Continuous Phototrophic Hydrogen Production from mixed organic acids

Ruying Li, Tong Zhang & Herbert H. P. Fang*

Centre for Environmental Engineering Research, Department of Civil Engineering, the University of Hong Kong, Pokfulam Road, Hong Kong, China

BACKGROUND

Phototrophic fermentation is one of the most promising processes to produce hydrogen, with higher substrates utilization efficiency compared to the dark fermentation, since it can utilize the byproduct of dark fermentation, the organic acids. The combination of dark and photo fermentation has been proposed as an efficient process. In order to put the two-step hydrogen producing process into practical application, a continuous phototrophic hydrogen production system should be conducted using mixed culture and a long time steady-state operation should be maintained.

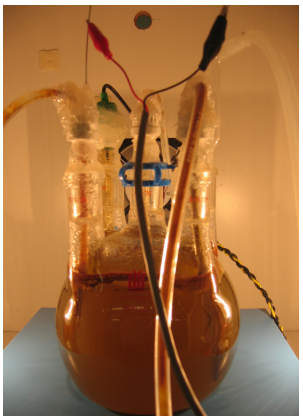

Figure 1 Continuous H_2 production reactor

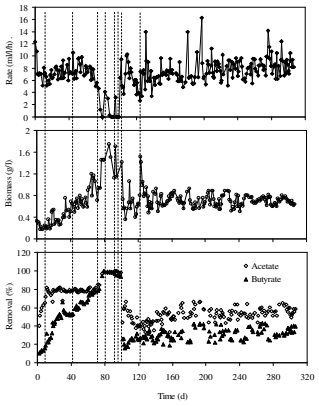

Figure 2 Continuous H_2 production from mixed organic acids.

OBJECTIVES

1. to investigate continuous hydrogen production by an enriched phototrophic sludge from mixed organic acids.
2. to examine the effects of pH and ammonium concentration on hydrogen production, as well as the characteristics of substrates utilization by the phototrophic sludge.

RESULTS AND CONCLUSION

The CSTR photo bioreactor for hydrogen production by an enriched phototrophic sludge has been operated continuously for 306 days using the mixture of acetate and butyrate. At the biomass concentration of 0.7±0.1 g/l and HRT of 48 h, the H_2 production rate was 8.0±1.9 ml/l/, and the maximum rate was 16.2 ml/l/h. The predominant populations were LA15 (42.3%), closely related to *Rhodobacter* sp. TCRI14, and LA01 (38.5%), closely related to *Rubrivivax gelatinosus*.

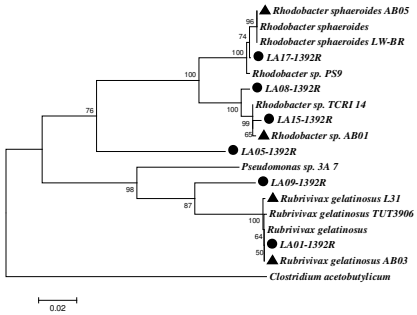

Figure 3 Phylogenetic tree of OTUs in the phototrophic sludge (●OTUs; ▲Isolates)

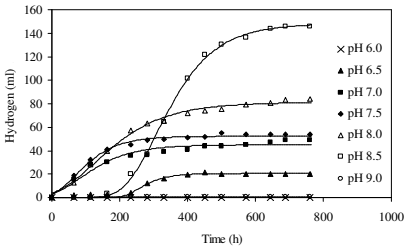

Figure 4 H_2 production at various pH

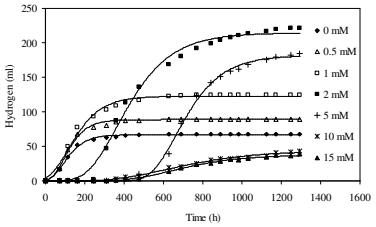

Figure 5 H_2 production at various NH_4^+ concentrations.

The optimal pH for this phototrophic sludge was pH 8.5 for hydrogen production and pH 7.0 for cell growth. Hydrogen production was promoted by 2 mM of ammonium, but repressed by the ammonium above 5 mM.