Extractive Distillation of Pervaporation Process for Dehydration of 1 Propanol.

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Unit System:

1. Temperature: Celsius (°C)
2. Pressure: atm
3. Molar Flow: Kmol/h
4. Mass Flow: Kg/h
5. Volumetric Flow: m^3/h
6. Other units are in SI units

❖ Background

N-Propanol (NPA) is a very important solvent and organic synthesis intermediate. It can be used to synthetize biodiesel which helps to reduce greenhouse gas emissions. NPA also has important applications in medicine, coating, and other fields. n-Propanol, as an important chemical raw material, is used as a solvent and intermediate in chemical industrial production and drug synthesis. In chemical production, alcohol and water easily form an azeotrope which is difficult to separate. A method of dehydration of n-propanol by pervaporation-assisted extractive distillation is proposed. Glycerol is selected as entrainer by quantum chemical calculation.

❖ Description of Flowsheet

The flowsheet contains two distillation columns named as "DC-01" and "DC-02". "DC-01" has 59 trays and 51st tray is the feed location for feed "S-01" and 5th stage is the feed for solvent. "DC-02" has 10 trays and 4th tray is the feed location for the feed "S-03". Glycerol has been used as an entrainer. "COOL-01" act as condenser for the column "DC-02". Then Solvent is sent to the 5th tray of column "DC-01".

Pure 1-Propanol of **99.07%** purity is obtained in column "DC-01" and water of **99.45%** purity is obtained in "DC-02". The bottom product of column "DC-02" containing glycerol which act as a solvent feed for the column "DC-01" is recycled and cooled with "COOL-01"

❖ Flowsheet
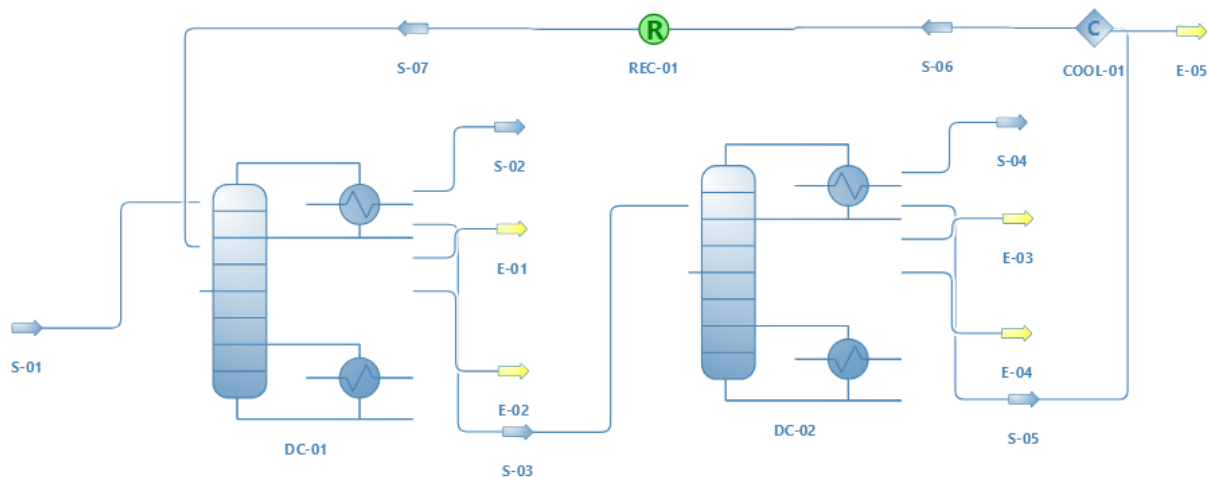
❖ Result

Master Property Table								
Object	S-07	S-06	S-05	S-04	S-03	S-02	S-01	
Temperature	65	65	300.951	97.7573	162.397	96.7688	65	C
Pressure	1	1	1	1	1	1	1	atm
Mass Flow	16569	16569	16569	1093.71	17662.7	2391.01	3484.72	kg/h
Molar Flow	179.929	179.929	179.929	59.9523	239.881	40.0477	100	kmol/h
Volumetric Flow	13.5503	13.5503	8475.83	1.14142	16.3574	3.25737	3.95689	m3/h
Molar Fraction (Mixture) / 1-propanol	2.74194E-07	2.74194E-07	2.74194E-07	0.0054106	0.00135245	0.990709	0.4	
Molar Fraction (Mixture) / Glycerol	0.9999	0.9999	0.9999	8.14181E-11	0.75	1.97901E-13	0	
Molar Fraction (Mixture) / Water	9.97258E-05	9.97258E-05	9.97258E-05	0.994589	0.248648	0.00929072	0.6	

❖ Reference

https://pubs.acs.org/doi/abs/10.1021/acssuschemeng.0c00263