Reactive Distillation method for Production of n-Propyl Acetate

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Introduction and Background:

As a favorable organic solvent, n-Propyl Acetate is widely used in many fields. This clear, colorless liquid is known by its characteristic odor of pears. Due to this fact, it is commonly used in fragrances and as flavor additive. It is commonly formed by the esterification of Acetic acid and 1- Propanol (known as condensation reaction). The transesterification of Methyl Acetate and 1- Propanol can be expressed as follows:

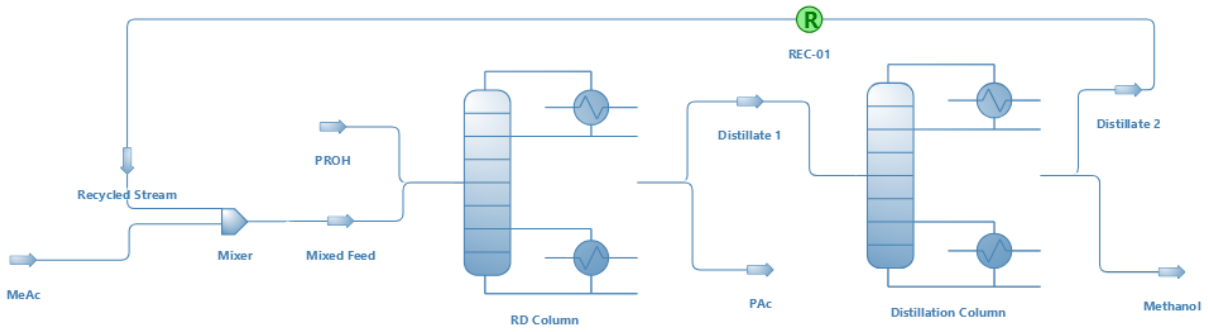
MeAc+ PROH $\longleftrightarrow$ PAc + MeOH

This is a Pseudo Homogeneous reversible reaction which is catalyzed by strongly acidic ion exchange resin Amberlyst-15.

Description of the flowsheet:

Here we are using two column, one reactive distillation column and other, simple distillation column with pressure 1 atm each. In the first column, esterification reaction takes place between Methyl Acetate and 1- Propanol to form n-Propyl Acetate and Methanol. There are 74 stages in first column. Feed enters at stage number 38 and 68 and reaction takes place between stage 38 and 68. Here, we are getting 99.5 mol% PAc as residue. The distillate having Methanol with methyl acetate is fed to 14^{th} stage of a distillation column having total 24 stages. We are getting almost pure Methanol as residue and the distillate is recycled.

Flowsheet Diagram:



Results:

Master Property Table									
Object	Recycled Stream	PROH	PAc	Mixed Feed	Methanol	MeAc	Distillate 2	Distillate 1	
Molar Flow	53.6627	50	50	103.662	49.9997	50	53.6627	103.662	kmol/h
Molar Fraction (Mixture) / Methyl acetate	0.345583	0	0.000230659	0.659304	1.24878E-05	1	0.345583	0.178903	
Molar Fraction (Mixture) / 1-propanol	2.97558E-09	1	0.00340281	1.55792E-08	0.000838497	0	2.97558E-09	0.000404435	
Molar Fraction (Mixture) / N-propyl acetate	2.3059E-06	0	0.995826	4.3141E-05	1.88169E-05	0	2.3059E-06	1.02697E-05	
Molar Fraction (Mixture) / Methanol	0.654415	0	0.000540453	0.340653	0.99913	0	0.654415	0.820682	