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Project Title : Study of hydrogen gas production from crude glycerin produced from palm-biodiesel manufacturing

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Hydrogen production from the anaerobic fermentation of crude glycerin is studied in order to value-add the surplus glycerin by-product from biodiesel process. Crude glycerin (CG) from biodiesel production is partially cleaned up and fed to the anaerobic fermentations by *Enterobacter aerogenes* and a mixed culture of microorganisms (from an industry biogas production unit). The contaminant removed from CG is a mixture of matter organic non-glycerin (MONG) that can reduce the efficiency of converting crude glycerin to value-added products. Removing MONG from CG can be simply and inexpensively done by the acidification of CG resulting in a MONG recovery of 75% and CGMR (Crude glycerin with MONG removed) with a MONG content of 6.43%. From the anaerobic fermentations, the effect of substrate inhibition is found. Ethanol is the main product from the fermentation by *E. aerogenes*. When refined glycerin and CGMR are used with the initial glycerin concentration of less than 30 g/l, the anaerobic digestions by *E. aerogenes* produce comparable results of glycerin conversion and ethanol yield. However, glycerin initial concentration of 10g/l is required to achieve a glycerin conversion of higher 90%. The fermentation of CG does not give competitive experimental results. Meanwhile, the fermentation of CGMR by a mixed culture of microorganisms is studied with an initial glycerin concentration of about 12 g/l in tap water and no additional supplement nutrition is applied. As a result, the hydrogen yield can be increased by 7.25 times and hydrogen content in the gas product is enhanced to about 83% when sludge is heat-pretreated before use. The maximum hydrogen yield obtained is 0.0029 g H_2/g glycerin when the heat-pretreatment can enrich the hydrogen-producing bacteria. In conclusion, the fermentation of CGMR introduces the possibility of using CGMR in the biological process of converting glycerin to value-added products. Furthermore, if the recovered MONG is a regained biodiesel feedstock, use of CGMR will help increase the efficiency of natural resource usage.