Microbial characterization of hydrogen producing bacteria in fermented food waste at different pH values

ABSTRACT

An anaerobic fermentation of food waste was conducted in a 0.5 L bioreactor incubated at a thermophilic temperature of 55 °C to evaluate the effects of different controlled pH values (5.0, 5.5 and 6.0) on biohydrogen production. Effective biohydrogen production was found at controlled pH 5.5 and 6.0 corresponding to lower lactic acid production compared to pH 5.0. It was demonstrated that biohydrogen production from food waste was pH-dependent with hydrogen yields of 79, 76 and 23 mmol H2/L-media/d for pH 5.5, 6.0 and 5.0, respectively. Specific microbial determination for Clostridium sp. and total bacteria quantification were carried out by the fluorescent in-situ hybridization (FISH) technique. The number of Clostridium sp. for acclimatized sludge, fermentation broth at pH 5.0, 5.5 and 6.0 were 2.9 × 108, 3.6 × 108, 7.8 × 108 and 5.4 × 108 cells/ml, respectively. The quantification analysis showed that 92% of the total bacteria belonged to Clostridium sp. from clusters I and XI from the sample at controlled pH 5.5. The denaturing gradient gel electrophoresis (DGGE) bands of the sample after heat-treatment, acclimatization and during fermentation indicated the presence of Bacteroidetes, Caloromator australicus sp. and Clostridium sp.

Keyword: Biohydrogen; Food waste; Thermophilic; pH; Fluorescent in situ hybridization; Denaturing gradient gel electrophoresis