Engy-5140: Chemical and Nuclear Waste Processing Fall 2019 UMass Lowell; Prof. V. F. de Almeida **06Dec2019**

Final Project 02 18Dec2019

Name: `your name`

Guidance:

- Work within your team only. Be clear and complete in your answers.
- Save your work frequently to a file locally to your computer.
- During your work and before submitting the final version do: `Kernel` -> `Restart & Run All`, to verify your notebook runs correctly.
- Save your file again.

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Problem Statement

Wastewater (L) containing VOCs enters the top of a stripper at 500 gpm, where 99.95+ wt% of the VOCs at 70 ˚F are to be removed with air entering the bottom at 70 ˚F, and 15 psia. Assuming ideal gas behavior and Raoult's law, $K_i = \frac{P_i^*}{P\, x_{i,L}^*}$, where P_i^* is the vapor pressure of the ith component, P is the total pressure, and $x_{i,L}^*$ is the saturation mole fraction in the liquid phase, and using the network modeling approach covered in this course, provide answers to the questions below.

Additional data provided:

VOC	$\rho_{i,L}$ [mg/L] in the wastewater	$x_{i,L}^*$ @ 70˚F	P_i^* [psia] @ 70˚F
Toluene	50	0.00012	0.449
Ethylbenzene	20	0.000035	0.149
Benzene	150	0.0004	1.53

(based on Seader, Henly, and Roper textbook Separation Process Principles Chap. 6, 2016)

Problem 1 (100 pts)

1. Design a trayed column and provide construction/operation parameters.
2. What are the efficiencies of your stripper?
3. Compare the partition coefficient given in the problem statement to another source of data and calculate the effect on efficiency.
4. If the air is vented to the environment what is the mass of each VOC per day released?
5. What is the mass of each VOC in the released water per day?
6. Describe the hazards to humans if the water is consumed.

Answers: