Thermophilic Biohydrogen Production with Trickling Biofilter: Optimization and Long-term Stability

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Continuous H_2 production was studied in a pilot-scale thermophilic trickling biofilter (TBR) system at 55 – 64 °C for 234 d. The reactor was packed with a fibrous support matrix with a void fraction of 0.95 and was inoculated with microbial consortia which were obtained from a continuously stirred tank reactor (CSTR) operated at 55 °C for H_2 production. Important parameters investigated include pH, temperature, hydraulic retention time (HRT), and glucose concentration in the feed. The optimal pH and temperature were 5.50 ± 0.20 and 60 °C. With decreasing HRT (4 - 12 h) or increasing inlet glucose concentration (6.86 – 27.4 g/l), the volumetric H_2 production rate increased but the H_2 production yield to glucose decreased gradually. The biogas composition was almost constant regardless of operating conditions at 53 ± 4 % (v/v) of H_2 and 47 ± 4 % (v/v) of CO_2. No appreciable CH_4 was detected when the reactor was under normal operation. Carbon mass balance showed that, in addition to cell mass, lactate, *n*-butyrate, CO_2 and acetate were major fermentation products that comprised more than 85% of the carbon consumed. The maximal volumetric H_2 production rate and H_2 yield to glucose were 1050 ± 63 mmol H_2/l(d and 1.11 ± 0.12 mol H_2/mol glucose, respectively. This is the first report on continuous H_2 production by a thermophilic TBR system.

References

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