Hydrogen mediated biogas upgrading in a two-stage mesophilic reactor

Bassani, Ilaria; Kougias, Panagiotis; Treu, Laura; Angelidaki, Irini

Published in:
Book of Abstracts. DTU's Sustain Conference 2015

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Hydrogen mediated biogas upgrading in a two-stage mesophilic reactor

Ilaria Bassani, Panagiotis G. Kougias, Laura Treu, Irini Angelidaki*

DTU Environment

*Corresponding author email: iria@env.dtu.dk

In this study, biogas upgrading was tested in an innovative two-stage mesophilic reactor, where the CO_2 in the biogas was coupled with external H_2 and converted into CH_4 by hydrogenotrophic methanogenesis. The first stage was responsible for the most of the biogas produced, while in the second one, where the H_2 was injected, the CO_2 was converted to CH_4 (Fig 1). Prior to the H_2 addition, the biogas was composed by 70% CH_4 and 30% CO_2. On the contrary, upon H_2 addition, the CO_2 content decreased to 9% upgrading the biogas to 89% CH_4 (Fig 2). Archaeal population increased to approximately the half of the total community. The increase of hydrogenotrophic methanogens, with Methanoculleus as dominant genus, and syntrophic bacteria and the decrease of aceticlastic methanogens and fermentative bacteria assert the selective pressure of the H_2 toward the hydrogenotrophic pathway, enhancing the CO_2 consumption and thus the biogas upgrading. Moreover, in absence of aceticlastic methanogenesis, acetate was likely degraded via syntrophic acetate oxidation with hydrogenotrophic methanogens, by bacterial groups such as Thermoanaerobacteraceae (1).

Fig 1: Two-stage reactor configuration.

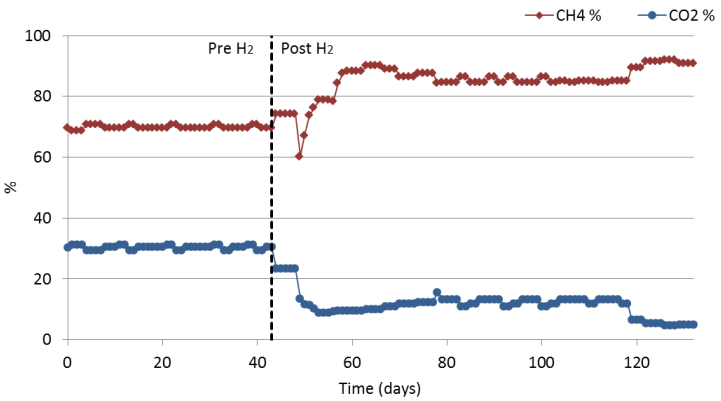

Fig 2: Biogas composition prior and after the H_2 addition.

REFERENCES:

1. Lü et al. Metaproteomics of cellulose methanisation under thermophilic conditions reveals a surprisingly high proteolytic activity. ISME J. **2014**, 8 (1), 88–102.