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Bioproduction of chemical Compounds by CO_2 fixing cell factories.

Fariza Ammam[*], Pier-Luc Tremblay[1], Dawid Mariusz Lizak[1], Karsten Zengler[1] and Tian Zhang[1].

1: DTU Biosustain, Kogle Alle 6, 2970 Hørsholm, Denmark

*Corresponding author email: faram@biosustain.dtu.dk

Acetogens are strict anaerobes able to fix carbon dioxide and to synthesize metabolic end-products suitable directly for use or as precursors for the production of biofuels. Technologies using acetogenic bacteria as biocatalysts to reduce carbon dioxide to chemical commodities like syngas fermentation and microbial electrosynthesis have attracted increasing attention during the last decades. Microbial electrosynthesis (MES) is the process in which bacteria receive electrons from a cathode and reduce carbon dioxide into multi-carbon compounds. This technology is in its nascent stage of development and requires optimization to achieve success and reach commercialization. Understanding the biology of the process and improving the performance of the biocatalysts (electroautotrophic acetogens) is important and required for further development. To date only acetate and traces of 2-oxobutyrate are produced by MES. Our objectives are to diversify MES products and to increase the production yield. In order to reach our objectives, we deploy different strategies: (i) rapid enhancement of the production by optimization of MES parameters, (ii) carbon chain elongation using a mixed culture, (iii) conversion of fatty acids to fuels using enzymes proprieties of acetogens in MES system. These approaches resulted in the improvement acetate production of and the generation of ethanol, butyrate and caproate as end-products in MES. Our results demonstrate the potential of CO_2 fixing factories as a clean and sustainable strategy for biocommodities production.