Pressure Swing Distillation for separating minimum-boiling azeotrope ethyl-acetate and ethanol

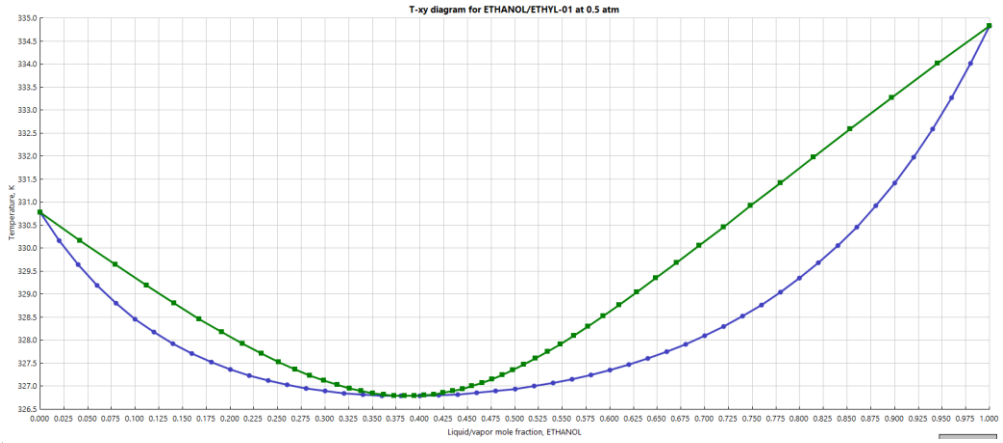
Problem Statement

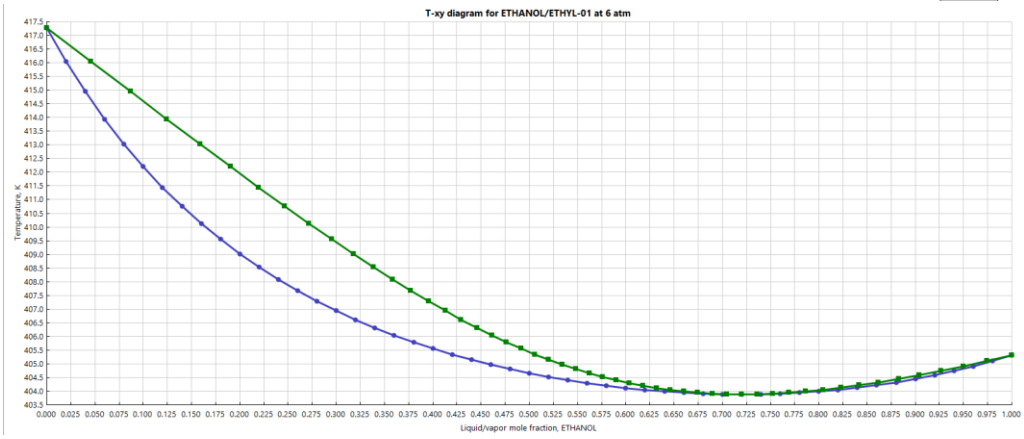
Separation of a 100 kmol/hr Ethyl-acetate and ethanol mixture containing 50 % mol fraction EA.

Introduction

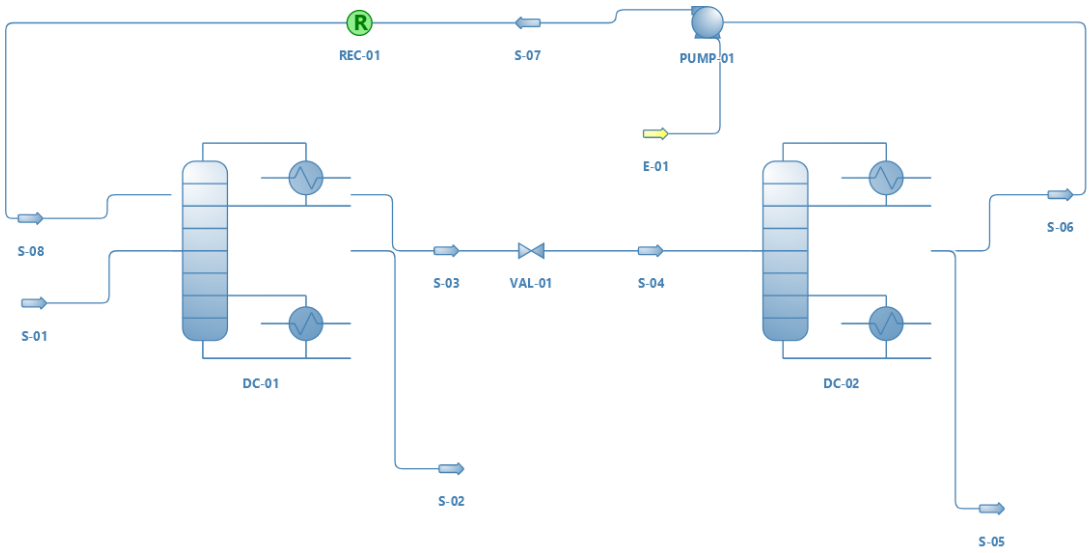
Ethyl acetate (EA) and ethanol (ETOH) are both essential raw materials and solvents widely used in the chemical industry due to their excellent solubility. However, it remains a significant challenge to effectively separate their mixtures since the presence of minimum boiling azeotrope at composition and temperature of 55.55 mol percent EA and 344.96 K at the atmospheric pressure (101325 Pa) respectively. Pressure swing distillation is a commonly used process to separate azeotropic mixtures whose compositions are pressure sensitive.

Azeotropic Data





Flowsheet Description



The feed (50 % mol fraction EA) and recycle enters the HPC at stages 44 and 47, respectively. The bottoms product obtained is 99.996% mol fraction ethyl acetate. The distillate S-04 is then fed into LPC in stage 15, and the bottom product obtained (S-05) is 99.996 % mol fraction EA. The distillate obtained is then recycled back with the feed in HPC.

Results

Material Streams				
Object	S-01	S-02	S-05	
Temperature	320	416.824	334.894	K
Pressure	607950	607950	50662.5	Pa
Molar Flow	27.7778	13.8889	13.8889	mol/s
Molar Fraction (Mixture) / Ethyl acetate	0.5	0.996	0.004	

References

https://www.sciencedirect.com/science/article/pii/S1383586617313023?via%3Dihub