Press release

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Unique equipment for biotechnological capture and conversion of CO_2 into chemical building blocks developed in the BioRECO$_2$VER project

CO_2 as renewable carbon source

Carbon is the main element in numerous materials used in industrial processes and in our daily lives. It is currently mostly provided from fossil sources. But what if carbon could be used directly from CO_2 emissions? Biotechnology shows particularly great potential for the eco-effective conversion of climate-damaging CO_2 emissions into valuable basic chemicals. A consortium of 12 partners investigated this pathway in the EU-funded BioRECO$_2$VER project, examining the conversion of CO_2 emissions from refineries and the cement industry into the chemical building blocks isobutene (C_4H_8) and lactate ($C_2H_6O_3$).

Innovative chemo-enzymatic concept for CO_2 Capture

Project partner Luleå University of Technology (LTU) focused on the first process step of capturing and concentrating CO_2 from industrial point sources. Their team developed a hybrid chemo-enzymatic process consisting of a novel solvent blend and an ultrastable carbonic anhydrase (CA) enzyme. The solvent blend included an amino acid ionic liquid and a tertiary amine and displayed a good compromise between enzyme compatibility, absorption rate, capacity and desorption potential. In addition, LTU generated ultrastable enzyme mutants that showed 50% increased resistance to selected flue gas inhibitors compared to the original CA. This 3-component CO_2 capture process was scaled up in a pilot rig, and the set-up further used for real off gas pre-treatment in the project.

Two unique pilots for biotechnological CO_2 Conversion/Utilization

The biotechnological conversion of (captured) CO_2 and the co-substrate hydrogen by microorganisms poses technical and economic challenges because it takes place in the liquid phase and the substrates are gases which are poorly soluble. The BioRECO$_2$VER project investigated two approaches to address this: fermentation under elevated pressure and bio-electrochemistry with *in situ* production of hydrogen.

Pressurized fermenter

Project coordinator VITO designed a flexible and multifunctional high-pressure fermenter, customized for research activities with advanced online sensors, monitoring and control, and also including a membrane filtration unit to achieve high concentrations of the microbial biocatalysts. The set-up was broadly tested in the BioRECO$_2$VER project both with pure CO_2 and CO_2-rich off-gases but can also be used for investigations involving other poorly soluble gases, such as methane, oxygen, or synthesis gas. Pressures up to 10 bar can be applied. More information can be found here: http://nova-institute.eu/press/?id=279

First solely CO_2-based bio-electrochemical platform

University of Girona designed and tested a bio-electrochemical platform that is unique in the world. The key differentiators of the pilot plant are:

- Two parallel lines to test engineered strains and bio-electrochemical systems
- Fully automated pilot plant capable to control key operational parameters (pCO_2, pO_2, pH_2, pH, Temperature) to intensify the process performance
- Solid-liquid separation unit (membrane) to recover the planktonic cells and return them into the bio-electrochemical systems.

A video of the pilot is available here: http://bioreco2ver.eu/media/

This unique infrastructure will be used beyond the project to support further research and development activities in the broad area of CO_2 capture and conversion.

Free access to all project results

Last November, the consortium shared the project highlights and additional results with a broad and international audience. All presentations can be freely accessed here: http://bioreco2ver.eu/webinar/

The BioRECO$_2$VER project received funding from the European Union's Horizon 2020 research and innovation program under grant agreement number 760431. More information can be found at: www.bioreco2ver.eu/ and https://cordis.europa.eu/project/id/760431

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