314. Anaerobic granular sludge as biocatalyst for CH_4 production at moderate H_2/CO_2 pressures

Sónia G. Barbosa[1], Joana I. Alves[1], Marlene Lopes[1], Ana Luísa Arantes[1], M. Madalena Alves[1]

[1]*Centre of Biological Engineering, University of Minho, Braga, Portugal*

Unprecedented environmental concerns related to the intensive use of fossil fuels has led to the use of alternative energy carriers for the production of biofuels/biochemicals. In this context, the development of alternative technologies for carbon capture and utilization has attracting more and more attention. Gas fermentation is a promising strategy for the production of bioproducts through the conversion of carbon-containing gases, contributing at the same time, to the reduction of greenhouses gases emission. Microbial CO_2 conversion with renewable H_2, for production of alternative fuels, such as CH_4, open perspectives to solve different environmental problems. Hydrogenotrophic methanogens have a crucial role on the direct conversion of CO_2+H_2 into CH_4, hence the importance to study the specific hydrogenotrophic methanogenic activity (SHMA).

Objectives: In this work, a pressurized bioreactor was operated in batch mode, under increased H_2/CO_2 pressure from 100kPa to 500 kPa, to investigate its potential effect on SHMA, on CH_4 production rate and on microbial communities. Anaerobic granular sludge was used as biocatalyst. A mixture of H_2/CO_2 (80% H_2 and 20% CO_2, v/v) was used as sole carbon and energy source. Gaseous compounds were analyzed by gas chromatography, liquid products were analyzed by HPLC and archaeal diversity within granular sludge was monitored by 16S r-RNA based techniques.

Results: An increase in the SHMA as well as in the CH_4 production rate was observed with the increase of the initial H_2/CO_2 pressure. This results are very interesting since no inhibitory effects were observed on the microbial activity, demonstrating the resistance of the anaerobic granular sludge for CH_4 production at moderate H_2/CO_2 pressures (up to 500 kPa).

The Illumina sequence results showed that *Methanosarcinales*, *Methanobacteriales* and *Methanomicrobiales* were the three orders that prevailed in the pressurized system, for all the different pressures tested. However, hydrogenotrophic methanogens from *Methanobacterium* and *Methanospirillum* genera slightly increased their relative abundance, varying from 38% (100 kPa) to 41% (500 kPa) and from 8% (100 kPa) to 12% (500 kPa), respectively.

Conclusions/ Impact of the work: In conclusion, the archaeal community seems to be very stable when submitted to increasing H_2/CO_2 pressures, highlighting the potential of the anaerobic granular sludge as an efficient microbial platform for the production of added-value compounds from gaseous carbon waste streams.

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