Intensified bioprocess for the anaerobic conversion of syngas to biofuels

Filipa Pereira[1], Nuno Reis[2], Madalena Alves[1] and Diana Sousa[1]

[1]*IBB-Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal*

[2]*Department of Chemical Engineering, University of Cambridge, New Museum Site, Pembroke Street, CB2 3RA Cambridge, UK*

Syngas, composed mainly of CO, H_2 and CO_2 can be produced from several sources, including coal, oil and natural gas, tar sands, recalcitrant wastes and biomass. Syngas can be a potential feedstock for the sustainable production of biofuels and bulk chemicals. The selective biological conversion of syngas is a possible alternative to the chemical route. Nevertheless the biological route remains rather unexplored within the bioprocess engineering community. Some anaerobic micro-organisms have the ability to use CO, H_2 and CO_2 and produce renewable biofuels such as ethanol, butanol, and methane. Recently, the microbiology of syngas fermentation has been extensively reviewed (e.g. [1]). As in the stage of work planning, this work introduces the main issues in the topic of syngas fermentation to biofuels. The experimental work to be performed aims to develop a new anaerobic bioprocess for the conversion of syngas to biofuels, with principal interest in ethanol, butanol, and CH_4. An oscillatory flow reactor (OFR), presenting efficient gas-liquid mass transfer rates, will be explored carrying out proof-of-concept experiments using pure and defined mixed anaerobic cultures. Previous results from oxygen mass transfer studies [2] performed in an OFR, have shown effective improvement in gas-liquid mass transfer, when compared with conventional gas-liquid contacting technologies. In a later stage of this work, an energy based metabolic model will be developed to predict products formation according to specific environmental conditions.

References

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