Towards zero-emission processes in microbial biotechnology: selective C2-C6 alcohol production from CO_2 by microbial electrosynthesis

Title

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Description

In the light of climate change, it is more important than ever to achieve a sustainable future and enable carbon utilisation technologies. A promising technology to valorise CO_2 is microbial electrosynthesis (MES). MES uses specific types of microorganisms that are able to convert CO2 into valuable chemicals such as C2-C6 carboxylates, using renewable electricity as sole energy source (Fig.1). Exciting, isn't it?

How about trying to selectively produce C2 to C6 alcohols? Here comes the current project. My research project focuses on alcohol production, such as ethanol, from MES at high rate and high yield.

Ethanol has the highest market size of all organics as well as a higher market price than other MES products such as acetic acid. Ethanol has a wide array of applications, e.g. as fuel additive, solvent, and chemical precursor. Moreover, ethanol could be used as starting material for high-value microbial products.

However, to date, ethanol production in MES has been mostly reported in trace amounts. Hence we aim to enable microbial population selection for the selective production of ethanol from CO2, at high rates. Operating conditions (e.g. pH and temperature) and other key process design parameters will be investigated as tools to impact, and gain control over, product selectivity.

Additionally, we are continuously working towards optimising the reactor system to enable its application. One of the focus point is accelerating biofilm formation and growth in MES through e.g. alternative material for the biocathode or media engineering.

Mostly experimental approaches will be exploited in this research, though our group also applies mathematical and computational modelling to support our work. For this project, we look for students with interests in (but not limited to): microbial community engineering, process design, process integration, electrode material synthesis, and/or reactor design. However, BEP and MEP projects are not fully defined yet, so other interests may be of value to the team!

Sounds interesting to you? Would you like to learn more or work on this exciting project? Don't hesitate to reach out!

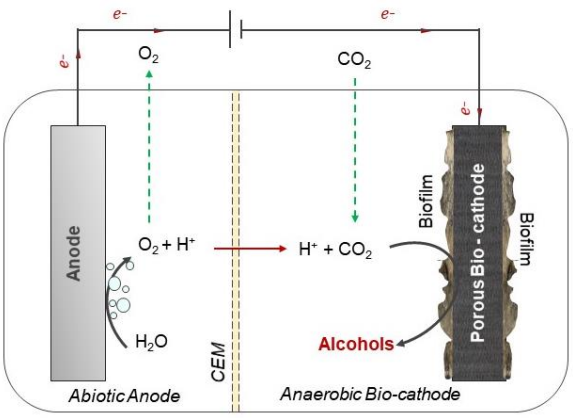

Figure 1. Schematic representation of MES