
CL-402: Chemical Process Technology

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7th semester, Department of Chemical Engineering
Indian Institute of Technology Guwahati, Guwahati

Tutorial-4

Use Aspen Plus V8.8 to solve all the problems.

Problem-1: Rigorous Distillation Calculations: RadFrac

A feed consisting of 40 mol% propane and 60 mol% isobutane is to be separated by distillation. Feed flowrate is 1 kmol/s and the feed temperature is 322 K. Condenser is operating at 16.8 atm pressure while stage pressure drop is 0.0068 atm. Use CHAO–SEAD thermodynamic model. Assume that the specification of the heavy impurity in the distillate (isobutane) is 2 mol% and that the specification of the light impurity in the bottoms (propane) is 1 mol%.

- Design a distillation to accomplish the separation i.e. find number of stages, feed stage, diameter and height of the column.
- Investigate the effect of feed stage on reboiler heat duty.
- Perform the steady-state economic optimization of the distillation column based on total annual cost (TAC) using the following data:

Parameter	Value
Condensers	
Heat Transfer Coefficient	0.852 kW/K.m ²
Differential Temperature	13.9 K
Capital Cost	7296 (area in m ²) ^{0.65}
Reboiler	
Heat Transfer Coefficient	0.568 kW/K.m ²
Differential Temperature	34.8 K
Capital Cost	7296 (area in m ²) ^{0.65}
Column Vessel Capital Cost	17640 [diameter (D) in meters] ^{1.066} [length (L) in meters] ^{0.802}
Energy Cost	\$4.7/10 ⁶ kJ
