ABSTRACT

Lignocellulosic biomass is a source of bioethanol which is very abundant and friendly to the environment. Bioethanol is obtained after the lignocellulosic biomass is converted through a biorefinery process. The biorefinery process is consisting of three stages: pretreatment, enzymatic saccharification, and fermentation. From the three stages, relatively high funding and a relatively long time in experimental research are required. Therefore, this research aims to optimize bioethanol production from a biorefinery in the form of a simulation using SuperPro Designer (SPD) software. The SPD simulation model at each stage of the process refers to published experimental research, with the simulation data validated at each stage against the data from the research. Then examined and searched for the optimum ethanol production in bagasse biomass, Empty Fruit Bunch (EFB) and Oil Palm Frond (OPF) using Ionic Liquid (IL) choline acetate (ChOAc) pretreatment with a range of IL to biomass ratio from 0 to 3 (g/g). The results showed the minimum ratio of IL into bagasse biomass, EFB, and OPF to get the optimum ethanol is 1.5. In the high-loading enzymatic process stage (100 g/L) on bagasse biomass, EFB, OPF each obtained glucose concentrations of 56.42 g/L, 64.13 g/L, 45.88 g/L, and xylose concentrations of 14.34 g/L, 14.19 g/L, 18.52 g/L. At the fermentation stage, the results obtained were a mixture of initial sugars in the form of glucose and xylose, then theoretical ethanol and ethanol yield concentrations, respectively, on bagasse biomass 26.65 g/L, 6.67 g/L, 15.52 g/L and 99. 37%, at EFB 28.95 g/L, 6.41g/L, 15.34 g/L and 99.85%, at OPF 20.85 g/L, 8.42 g/L, 15.11 g/L and 97.64%. From the data obtained, the biorefinery process can be further optimized by using SPD simulation, so that bioethanol can be produced from various biomass before carrying out heavy experimental research.

Keywords : **Bioethanol, Biomass, Choline Acetate, Optimization, SuperPro Designer**