Characterizing the growth of *Moorella thermoacetica* contributing to its industrial use for CO_2 sequestration

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ABSTRACT

CO_2 fixing microorganisms have the potential to produce valuable chemicals from atmospheric CO_2 without using biomass-derived feedstocks. In this context, they have been considered as a valuable renewable resource for industrial biotechnology to address the issue of CO_2 sequestration. Photosynthetic CO_2 fixation having numerous challenges for its applicability to larger industrial-scale solutions, in the last decade, non-photosynthetic CO_2 fixation from extremophilic bacteria has gained momentum in the biotechnological investigations. These organisms possess the ability to assimilate CO_2 through the acetyl-CoA reduction, Wood – Ljungdahl (W-L), pathway. This is actually the oldest CO_2 fixation mechanism, before the presence of oxygen in the atmosphere. The extremophilic bacteria that possess this capability are acetogens and while acetate is the main product of CO_2 fixation, their metabolism can be appropriately tuned towards other products, including ethanol, butanol as biofuels and other high-added value chemicals. Model acetogen that has been investigated for its use in optimized CO_2 bioconversion processes is the obligate anaerobe *Moorella thermoacetica*[1]. *M. thermoacetica* has been fully sequenced and the reconstructions of its metabolic[2] and protein network[3] models currently exist. This enables the biomolecular modeling of metabolic phenotypic data for the understanding of the involved mechanisms and the prediction of the microbe's physiology in other set of conditions.

In this work, we will show the establishment of an anaerobic microbial growth laboratory at FORTH/ICE-HT and the characterization of the different growth stages of *M. thermoacetica* mixotrophic fermentation using also metabolic profiling analysis. The ultimate goal is to compare the normal growth process of *M. thermoacetica* to that in the presence of toxic heavy metal traces that may be present in real-life gas emissions. This data will contribute to the study of the particular microorganism and its use in industrial applications.

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KEYWORDS: non-photosynthetic microbial CO_2 assimilation, *Moorella thermoacetica*, extremophiles, industrial biotechnology, metabolic engineering

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