ERA CoBioTech

BioTech Research & Innovation Hack

2021

ERA CoBioTech Funded Projects at A Glance: MCM4SB

Replacing food-competing feedstocks with Methanol, CO_2 and Methylamine for a Sustainable Bioeconomy

PART OF EUROPEAN BIOTECH WEEK

INNOVATION IS IN OUR GENES

MCM4SB

Replacing food-competing feedstocks with Methanol, CO2 and Methylamine for a Sustainable Bioeconomy

Researchers in MCM4SB are going to exploit the potential of two model methylotrophs, one thermophile and one mesophile, to use C1 feedstocks, methanol, CO2 and methylamine, for the production of one bulk and one speciality chemical.

Project coordinator:

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Norwegian University of Science and Technology, (Norway)

Consortium

Marmara University, (Turkey)

Aces Bio d.o.o., (Slovenia)

Bielefeld University, Germany)

Project duration:

01 April 2021-01 April 2024

Total budget: 876.000 €

A challenge of the sustainable bioeconomy is not only replacing petrochemical or other non-renewables as feedstock for biotechnology, but also to avoid the use of renewables that do have competing uses in the feed and food industries. However, current biotechnological production of bulk chemicals mostly relies on the use of sugar-containing raw materials and agricultural products. To this end, the project aims to combine utilization of C1 sources, methanol with CO2 and/or methylamine, for production of the bulk chemical L-malate and the specialty chemical N-methyl-L-glutamate. CO2 is abundant in the atmosphere and its feasible capture and storage can make it a low-cost and sustainable carbon source. Methanol and methylamine can be reduced from CO2. The selected targets for microbial synthesis are two important products of different market volumes. L-malate is among the 12 most important platform chemicals available from biomass. N-methyl-L-glutamate is an N-functionalized amino acid used in the pharmaceutical and fine-chemical industries as building blocks for the preparation of stable bioactive molecules. For this goal, two different methylotrophic organisms, *Bacillus methanolicus* and *Methylobacterium extorquens*, differing in their central methanol assimilation metabolism as well as their environmental adaptation to different growth temperatures will be used. *B. methanolicus* is a thermophilic methylotroph that utilizes ribulose monophosphate cycle to assimilate methanol and is not able to use methylamine as carbon source; on the other hand, *M. extorquens* utilizes methylamine via the N-methyl-L-glutamate pathway. As a result, by combining systems and synthetic biology approaches, platform strains utilizing non-feedstocks will be constructed for microbial synthesis of a wide range of value-added chemicals.

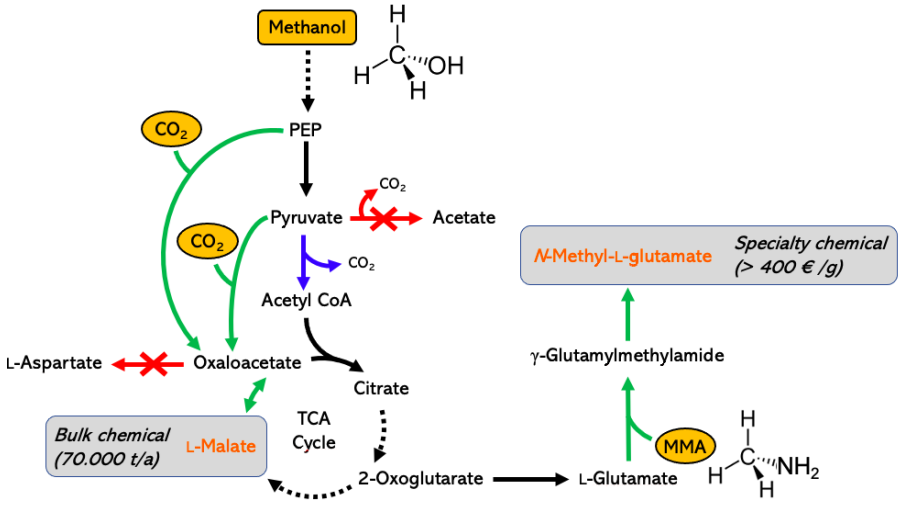

Figure 1: Conversion of C1 feedstocks methanol, CO2 and methylamine to L-malate and N-methyl-L-glutamate

This project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No [722361]

MCM4SB convenes the expertise of four different partners to use a combination of synthetic biology, systems biology, and bioinformatics approaches for reaching its goals. Specifically, strain development efforts will include genetic constructs for gene overexpression and CRISPRi-based gene repression based on synthetic elements. Then systems level analysis will use constraint-based metabolic modelling and its statistical analysis, complemented with transcriptional analyses and analyses of secreted metabolites for further strain development and validation. Finally, techno-economic assessment will help to steer the bioprocess design by assessing the economic feasibility, bottlenecks, and operation targets for process improvement and identify possible trade-offs during early stages of design and development. Furthermore, Responsible Research and Innovation will be a cross-cutting and integrated research activity in MCM4SB with a focus on sustainable bioeconomy based on renewable feedstocks.

Expected project result is the delivery of biological materials, technology, products and processes needed and applicable for the industry, as well as new fundamental knowledge relevant for the general public and scientific society. The tools developed for the construction of platform strains for sustainable biosynthesis of two exemplary products may further be used to extend the metabolism of the strains for the synthesis of a wide range of other value-added molecules.

The project will establish a transnational cooperation between academia and industry by sharing of resources, broader knowledge exchange, better translation of results and a more comprehensive training of early-career scientists.

The active participation of the industrial partner: small and medium-sized enterprise (SME) Acies Bio, will contribute to the translation of research outcomes towards industrial scale bioprocess and drive innovation.

Project website: https://www.ntnu.edu/web/mcm4sb/mcm4sb

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