Effect of Distillation column sequence on the separation of Methanol, Ethanol and 1-propanol

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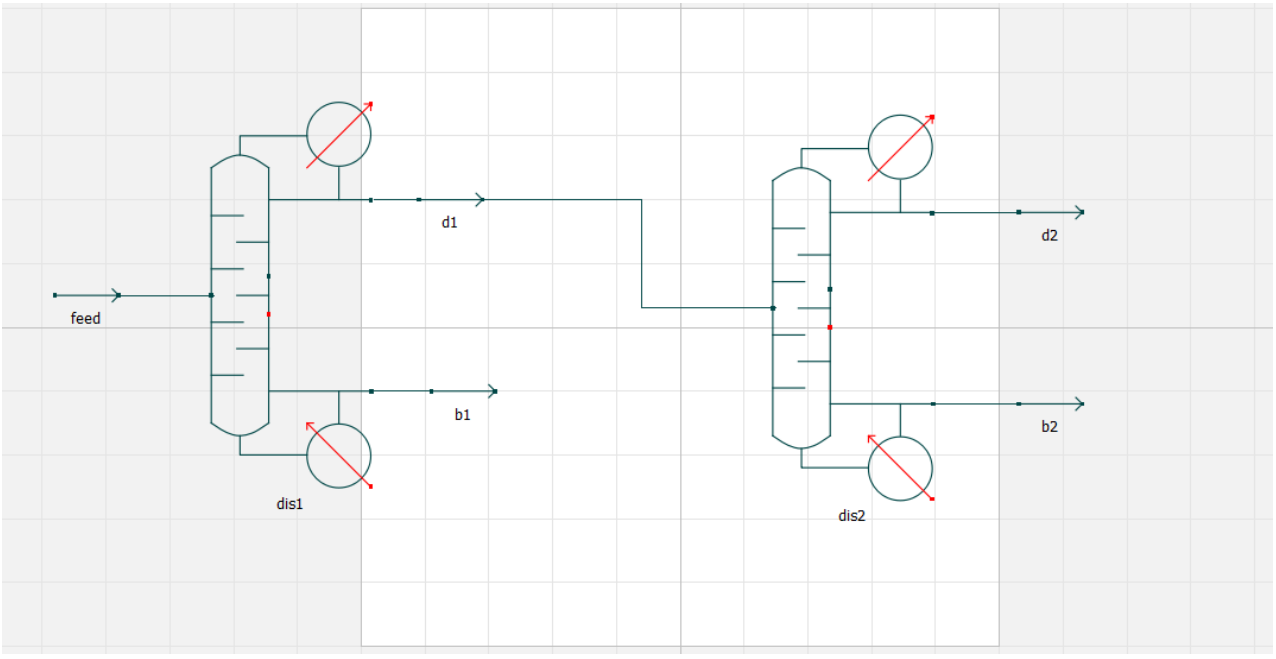
Background & Description:

Distillation is one of the most common and energy-intensive separation processes. These are used extensively in various chemical processes to separate components from mixtures. In these processes the feed usually contains more than two components. The distillation columns are placed in series where at each column a component is desired to be separated from the mixture based on their relative volatility. For streams containing more than 2 components, there could be more than a one way to sequence and separate the components. Therefore, the sequencing of distillation columns plays a major role in designing the separation process. In this work, two different sequences of distillation columns are simulated to separate a mixture containing aliphatic alcohols namely Methanol, Ethanol and 1-propanol and the results are compared to draw meaningful conclusion.

Flowsheet:



Results:

1) DWSIM Output

Output D1

PROPERTIES TABLE		
Ethanol-Methanol	Molar Fraction (Mixture) / Ethanol	0.55980689
Ethanol-Methanol	Molar Fraction (Mixture) / Methanol	0.42823599
Ethanol-Methanol	Mass Fraction (Mixture) / 1-propanol	0.017861737

Output D2

PROPERTIES TABLE		
Methanol-out	Molar Fraction (Mixture) / Ethanol	0.017888033
Methanol-out	Molar Fraction (Mixture) / Methanol	0.98211196
Methanol-out	Molar Fraction (Mixture) / 1-propanol	8.0012653E-09

Output B1

PROPERTIES TABLE		
Propanol-out	Mass Fraction (Mixture) / Ethanol	0.020575268
Propanol-out	Mass Fraction (Mixture) / Methanol	0.00022639757
Propanol-out	Mass Fraction (Mixture) / 1-propanol	0.97919833

Output B2

PROPERTIES TABLE		
Ethanol-out	Molar Fraction (Mixture) / Ethanol	0.96874936
Ethanol-out	Molar Fraction (Mixture) / Methanol	0.010270449
Ethanol-out	Molar Fraction (Mixture) / 1-propanol	0.02098019

2) OpenModelica Output

COMPONENT	B1	D1	B2	D2
ETHANOL	0.0255435	0.560177	0.96951	0.0173469
METHANOL	0.000224203	0.428232	0.0100768	0.982653
1-PROPANOL	0.974232	0.0115906	0.0203324	1.68358e-08