Ex-situ biogas upgrading and enhancement in different reactor systems

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Biogas upgrading is envisioned as a key process for clean energy production. The current study evaluates the efficiency of different reactor configurations for ex-situ biogas upgrading and enhancement, in which externally provided hydrogen and carbon dioxide were biologically converted to methane by the action of hydrogenotrophic methanogens. The methane content in the output gas of the most efficient configuration was >98%, allowing its exploitation as substitute to natural gas. Additionally, use of digestate from biogas plants as a cost efficient method to provide all the necessary nutrients for microbial growth was successful. High-throughput 16S rRNA sequencing revealed that the microbial community was resided by novel phylotypes belonging to the uncultured order MBA08 and to Bacteroidales. Moreover, only hydrogenotrophic methanogens were identified belonging to Methanothermobacter and Methanoculleus genera. Methanothermobacter thermautotrophicus was the predominant methanogen in the biofilm formed on top of the diffuser surface in the bubble column reactor.

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