochemical with electrochemical reactions. This combination is the reason, that allows the conversion of such different wastes such as plastic, biomass or food waste. The

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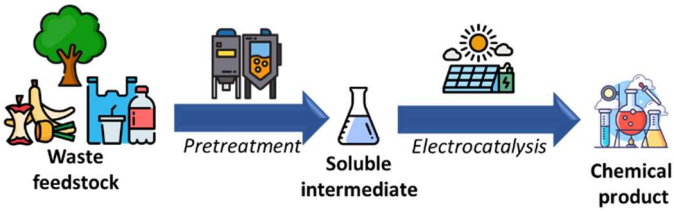
other great advantage of this process type is that it generally operates at room temperature, in aqueous medium, without the addition of any toxic or harmful chemicals and with electricity as main energy input.

To develop suitable processes for all different waste types, a detailed understanding of the underlying reaction mechanisms and electrochemical processes is required. For this purpose we apply high-tech surface analysis techniques such as “low energy ion scattering” (LEIS), that allows the determination of the chemical structure in an unprecedented accuracy.

We are currently working to apply bio-electrochemical processes for the conversion of several waste types. For example, we have made great progress to achieve one of our main goals, which is the conversion of plastic waste into chemical intermediates (especially alkenes – which are the backbone molecules of chemical industry).

Impact and effects

The bio-electrochemical processes developed by CEST and our collaborators, have the potential to replace fossil resources in chemical industry and obtain many of the essential chemical intermediates, from waste substrates. The conversion of waste substrates has obviously a vastly improved environmental balance compared to conventional production routes.



Schematics of a bio-electrochemical process. Copyright: Christian Pichler

The bio-electrochemical processes are a highly innovative class of reactions, with great potential and they can be easily coupled with renewable energy generation. Finally, they are a promising possibility to implement the concepts of circular economy in chemical industry.

Project coordination (Story)
Dr. Christian Pichler
Vice Chief Scientific Officer
CEST

T +43 (0) 2622 222 66 521
christian.pichler@cest.at

CEST
Viktor Kaplan Straße 2
2700 Wiener Neustadt
T +43 (0) 2622 222 66 521
christian.pichler@cest.at
www.cest.at

Project partners

- Borealis AG, Austria
- BOKU, Austria
- University of Wuppertal, Germany

This success story was provided by the consortium leader/centre management and by the mentioned project partners for the purpose of being published on the FFG website. Further information on COMET: www.ffg.at/comet