Topic: Investigation of Microbial Dynamics and Metabolic Profiles in Biohydrogen Production from Food Waste

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ABSTRACT

Dark H_2 fermentation of a synthetic non-sterile food waste was carried out in 0.5 L batch reactors to study the effects of organic loading by the activity of the organisms in the reactors and to compare the activity of *Clostridium butyricum TISTR1032* with anaerobic sludge under the conditions of initial pH 6 and 37^{o}C. Better performance of H_2 fermentation regarding the H_2 yield and specific rate by *C. butyricum* over the anaerobic sludge was observed at 2.5% VS food waste. Up-scaling for 5 L semi-batch reactors by *C. butyricum* with 2.5% VS food waste was studied under controlled and uncontrolled pH condition to monitor the dominant organisms and metabolic profiles in long term fermentation. An accomplishment of H_2 production in 5 L semi-batch reactors based on the H_2 yield, specific H_2 production and maximum H_2 production under uncontrolled pH condition performed higher than those under controlled pH condition. Metabolite profiles and DGGE results indicated that solventogenesis was induced and it is the limitation factor under uncontrolled pH condition. On the other hand, acetogenesis and lactic acid production was presumed to result in the competition of *C. butyricum* and finally affected the stability of the overall hydrogen fermentation process under controlled pH condition. To better understand the metabolic flux reaction in dark fermentation by anaerobic sludge from complex substrates, rice starch fermentation was constructed in 0.5 L batch reactor and metabolic flux analysis was used to evaluate intracellular flux. The results indicated that acetogenesis and butyric acid oxidation pathways were the important actions resulting in the net H_2 production.

Keywords: hydrogen fermentation, food waste, *C.butyricum*, microbial dynamics, Metabolic Flux Analysis (MFA)