

Special Research Project Title	Study the Effect Chemical Pretreatments for Sugars Production from Thai Bagasse
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Abstract

Sugarcane bagasse is a commercial lignocellulosic material that is rich in cellulose, which can be hydrolyzed into glucose sugar. Moreover, the hemicellulose is the polysaccharide composed of varied type of monomer, which can be hydrolyzed into the monomeric sugar such as xylose, glucose and arabinose etc. However, lignin is an aromatic polymer that is considered to be the physical barrier of enzymatic hydrolysis. Therefore, this composition would be removed from the lignocellulosic bagasse before the hydrolysis and fermentation step. The acid/alkaline pretreatment is applied for the pretreatment method of this thesis. The effects of sodium hydroxide (NaOH) (1-5 % w/v), Potassium hydroxide (KOH) (1-5 % w/v), sulfuric acid (H₂SO₄) (1-5 % v/v) and hydrochloric acid (HCl) (1-5 % v/v), temperature (105-130 °C) and reaction time (30 – 90 min) were studied in this experiment. The concentration of sugar products, furfural, hydroxymethylfurfural (HMF) and acetic acid were analyzed by using the High Performance Liquid Chromatography (HPLC) and the soluble lignin was analyzed through UV – visible spectrophotometer while the pretreated solid was analyzed by using the TAPPI method. The response surface methodology was applied in the part of Design of Experiment (DoE) and used for comparing the results between different chemical groups. The experimental result was analyzed by Analysis of Variance (ANOVA) to determine the significant effects of parameters. From the experimental results, the acid pretreatment was the most proper method for removing the hemicellulose from bagasse in the form of xylose sugar whereas the alkaline pretreatment was efficient for lignin removal. The RSM result revealed that 3% v/v HCl at 105 °C for 30 min was the suitable condition that gave the highest concentration yield of xylose as 31.39 g/l while 82.50 g/l of soluble lignin was derived from 5% w/v KOH at 115 °C for 90 min. Finally, the efficiency of each chemical pretreatment for glucose production was determined by enzymatic hydrolysis and the highest yield of glucose sugar was derived from the bagasse that pretreated by 5% NaOH at 130 °C for 90 min as the concentration of 19.31 g/l. For these reasons, the lignin composition is considered to be the main physical barrier for glucose production from enzymatic hydrolysis. The findings of this thesis represent an effective pretreatment method for removing lignin,

which can help to improve the efficiency of glucose production from hydrolysis process.

Keywords: Lignocellulosic/ Sugarcane bagasse/ Alkaline/acid Pretreatment/ Response surface methodology/ Analysis of variance (ANOVA)/ Enzymatic hydrolysis