BioHydrogen Advanced Method for Wastes to Energy Conversion

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Abstract:

BioHydrogen, the production of hydrogen by microorganisms, has been studied in various aspects: bacterial dark fermentation, photosynthetic microbes, and *in vitro* and bio-inspired systems. Hydrogen production by fermentative bacteria from biomass (bio-residues as municipal wastes or primary products) is an important field of BioHydrogen. Biomass is renewable and can be considered as a sink for energy from sunlight.

Dark H2 fermentation is the closest to the stage of realistic application. However, the bottleneck is the relatively low yield of H2 per unit of biomass consumed. H2 is also produced from the products of fermentation under illumination. The major issues of the biohydrogen from wastes are 1) the yield of the hydrogen and 2) the adaptability for various kinds of wastes.

We have examined various methods to establish the essential points of the technology. There is a limitation of anaerobic process for H2 yield (2-3 mol H2/glucose). It is simply known based on the energy diagram as the anaerobic decomposition and H2 production is ca, negative 180-250 kJ/gluose, whereas H2 production from such fatty acids is positive 150-220 kJ (energy supply is required). Combination of anaerobic bacteria with photosynthetic bacteria enhances the yield of the hydrogen. Two-step process is simple but the co-culture of the two kinds of bacteria compensates the reduction of pH reduction and enhances the H2 yield (ca. 7 mol H2/glucose). Thermophilic anaerobic bacteria is a very important digester of wastes as the reaction should be fast and sterilization is not required. However, photosynthetic bacteria is not so durable to high temperature. Two step process is needed for the case. Many enlarged scale researches are on going.

The progress and the level of the technologies are reviewed in my presentation based on the activities of IEA-HIA Task 21 (BioHydorogen) and Asia BioHyLinks. And I should like to introduce some possible methods for future applications.

Keywords:

BioHydrogen, Wastes, Biomass, Anaerobic Bacteria, Photosynthetic Bacteria