Hydrogen Production in a Microbial Electrolysis Cell Fed with Volatile Fatty Acids

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ABSTRACT

The organic matter consumption and the hydrogen production rate were evaluated in a two chamber microbial electrolysis cells (MEC). Three chemical oxygen demand concentration (COD) levels (400, 600 and 1200 mg/L) were tested. The COD was composed of a mixture of volatile fatty acids (VFAs) present in the effluent of a dark fermentation process containing. Two levels of voltage were studied: 350 mV and 550 mV. The MEC were operated in 120-hours batches. The performance of the MFC was evaluated using either an anionic (AEM) or a cationic exchange membrane (CEM). The robustness of the MEC was tested using a real dark fermentation effluent and another spiked with 1100 mg/L glucose. The highest production rates (81 mL/L/d) were obtained with 550 mV and 85% of COD consumption was attained. No significant differences on hydrogen production rate were observed when the COD was increasing from 400 to 1200 mg/l and using 550 mV. However, maximal hydrogen production rates were obtained with the lower COD concentration using 350 mV. No significant differences in the performance of the MEC were found by using AEM or CEM and also no significant differences of hydrogen production rates were found when real substrate o synthetic substrate was fed to the MFC. The substrate spiked with glucose was more slowly degraded since glucose was first transformed into VFAs (first 48 h) then the VFAs were consumed to produce hydrogen. In this case, methane and carbon dioxide were found after 120 h.

Keywords: microbial electrolysis cells; hydrogen; volatile fatty acids