

Modelling and simulation of an electrochemically mediated biofilm reactor biogas upgrading

Master's thesis number: 43-22

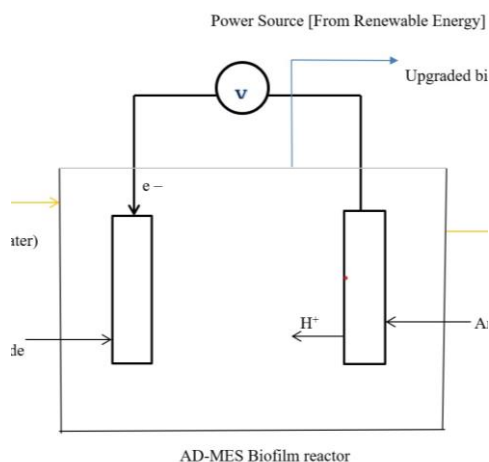
Introduction and background:

Biogas is a significant energy source delivering 5.5-7kWh/m³ and the energy content is determined by methane content. The crude biogas obtained from AD has a low calorific value since it constitute CO₂. It should be upgraded by increasing the CH₄ content to use for vehicle fuel as well as biomethane generation to add to the public grid. Domairani et al (2021) developed a simple mechanistic model for an electrochemically mediated biofilm reactor for biogas upgrading with MES integration with AD. To optimize the process, further research is needed, including a better knowledge of the actual mechanisms and the development of mathematical models for both simulation and control. Since the experimental work is impractical to do in the system for different operating conditions, mathematical modelling can extrapolate such results.

Problem description and objective:

It is essential to realize the role of MES in producing value-added fuels or chemicals (CH₄) with the utilization of renewable electricity from wastewater. This thesis is the continuation project from the last year. The previous model's behaviour was far from realistic, and more parameters should be added to the model. The drawbacks of the existing model should be minimized and improved the model to get closer model approximations.

The purpose of this study was to develop the mechanistic model of a biofilm-mediated MES-AD integrated system for biogas upgrading by converting CO₂ to CH₄, realizing the limitation of the previous model. Some other objectives of the task are implementation of ADM1 in biofilm compartment in AQUASIM tool, literature review on existing MES modelling, identifying the current model limitation and work towards its improvement, Process simulation and identify important process parameters.



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