CL-402: Chemical Process Technology

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7th semester, Department Of Chemical Engineering

Indian Institute of Technology Guwahati

Tutorial-1

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

1: Develop a process flowsheet for the liquefaction of propane. The process starts with propane vapor at ambient conditions (298 K and 1 bar), which is compressed to 15 bar, cooled back down to 298 K, expanded through an adiabatic valve to 1 bar, and then the resulting gaseous and liquid streams are separated. Use Peng-Robinson equation of state as the thermodynamic model and consider no recycle of the gaseous stream

2: Repeat Problem 1 with Soave-Redlich-Kwong equation of state. Compare the compressor work required and the amount of liquefied propane produced with the values obtained using the Peng-Robinson equation.

3: Repeat Problem 1 with the Peng-Robinson equation of state using an increased compressor outlet pressure of 20 bar. Compare the compressor work required and the amount of liquefied propane produced with the operation at 15 bar.

4: All the previous examples were once-through calculation. Practically, it would not be acceptable to release the propane vapor leaving the separator to the atmosphere, as propane is explosive as well as valuable resource. A simple way to deal with this is to recycle the propane vapor back into the process by mixing it with the feed and returning it to the compressor. This would increase the flows of all the process streams, since they would now be the sum of the feed flow and the recycle flow, increase the work needed in the compressor, and affect the heat to be removed in the heat exchanger, but would have the advantage that only liquid propane would be produced in the process. Repeat Problem 1 with recycle calculation using the Peng-Robinson equation of state. Compare the compressor work required and the amount of liquefied propane produced against the once-through operation.