New concept water purification module combined with renewable energy production

Jung-Yeol Lee, Kyung-Sok Min*

Department of Environmental Engineering, Kyungpook National University, 1370 Sankyuk-dong, Buk-gu, Daegu 702-701, Korea
Tel. +82 53 950 4787; Fax: +82 53 959 7734; email: ksmin@knu.ac.kr

Received 14 October 2011; Accepted 24 December 2011

ABSTRACT

The co-culture process of Clostridium butyricum (dark fermentation bacteria) and Rhodobacter sphaeroides (photo fermentation bacteria) with a single or dual reactor was evaluated for hydrogen production. A dual reactor with optional actions of pH and illumination (first reactor: pH 5.5 and no light, second reactor: pH 7.0 and 5000 lux illumination) was used to fulfill the optimized conditions of each dark and photo fermentation bacteria. In comparison, the sole pH was applied to a single reactor. A higher rate of hydrogen production was obtained from the co-culture system with the dual module (dual system: 26.2 ml-H2/l·h, single system: 12.4 ml-H2/l·h). In addition, the VFA concentrations in the fermented liquid of the dual reactor system were lower than that of the single reactor system. The superiority of this operating system was proven by a repeated fed-batch run with the hydrogen production rate of 25.2 ml-H2/l·h. The fermentation of organic waste consisting of food-wastewater and sewage sludge was also attempted in a two-phase fermentation system. A stable hydrogen production rate of 60 ml-H2/g-COD/d demonstrated the way to differentiate this operation access from the conventional one-phase fermentation system. This system was a practicable alternative treatment process for problematic organic wastewater producing stable hydrogen as an energy source.

Keywords: Bio-hydrogen; Co-culture; Dual reactor; Organic wastes; Two-phase fermentation; Water purification

*Corresponding author.

First Academic Workshop on Non-point Source Pollution Research, 2011, Korea