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**Electron flow of biological H<sub>2</sub> production by sludge under simple thermal treatment: Kinetic study**

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**Abstract**

Mixed culture sludge has been widely used as a microbial consortium for biohydrogen production. Simple thermal treatment of sludge is usually required in order to eliminate any H<sub>2</sub>-consuming bacteria that would reduce H<sub>2</sub> production. In this study, thermal treatment of sludge was carried out at various temperatures. Electron flow model was then applied in order to assess community structure in the sludge upon thermal treatment for biohydrogen production. Results show that the dominant electron sink was acetate (150–217 e<sup>-</sup> meq/mol glucose). The electron equivalent (e<sup>-</sup>) eq balances were within 0.8–1.8% for all experiments. Treatment at 100 degrees C attained the highest H<sub>2</sub> yield of 3.44 mol H<sub>2</sub>/mol glucose from the stoichiometric reaction. As the treatment temperature increased from 80 to 100 degrees C, the computed acetyl-CoA and reduced form of ferredoxin (Fd<sub>red</sub>) concentrations increased from 13.01 to 17.34 e<sup>-</sup> eq (1.63–2.17 mol) and 1.34 to 4.18 e<sup>-</sup> eq (0.67–2.09 mol), respectively. The NADH(2) balance error varied from 3 to 10% and the term e<sup>-</sup> (Fd<sub>red</sub> ↔ NADH(2)) (m) in the NADH(2) balance was NADH(2) consumption (m = -3). The H<sub>2</sub> production was mainly via the Fd-hydrogenase system and this is supported with a good NADH(2) balance. Using the modified Gompertz model, the highest maximum H<sub>2</sub> production potential was 1194 ml, whereas the maximum rate of H<sub>2</sub> production was 357 ml/h recorded at 100 degrees C of treatment.

**Keywords**

**Author Keywords:** Biohydrogen; Electron flow model; H<sub>2</sub> yield; Kinetic model; Stoichiometry  
**Keywords Plus:** BIOHYDROGEN PRODUCTION; HYDROGEN PRODUCTION; BIO-HYDROGEN; WASTE-WATER; ACID-PHASE; FERMENTATION; GLUCOSE; METABOLISM; BIODESEL; METHANE

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