XIV International Congress of the Mexican Hydrogen Society
Cancun, Mexico, 2014

Biohydrogen Production from Organic Solid Waste in a Discontinuous Process

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ABSTRACT

The organic solid waste (OSW) represents more than 60% of total urban waste and include 75% of easy-to-degrade matter. Using a fermentative process, the organic matter is transformed into H_2, CO_2 and organic acids and alcohols, this make feasible the biological production of H_2. There exist several parameters that affect the H_2 production as the hydraulic residence time (HRT). In order to optimize the process is necessary to determine the HRT where the H_2 production is maximized. The objective of this study was to evaluate the effect of HRT on H_2 production form OSW in a Sequencing Batch Reactor (SBR). Different HRT (72, 24, 12 and 6 h) were evaluated in an SBR of 1.25L (with a head space of 250 mL and an exchange volume of 50%). Each HRT was maintained in the reactor at least 10 degradation cycles. OSW at 5gVS/L was filled as substrate at each degradation cycle. The reactor was inoculated with fermentative H_2 producers selected by a thermal shock pre-treatment (103-105 °C during 1 h). H_2, CO_2, methane and Volatile Fatty acids (VFA) were determined by gas chromatography. Kinetics of H_2 production was adjusted to the Gompertz model. The results showed that the values for H_2 in biogas varied from 22 to 48% depending the HRT. The highest H_2 production was obtained applying an HRT of 24 followed by the HRT of 12 h. The maximum H_2 percentage in gas (48 ± 6 %), maximum volumetric H_2 production (757 ± 391 mL H_2) and the maximum H_2 production rate (328 ±144 mL H_2/h) were obtained at HRT of 24 h. Acetic acid was the main VFA obtained. Higher propionic acid production was observed at HRT of 6h, reducing the maximal H_2 generation to 282 ± 24.

Keywords: Bio-hydrogen; HRT;organic solid waste.