DEDI WAHYUDI. Process Design of Bioethanol Dehydration Using Zeolite Molecular Sieve by Vacuum Swing Adsorption Technique. Under direction of DWI SETYANINGSIH and MUHAMMAD ARIF YUDIARTO.

Bioethanol is produced by fermentation of glucose with microorganism and followed by distillation. Distillation process can produce technical grade ethanol with concentration of $\leq 95\%$-v. To get Fuel Grade Ethanol (FGE), degree of $\geq 99.5\%$-v is required dehydration process. There are a lot of development on bioethanol dehydration techniques, however the productivity is still not efficient and effective. Therefore, a process design is need to improve the system operation for more user-friendly and productive. This research aims are to obtain design of dehydration process of bioethanol by Vacuum Swing Adsorption (VSA) technique which can produce FGE and to set up optimum condition of dehydration process. The research also included quality comparison of ethanol which was adsorption with two adsorbers. The type of Zeolite Molecular Sieve (ZMS) applied in this study was synthetic 3Å zeolite and modified natural zeolite. Furthermore, the concentration of ethanol feed for trial run was 90 and 95%-v with the adsorption-desorption vacuum pressure of 10, 20, and 30 cm.Hg. The results showed that the dehydration of bioethanol by VSA can increase ethanol purity from 90 to 95%-v or technical grade to fuel grade. It can be concluded that the optimum condition for VSA dehydrator is at minimum vacuum pressure of 20 cm.Hg, the ethanol feed concentration of 95%-v, and temperature of 80$^\circ$C. Time for starting at produce volume of 1.93 liter for synthetic ZMS and 1.63 liter for modified natural ZMS. Synthetic ZMS was more stable at three times adsorption-desorption cycle than modified natural ZMS.

Key words: bioethanol, zeolite molecular sieve, vacuum swing adsorption, fuel grade ethanol, dehydration.