



## Intensified bioprocess for the anaerobic conversion of syngas to biofuels

Filipa Pereira<sup>1</sup>, Nuno Reis<sup>2</sup>, Madalena Alves<sup>1</sup> and Diana Sousa<sup>1</sup>

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

<sup>2</sup>*Department of Chemical Engineering, University of Cambridge, New Museum Site, Pembroke Street, CB2 3RA Cambridge, UK*

Syngas, composed mainly of CO, H<sub>2</sub> and CO<sub>2</sub> 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<sub>2</sub> and CO<sub>2</sub> 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<sub>4</sub>. 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

- [1] Sokolova TG, Henstra AM, Sipma J, Parshina SN, Stams AJM, Lebedinsky AV, "Diversity and eco-physiological features of thermophilic carboxydophilic anaerobes", *FEMS Microbiology Ecology* (2009) **68**:131-141.
- [2] Reis N, Pereira RN, Vicente AA, Teixeira JA, "Enhanced gas-liquid mass transfer of an oscillatory constricted-tubular reactor", *Industrial & Engineering Chemistry Research (ACS Publications)* (2008) **47**:7190-7201.