

Biological Methanation: a chance as well as a challenge for CO₂ upgrading

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In the context of Power-to-Gas, biological methanation is an environmentally friendly alternative to the catalytic methanisation to upgrade biogas to biomethane or to produce synthetic methane from renewable electricity and carbon dioxide [1]. Biological in situ methanation allows the direct purification of raw biogas within an anaerobic fermenter and transforms it into biomethane with a potentially high CH₄ content of >90% [2]. This form of methanation however presents high requirements for hydrogen dosage and process control. On the other hand, biological ex situ methanation combined with electrolytic H₂ production represents an alternative to conventional CO₂ elimination processes for biogas. Similar to catalytic methanation, the biological alternative can also be used combined with any source of carbon dioxide, regardless of biogas production.

In microbiological methanation processes, the rate of methane formation is lower than in the catalytic variant. The complexity of the technology and the process design as well as material requirements however are significantly lower in the biological variant compared to catalytic methanation. Up to date, in most biological biomethanation reactors the full CH₄ production capacity has not been exploited due to a considerable limitation of H₂ transport and mass transfer into the liquid phase. An optimal bioreactor design will have to consider both maximum hydrogen mass transfer as well as optimal conditions for growth and metabolism of methane producing Archaea.

As part of the SCCER Biosweet, researchers from the ZHAW Wädenswil and the Paul Scherrer Institute are working on the basis necessary for the design, dimensioning and modelling of both variants, in-situ as well as ex-situ methanation. In this way, it will be possible in the future to give the Power-to-Gas installations the best possible configuration according to their location and boundary conditions.

[1] Krautwald, J., Baier, U. *Aqua & Gas*, **2016**, 7/8, 18-23.

[2] Strevett, K.A. et al. Chemo-autotrophic biogas purification for methane enrichment: mechanism and kinetics. *Chem. Eng. J. Biochem. Eng. J.*, **1995**, (58), 71–79