

Valorization of CO₂-rich off-gases to monomers and biopolymers through biotechnological process

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Carbon dioxide or CO₂ is considered to be the major cause of climate change by its accumulation in the atmosphere and its greenhouse properties. To counteract climate change, most research focused in the past on Carbon Capture and Storage (CCS). Nowadays it is recognized that rather than just storing it, emitted CO₂ can be a valuable source of carbon for the production of commercially valuable products. This Carbon Capture and Utilization (CCU) approach provides much needed additional capacity in the move towards a low carbon economy. Clearly, CO₂ is the ultimate sustainable resource, available everywhere, in unlimited quantities, and forever.

This presentation focuses on the use of CO₂ as feedstock for the synthesis of biopolymers using biotechnology as core process. Two utilization forms will be discussed. VITO's activities in this area will be presented with results of selected projects and activities.

First, CO₂ can be utilized as renewable carbon source for the direct production of biopolymers via fermentation. As a case study, the use of *Cupriavidus necator* for the sustainable production of the biopolymer polyhydroxyalkanoate from CO₂ will be discussed. Test work encompassed optimizations with mock-up gas mixtures and real CO₂-containing off-gas. Biopolymers can also be produced in an indirect manner from CO₂ through the synthesis of chemical building blocks from CO₂. The conversion of CO₂ to different organic acids (such as acetic acid, lactic acid and succinic acid) was evaluated using either bacteria or enzymes as biocatalysts. We will end the presentation with an outlook on the potential and challenges of bioconversion processes for CO₂ valorization to biopolymers.