Modeling and Optimization Study on Pressure Swing Distillation for the Separation Process of Acetone-Methanol Mixture and Vapor-Liquid Equilibrium Experimental Study

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Azeotropic point of acetone-methanol binary system varies sensitively depending on pressure change. This principle was applied to obtain pure acetone and methanol using 2 columns operated in sequence at two different pressures. This separation process is known as pressure-swing distillation (PSD). This study focused on the modeling and optimization of PSD process for the separation of the azeotropic mixture of acetone-methanol. The proper thermodynamic model to be used in the simulation was selected based on the prediction of the liquid activity model which gives the best fit for the vapor-liquid equilibrium experimental data of the involved binary system. For the simulation works, PRO/II was utilized to create a model of PSD using two column configurations, a low-high pressure (LP+HP) and a high-low pressure (HP+LP) column configuration. The optimum number of theoretical stages, reflux ratios and feed stage locations were determined for the LP column and HP column to minimize heat duty. Since PSD operated at different pressures, hot and cold utility consumption is quite large, thus, heat integration was applied to the system.