

Chemical Engineering 476  
Homework 26

1. CS<sub>2</sub> is to be removed from a N<sub>2</sub> stream by absorbing it into a hydrocarbon oil.

The inlet pressure of CS<sub>2</sub> = 50 mm Hg

The outlet concentration is  $y_{out} = 0.005$

Pressure of inlet stream = 1 atm

Raoult's law applies with the vapor pressure of 346 mm Hg (use to get your equilibrium line)

The initial concentration of CS<sub>2</sub> in the liquid is zero.

The inlet gas flow rate is 0.4 m<sup>3</sup>/s @ 24°C

The liquid flow rate should be 1.5 times the minimum.

Find the outlet composition of the liquid and the number of equilibrium stages required.

Hint: Is this a dilute system?

2. Please answer the following questions (see Sections 13.1 and 13.2 of your text):
- What is liquid/liquid extraction (please define)?
  - Give two or three examples of industrial processes that use extraction.
  - Be familiar with the heuristics on p. 500. Why do you think that systems that apply mechanical energy are recommended for processes that require more than five equilibrium stages?
  - Examine the types of extractors in Table 13-1 and note a couple of things that you find of interest.
  - Why are the rules for selecting solvents changing? How might this impact you as a practicing engineer?
3. Please work Problem 13D.5 from your text. Use a McCabe Thiele diagram and then rework with use of the Kremser equation. Which method would you recommend? Why?
4. We have made use of composition specifications when we have used ChemCAD to design distillation columns. However, some simulation packages do not converge well with composition specs. Please design an atmospheric pressure distillation column to separate a 50/50 mixture of benzene and toluene (500 kmol/h) to a minimum of 98% purity. **Do not use a composition spec with the full distillation column simulation.** (You may use a recovery specification as usual for shortcut distillation calculations). With the reflux ratio and a flow rate specified, what happens to the temperature profile of the column as the reflux ratio is decreased? Why? Would the addition of more trays help in this situation?