Effect of Thermodynamic Models on Separation of Aromatic Compounds

using Distillation Column

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Background & Description:

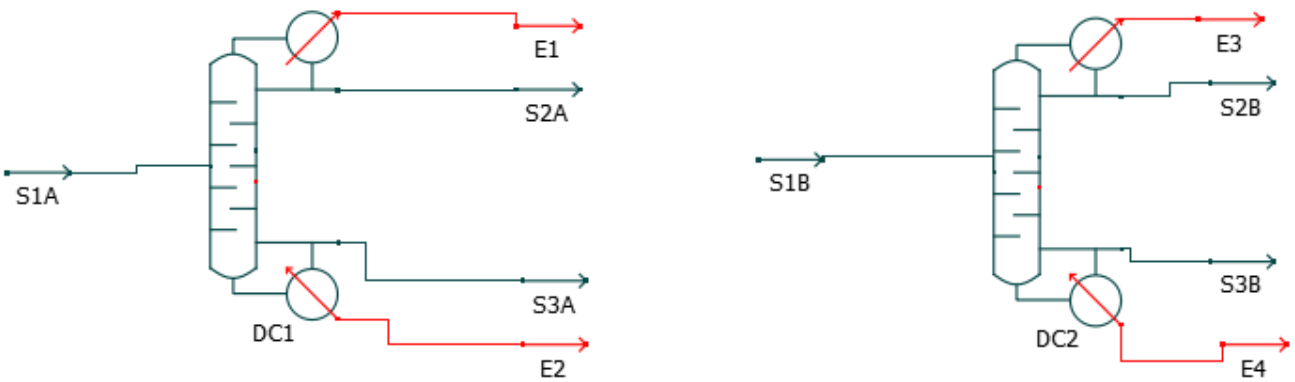
Background

Thermodynamic behavior of components is an integral part of design of a separation process.For instance, design and operation of distillation column primarily depends on how
accurately the phase equilibrium of the components of the solution is estimated. A process
engineer should assess whether the given mixture containing components behave ideally or is non-ideal.If the system is found to be non-ideal, then one has to choose appropriate thermodynamic model to estimate the phase equilibrium data. In this work a simple distillation process was simulated with two different thermodynamic models, namely Raoult's Law (ideal system) and Peng-Robinson (PR) model (one of the non-ideal models) to illustrate that thermodynamic models play a significant role in distillation column design.

Description of Flow Sheet

A feed containing equi-molar mixture of benzene and chloroform was fed to a distillation column at 25°C. Chloroform was obtained as distillate and Benzene was obtained as the bottom product. Two separate sequences of the flow sheet was developed, such that in one case, ideal Raoult's law was employed and in another case, Peng-Robinson model was employed.

Flowsheet:



Results:

DWSIM

Object	Distillation column-A	Distillation column-A	
Condenser Pressure	101325	101325	Pa
Reboiler Pressure	101325	101325	Pa
Reflux ratio	5.747956	4.9982226	
Number of stages	17	21	

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Object	Distillation column-A	Distillation column-A	
Condenser Pressure	101325	101325	Pa
Reboiler Pressure	101325	101325	Pa
Reflux ratio	5.75	5	
Number of stages	17	21	