

Supachok Tapananont 2009: Biohydrogen Production from Wastewater Sludge in a Recycle Paper Mill. Master of Science (Environmental Technology and Management), Major Field: Environmental Technology and Management, Department of Environmental Science. Thesis Advisor: Miss Prapaipid Chairattanamanokorn, D.Eng. 104 pages.

Hydrogen is an alternative and environmental friendly fuel capably substituting fossil fuels. The objective of this study was to define the suitable culture condition for the hydrogen production from sludge of a wastewater in a paper mill. The sludge contained cellulose, which can be used as a substrate for cellulase and hydrogen production. Cellulase could be produced from agricultural residues and also the sludge by *Trichoderma reesei* (TR) and *Phanerochaete sp.* (PC). The anaerobic fermentation of sludge that was pretreated and hydrolyzed with the crude cellulase was conducted to produce hydrogen. The highest production of cellulase under solid state fermentation on rice straw and rice bran with TR (TR-Cs) at pH 6 was  $2.90 \pm 0.02$  FPU/g and that on the sludge and rice bran with PC (PC-Cs) at pH 5 was  $1.53 \pm 0.07$  FPU/g. Pretreatment of the sludge with 3% NaOH for 2 hr. and hydrolysis with 5 FPU/g of TR-Cs and PC-Cs at 50°C and pH 4.8 for 24 hr. provided the highest concentration of reducing sugar at  $912.18 \pm 3.77$  and  $746.82 \pm 11.32$  mg/L, respectively. Moreover, the pretreatment with 3% NaOH under high temperature (121°C) before the enzymatic hydrolysis with TR-Cs and PC-Cs promoted the production of reducing sugar to  $1590.06 \pm 14.44$  and  $1447.05 \pm 52.97$  mg/L, respectively. The fermentation with heat-shock sludge of pretreated and enzymatic hydrolyzed pulping sludge (3.5%) and paper residue (0.5%) under the ratio of carbon and nitrogen (C/N) at 40, pH 6 and 37°C for 216 hr produced the highest hydrogen yield ( $7.23 \pm 0.11$  mmol/g cellulose).

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Thesis Advisor's signature

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