Pressure Swing Distillation for the Separation of Methyl Acetate-Methanol Azeotrope

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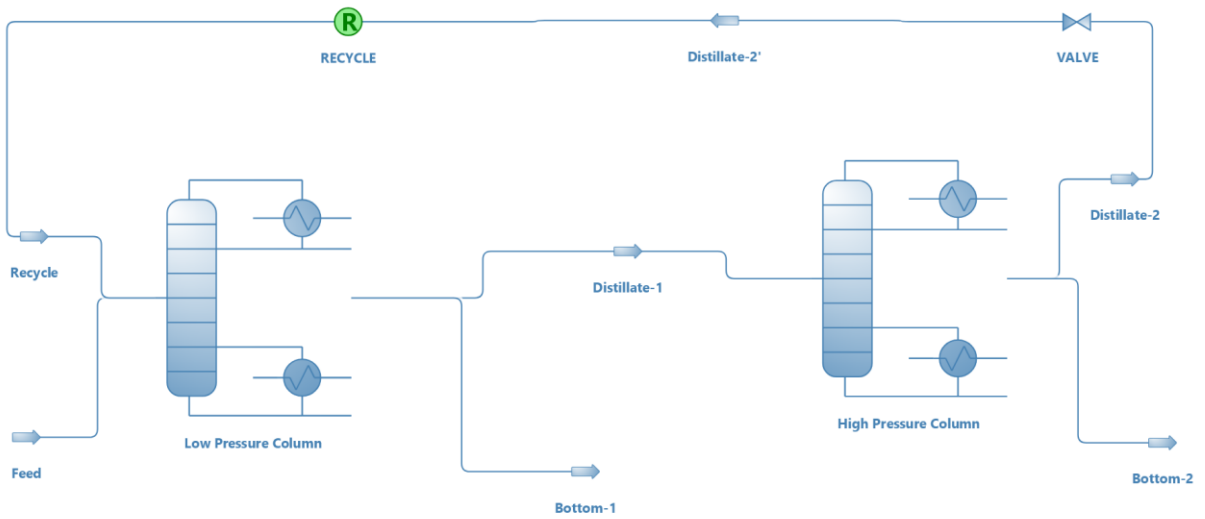
Background & Description:

In order to separate azeotropic mixture of Methly Acetate and Methanol, Pressure Swing Distillation is used. The main advantage of this distillation technique is the effective separation of azeotropic mixture without adding a third component. The Azeotrope is sensitive to pressure. That is why we use changes in pressure to separate methyl acetate and methanol.
Units used- atm for pressure, C for temperature and mass flowrate in kg/h
Here, the flow rate of the feed flow is 1000kg/h and its composition is 69.8 wt% methyl acetate and 30.2 wt% methanol. Two colums are used. The feed is fed into low pressure column which has the reflux ratio of 1.00. The pressure of this column is 1 atm, theoretical number of stages are 34, and feed stage is at 23. There are two product streams obtained from the column. Distillate-1 is fed into high pressure column with 2.4 reflux ratio. The pressure of this column is 9 atm, theoretical number of stages are 27, and feed stage is at 16. Bottom-1 contains methanol in high concentration. The high pressure columns gives two streams: Distillate-2 is recycled with the help of recycler(RECYCLE) while Bottom-2 contains methyl acetate in high concentration.

***Parameters used for separation of Methyl Acetate-Methanol mixture**

Column	Pressure(atm)	Reflux Ratio	No. of stages
LPC	1	1	34
HPC	9	2.4	27

Flowsheet:



Results:

FEED		
Temperature	25	C
Pressure	1	atm
Mass Flow	1000	kg/h
Molar Flow	18.8465	kmol/h
Mass Fraction (Mixture) / Methyl acetate	0.698061	
Mass Fraction (Mixture) / Methanol	0.698061	
Volumetric Flow	1.17274	m3/h

Bottom-1		
Temperature	64.5404	C
Pressure	1	atm
Mass Flow	287.587	kg/h
Molar Flow	8.9636	kmol/h
Mass Fraction (Mixture) / Methanol	0.997691	
Molar Fraction (Mixture) / Methanol	0.999	
Volumetric Flow	0.383249	m3/h

Bottom-2		
Temperature	132.685	C
Pressure	9	atm
Mass Flow	700.423	kg/h
Molar Flow	9.46051	kmol/h
Molar Fraction (Mixture) / Methyl acetate	0.999	
Mass Fraction (Mixture) / Methyl acetate	0.999567	
Volumetric Flow	0.925849	m3/h

So, with the help of pressure swing distillation, methyl acetate-methanol azeotropic mixture can be separated under parameters mentioned in the description.

Reference- Pressure Swing Distillation for the separation of Methyl Acetate-Methanol azeotrope by Keliang Wang, Jing Li, Ping Liu, Minglei Lian, Tingzhaou Du (https://doi.org/10.1002/apj.2319)