

Triple Column Pressure Swing with Extractive Distillation for Methyl Acetate-Methanol-Water Separation

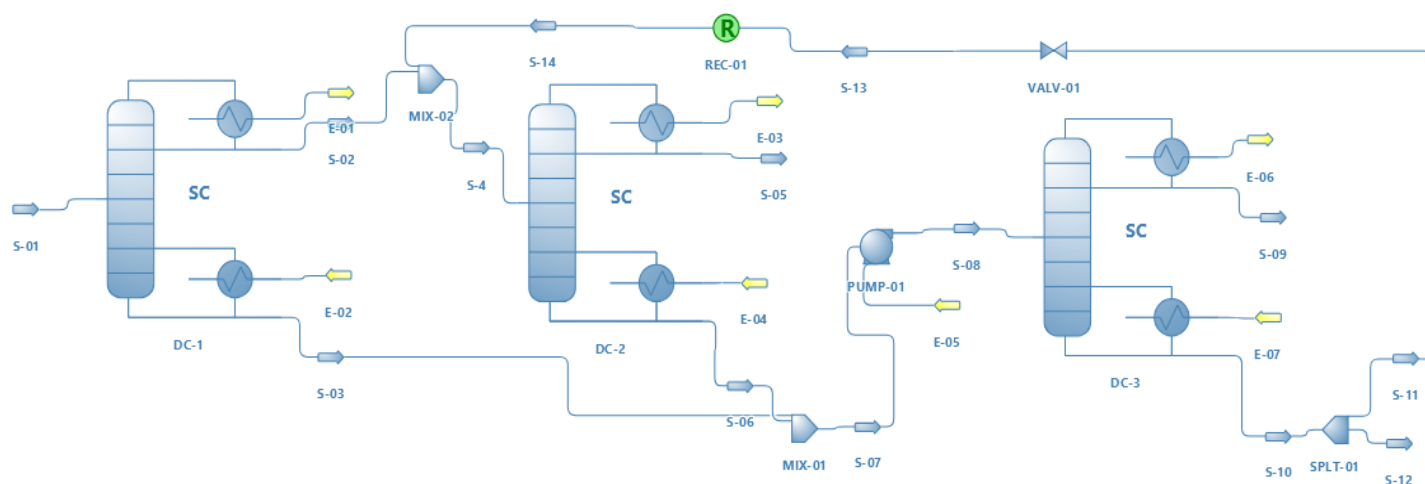
Ankita Karkera
Manipal Institute of Technology

Background & Description:

Methyl acetate and methanol are widely used as effective organic solvents in pharmaceutical and chemical industries owing to their excellent physicochemical properties. Methanol, methyl acetate, and water mixture form more than one different azeotrope, while its triangular diagram presents a distillation boundary at atmospheric pressure. Distillation is the most extensively used separation process in various chemical industries, but pressure-swing distillation and extractive distillation are the most common methods for separation of a binary homogeneous azeotrope. The simulation processes of the triple column pressure-swing with extractive distillation (TCPSED) were performed to separate this complex ternary system on DWSIM.

The mixture is fed at 3500 kg/h with the molar fraction of 0.45 methyl acetate, 0.45 methanol, and 0.15 water into the first column. The pressure of the first two, low-pressure columns is set at 20 kPa and the third, high-pressure column at 75 kPa. The solvent chosen for this unit operation is water and the solvent ratio is set to be 0.2. The solvent and azeotropic distillate from the first column is fed into the second low-pressure column. High purity methyl acetate (99.83%) is separated from the top of the second column whereas high purity methanol (99.79%) purity is separated from the top of the third column. The water separated from the bottom of the third column can be recycled as the solvent was added to the second column.

Flowsheet:



Results:

Property	S-09	S-05	S-01 (Feed)	
Temperature	330.178	290.272	292.642	K
Pressure	75	20	20	kPa
Mass flow	920.906	2385.17	3500	kg/h
Molar flow	7.96194	8.95233	19.9004	mol/s
Volumetric flow	67.851	412.683	3.9747	m ³ /h
Molar Fraction of methyl acetate	0.0020676	0.998526	0.45	
Molar Fraction of methanol	0.997932	0.00147361	0.4	
Molar fraction of water	1E-08	1.10144E-08	0.15	