Valorization of C1 substrates for the bio-based production of value-added chemicals

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Abstract

Since the rise of recombinant DNA techniques, the focus for sustainable bio-based production of value-added chemicals, i.e. amino acids, organic acids and aroma compounds tremendously increased. Beside valorization of renewable sugar-based feedstocks, carbon-one (C1) substrates like CO, CO2, CH4, formate and methanol attained interest in foreground of climate change. In particular methanol was identified as a promising feedstock for a bio-based economy, with a worldwide production of over 50 million tons and an estimated growth rate of 10–20% per year. The understanding of the complex microbial C1 and C2 assimilation pathways required half a century. Nowadays methylotrophic model organisms in the field like Methylobacterium extorquens and Bacillus methanolicus are well established. However, industrial bioprocesses relying on methanol feedstocks are limited. The specialized physiology and the on-going research in genetic engineering of methanol-assimilating microbes is the next challenge for building a climate-friendly bio-economy, relying on these next-generation feedstocks.

The recent growth in the field of systems-biotechnology, modelling and metabolic engineering enabled proof-of-concept studies for value-added products derived from methanol. But in comparison to advances with Escherichia coli, Corynebacterium glutamicum and Saccharomyces cerevisiae, the Methylotrophs are facing slow growth, low yields and a lower overall production performance. These challenges have to be tackled, to pave the way in a sustainable, climate- and environmental-friendly bio-economy, harnessing C1 substrates in the next generation fermentation processes. In this context, the Fraunhofer IGB BioCat addresses the combination of electrochemical CO2 reduction towards C1 compounds. This approach is combined using fermentation of methylotrophic microbes for the green and climate-neutral production of valueadded chemicals.

Biography

Jonathan Fabarius will complete his PhD at Saarland University, Germany in autumn 2018. He is a scientist at the Fraunhofer Institute for Interfacial Engineering and Biotechnology BioCat Straubing. He attained experience in the industrial biotechnology for more than five years, filedone patent application and is the co-author of a review for the bio-based production of valueadded chemicals.

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