Nanthaya Chumchuen 2009: Conversion of Sugarcane Bagasse to Ethanol by Steam Explosion Process. Master of Science (Chemistry), Major Field: Chemistry, Department of Chemistry. Thesis Advisor: Associate Professor Vittaya Punsuvon, Ph.D. 111 pages.

Due to high carbohydrate content (41.02% glucose and 34.60% xylose), sugarcane bagasse were often used as feedstock for ethanol production. The purpose of this work was to evaluate the effectiveness of two-step steam explosion pretreatment on sugarcane bagasse fractionation prior to the conversion into ethanol. The condition for the first steam explosion was optimized in order to remove most of hemicellulose as well as to alter bagasse structure. The severity factors, related to reaction temperature and residence time, were varied from 3.95 to 4.16. The best pretreatment was obtained at severity factor 3.96 when 53.55% of water insoluble fraction was recovered. This consisted of 56.51% cellulose, 6.54% xylose and 28.47% lignin, which after that was subjected to the second steam explosion. In this step, the solid residue was primarily impregnated in various concentrations of sulfuric acid (0.051, 0.102, 0.153 and 0.204 M). The 33.33% dry weight of soaking material was carried out in a steam explosion unit with severity factors of 3.64 and 3.94. In the production of ethanol, the substances for ethanol fermentation were compared. The solid from the first steam explosion was converted to ethanol through the SHF and SSF processes. The best ethanol yields from SHF and SSF processes were 10.70% and 11.89%, respectively. Liquid fraction from the second steam explosion pretreatment was fermented to ethanol. The best ethanol yield of 5.28% on bagasse basis was obtained. However, the SSF process was also applied on the mixture of liquid and solid fraction. This process provided the best ethanol yield as 11.73%. Thus, it could be concluded that the additional steam explosion pretreatment did not significantly improve the ethanol yield.

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