Simulation of Pressure-swing Distillation of Ethyl Acetate-Ethanol-Water

ABSTRACT

I am proposing a process of Pressure-Swing Distillation of the azeotrope of ethyl acetate-ethanol-water. The separation process is simulated by DWSIM and the effects of stages, reflux ratio, feed stage are observed and thus optimized. The Pressure of first column is 500 kPa, theoretical number of stages are 16, feed stage is 5, reflux ratio is 0.6; for second column Pressure is 101.325 kPa, theoretical number of stages are 15, reflux ratio is 0.3, feed stage is 4. The mole fraction of ethyl acetate at the bottom of the first tower is 0.9990. The mole fraction of ethanol coming out from the second tower is 0.9800.

NTRL is the chosen thermodynamic model, and the related binary interaction parameters are shown in Table 1.

Table-1. NRTL binary interaction parameter.

Component-1	Component-2	A-ij	A-ji	a-ij
Ethyl acetate	Ethanol	1278.65	1382.86	0.2988
Ethyl acetate	Water	5380.57	6719.58	0.4393
Ethanol	Water	-242.505	5195.44	0.2937

Azeotropic composition of ethyl acetate-ethanol-water at 101.325 and 500 kPa are shown in Table 2.

Table-2. Azeotropic mass(%) composition.

Pressure (kPa)	**Ethyl acetate**	**Ethanol**	**Water**
500	**58.54**	**41.37**	**0.09**
101.325	**77.69**	**14.04**	**8.27**

The process of pressure-swing distillation for separation of ethyl acetate-ethanol-water is simulated by DWSIM.

Table-3. Optimal parameters for the pressure-swing distillation for ethyl acetate-ethanol-water.

Column	Pressure (kPa)	Stages	Feed stage	Reflux ratio
HPC	500.000	16	5	0.6
LPC	101.325	15	4	0.4