Department of Chemical and Biological Engineering
University of Wisconsin-Madison
CBE 426 – Mass Transfer Operations
Fall 2019

Homework 10 — Due 11/15/2019

1. The equilibrium data for Water (A)-TCE (B)-Acetone(C) at 25°C, from Table 23.6 MSH, are transcribed below. Plot the data (including solubility curve and tie lines on a) an equilateral triangle diagram, b) a right-triangle diagram, and c) an x-y diagram for acetone. An equilateral grid is attached for convenience. Make copies as needed to answer questions 2-4

Water Layer (wt%)			Trichloroethane layer (wt%)		
TCE	Water	Acetone	TCE	Water	Acetone
0.4	99.6	0	99.9	0.1	0
0.52	93.52	5.96	90.93	0.32	8.75
0.73	82.23	17.04	73.76	1.10	25.14
1.02	72.06	26.92	59.21	2.27	38.52
1.17	67.95	30.88	53.92	3.11	42.97
1.60	62.67	35.73	47.53	4.26	48.21
2.10	57.00	40.90	40.00	6.05	53.95
3.75	50.20	46.05	33.70	8.90	57.40
6.52	41.70	51.78	26.26	13.40	60.34

2. A stream consisting of 100 kg/h of a 35:65 acetone-water solution is extracted in a single stage using with pure 1,1,2-trichloroethane at 25ºC to reduce the acetone content in the raffinate to 2% . How much TCE is needed?

3. The extraction is made in cross-current, adding pure solvent to each stage as follows: 0.5F kg of solvent to the first stage, $0.5R_1$ kg to the second stage and so on. The solvent rate to the last stage may be adjusted up or down by no more than 10% in order to get the 2% final raffinate. a) How many stages are required? b) How much total solvent is needed?

4. The same mixture described in Problem 2 is extracted in a continuous countercurrent cascade of mixer-settlers equilibrium stages.

(a) calculate the minimum solvent rate.

(b) For a solvent rate of 1.2 times the minimum find the flow rate and composition of the resulting raffinate and extract.

(c) Find the required number of equilibrium stages for the conditions of part (b). Plot the operating line on the x-y diagram to determine the number of stages.