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High Efficient Biohydrogen Production from Cassava Starch Processing Wastewater by Two Stage Thermophilic Fermentation and Electrohydrogenesis

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Abstract : A two-stage thermophilic fermentation and electrohydrogenesis process was used to convert cassava starch processing wastewater into hydrogen gas. Maximum hydrogen yield from fermentation stage by Thermoanaerobacterium thermosaccharolyticum PSU-2 was 248 mL H2/g-COD at optimal pH of 6.5. Optimum hydrogen production rate of 820 mL/L/d and yield of 200 mL/g COD was obtained at HRT of 2 days in fermentation stage. Cassava starch processing wastewater fermentation effluent consisted of acetic acid, butyric acid and propionic acid. The effluent from fermentation stage was used as feedstock to generate hydrogen production by microbial electrolysis cell (MECs) at an applied voltage of 0.6 V in second stage with additional 657 mL H2/g-COD was produced. Energy efficiencies based on electricity needed for the MEC were 330 % with COD removals of 95 %. The overall hydrogen yield was 800-900 mL H2/g-COD. Microbial community analysis of electrohydrogenesis by DGGE shows that exoelectrogens belong to Acidiphilium sp., Geobacter sulfurreducens and Thermincola sp. were dominated at anode. These results show two-stage thermophilic fermentation, and electrohydrogenesis process improved hydrogen production performance with high hydrogen yields, high gas production rates and high COD removal efficiency.

Keywords : cassava starch processing wastewater, biohydrogen, thermophilic fermentation, microbial electrolysis cell
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