

Fermentative Hydrogen Production with a Small Pilot Plant by using Molasses as Substrate

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Specification

Volume of fermenter: 200L
liquid: 160L
replacet.: 80L
Fermentation temperature: 40°C
culture pH: 5.0~5.5
Molasses sugar rate: ca.40%
Bacteria *Clostridium* sp.HN001 or Newly found microflora

Photo 1. Over view of the pilot plant.

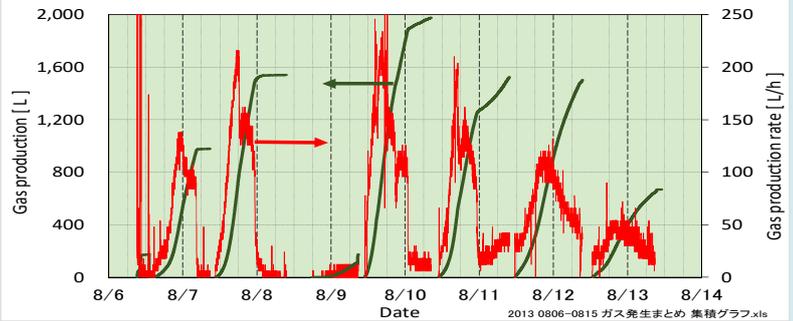


Fig. 1. Results of the workout of the pilot plant by fed batch operation with molasses.

A 80L from 160L fermented liquid was replaced every operation. About 1,400L gas production was expected since the replaced new liquid contained sugar ca.3.5%. H₂ concentration was ca.53% of the gas.

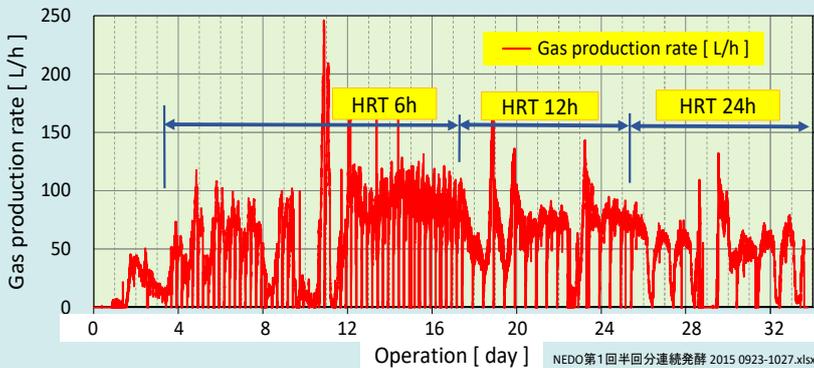


Fig.2. Gas production by a newly found microflora at different HRT. Short HRT operation achieved faster gas production, but the consumption rate of sugar was shorter than long HRT.

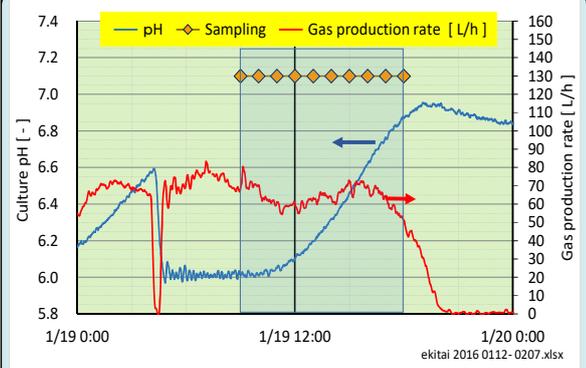


Fig.4. Timely sampling at the pH rising to analyze fermentation states.

Samples were took hour by hour from 9AM to 5PM.

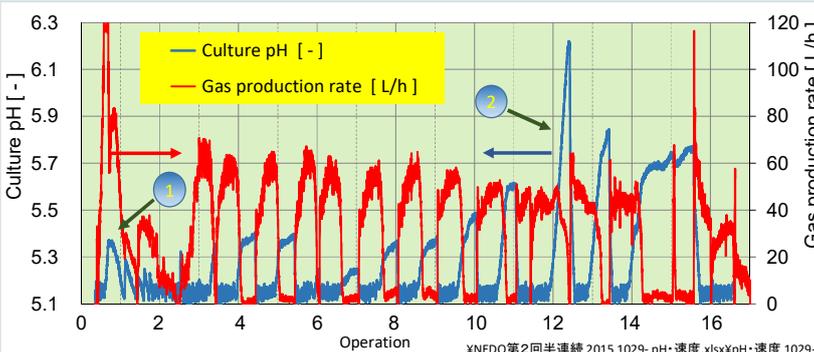


Fig.3. PH rising phenomena appeared on the fed batch operation. Culture pH was controlled at 5.10 to 5.15 through operation, but, as seen in pH curve, it often rose above the upper limit. This means that the flora decomposed some acids.

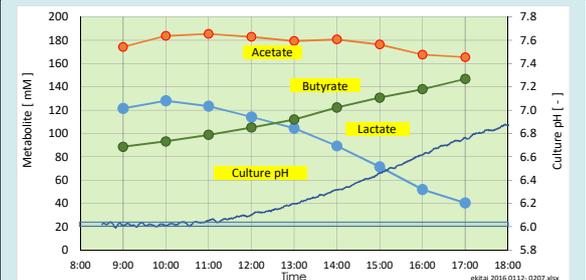


Fig.5. Metabolite change at the pH rising. Lactate decreased while butyrate increased. The relation can be expressed as $2\text{CH}_3\text{CHOHCOOH} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + 2\text{CO}_2 + 2\text{H}_2$.

References

- (1) Nishiyama, H and Tanisho, S. Fermentative Hydrogen Production by a Newly Isolated Mesophilic Bacterium HN001 16th World Hydrogen Energy Conference, Lyon, France, in CD ROM, 2006. (2) Yasuda, K. Biological hydrogen production from food waste by fermentation, Doctoral thesis, Yokohama National University, 2009. (3) Tanisho, S. et al., Fermentative Hydrogen Production from Molasses by a Pilot Plant Constructed in Okinawa, Report I, Proc. 33th Conf. Hydrogen Energy Systems Society Japan, 2013. (4) Tanisho, S. et al, Fermentative Hydrogen Production from Molasses by a Pilot Plant Constructed in Okinawa, Report II, Proc. 34th Conf. Hydrogen Energy Systems Society Japan, 2014.

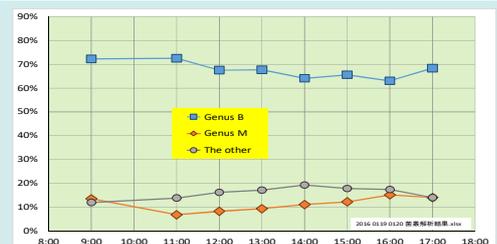


Fig.6. Formation change of microflora.