

12. Analysis of Bioconversion and Bacterial Community of Thermophilic Hydrogen Production Using UASB Reactor

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To solve the current energy issue, hydrogen has attracted with a great attention. The hydrogen gas can be produced by fermentation with organic waste, and the energy dose not release carbon dioxide. Thus the hydrogen is considered to become a one of sustainable and useful energy source. From previous studies it has been supposed that applying a UASB (Up-flow Anaerobic Sludge Blanket) reactor widely used for anaerobic wastewater treatment for hydrogen fermentation enables to perform effective biological hydrogen production, because produced granular sludge which work as a reacting field is produced in the reactor. In this study, we examined hydrogen production with UASB process under thermophilic condition. Starch wastewater. During the process, we analyzed a transition of biochemical conversion and bacterial community structures in the granular sludge. In this analysis, a UASB reactor equipping an external water jacket was used. The working volume of the reactor was 6L, and the temperature was controlled at 55°C. Starch was used as a sole substrate (15 g-starch/L). The reactor was operated for 86 days, and the HRT was decreased stepwise from 24h to 12h to increase its substrate concentration. Bacterial community in the granular sludge was estimated with 16S rRNA gene cloning analysis. During our operation, hydrogen content in processed biogas was in the range of 28.6 - 38.3%, and the pH value conversion of effluent was 4.6 - 5.3. The maximum yield of hydrogen production was 1.20mol H₂/mol glucose and was observed at HRT24h. At 24hHRT, butyric acid was dominant in the metabolite. But lactic acid was increased and butyric acid was decreased, when the HRT was shorter than 24h. In the bacterial community, *Thermoanaerobacterium*, which is known as a hydrogen producing bacterium, was dominated. From FISH observation, *Thermoanaerobacterium* was predominant at 24h HRT, but its population size was decreased at 16h HRT. The shifting of bacterium population might be caused by conversion of metabolite composition.