

Acclimatation of Bacterial Communities for Biohydrogen Production by Co-Digestion Process in Batch and Continuous Systems

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Abstract : The co-digestion process of crude cheese whey (CCW) with fruit vegetable waste (FVW) for biohydrogen production was investigated in batch and continuous systems, in stirred 1.8 L bioreactors at 37°C. Five different C/N ratios (7, 17, 21, 31, and 46) were tested in batch systems. While, in continuous system eight conditions were evaluated, hydraulic retention time (from 60 to 10 h) and organic load rate (from 21.96 to 155.87 g COD/L d). Data in batch tests showed a maximum specific biohydrogen production rate of 10.68 mmol H₂/Lh and a biohydrogen yield of 449.84 mL H₂/g COD at a C/N ratio of 21. In continuous co-digestion system, the optimum hydraulic retention time and organic loading rate were 17.5 h and 80.02 g COD/L d, respectively. Under these conditions, the highest volumetric production hydrogen rate (VPHR) and hydrogen yield were 11.02 mmol H₂/L h, 800 mL H₂/COD, respectively. A pyrosequencing analysis showed that the main acclimated microbial communities for co-digestion studies consisted of Bifidobacterium, with 85.4% of predominance. Hydrogen producing bacteria such as Klebsiella (9.1%), Lactobacillus (0.97%), Citrobacter (0.21%), Enterobacter (0.27%), and Clostridium (0.18%) were less abundant at this culture period. The microbial population structure was correlated with the lactate, acetate, and butyrate profiles obtained. Results demonstrated that the co-digestion of CCW with FVW improves biohydrogen production due to a better nutrient balance and improvement of the system's buffering capacity.

Keywords : acclimatation, biohydrogen, co-digestion, microbial community

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