C1-TO-XOH: ENHANCING ALCOHOL PRODUCTION FROM CO_2 IN BIOFILM-DRIVEN MICROBIAL ELECTROSYNTHESIS

PROJECT DETAILS

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PROJECT DESCRIPTION

The production of commodity chemical, fuels and feed from the greenhouse gas carbon dioxide (CO_2), also known as carbon capture and utilisation (CCU), is key to defossilise the economy at global scale, and to push chemical and energy industries away from fossil fuels. The outlook of a chemical industry where renewable feedstock and electrical energy will be at the centre is appealing to many societal, industrial and government stakeholders. The targeted synthesis of multi-carbon compounds from CO_2 would be an ideal prospect for industry to mitigate CO_2 emission in the future. Microbial electrosynthesis (MES) relies on electroactive microorganisms that are able to use electrons derived from electrodes to catalyse the reduction of CO_2 to multi-carbon end-products.

As much as 75% of all MES studies report solely on acetate production. Diversification and selection towards other chemical is critical to target larger markets, shifting MES to a higher level of interest. Only in recent years the product spectrum expanded to mostly mixtures of acetate, butyrate and hexanoate, showing the production of chemical with larger market potential is possible. Acetate can also act as a precursor for the production of more profitable compounds, such as ethanol. Ethanol has, compared to the aforementioned chemicals, not only the largest market capacity, but also the widest array of applications (e.g. as fuel additive, solvent and chemical precursor).

Despite prosperous outlook for ethanol production in MES, alcohol has not been produced as the main product in MES. **This PhD project aims to enhance alcohol production from CO_2 in biofilm-driven MES with a selective microbial community.** Key process design parameters, such as pH and gas partial pressure, will be assessed as tools to gain control over product selectivity. In addition to this, reactor optimisation will be applied to spatially gain control over the product spectrum. To tackle this challenge, both experimental and mathematical approaches will be used to tackle this challenge.

Are you a student with interests in microbial community engineering, process design, process integration, electrode material synthesis and/or reactor design? Or in pure and co-cultures of microorganisms? Then we might have an interesting BEP/MEP opportunity for you! If you would like to learn more about this project, or if you are interested in working on it, please feel free to reach out.

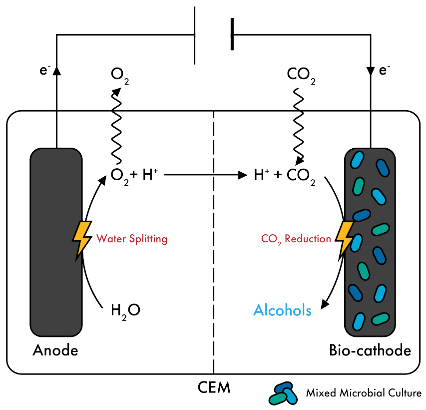

Figure 1: Schematic representation of the project's approach.