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

Final Project 05 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

A mixture of 3 mol% CO_2 and 2 mol% of NH_3 is contacted with a slightly caustic water solution (assume the caustic solution has the properties of pure water) in an absorber. A 97% absorption of CO_2 is needed. The air-flow rate is 5,000 ft ^{3} /minute at 60˚F and 1 atm. It may be assumed that the equilibrium curve for CO_2 is $X^*_{CO_2,G} = 1.75X_{CO_2,L}$ where X is the mole ratio of CO_2 to CO_2 -free carrier. The NH_3 solubility follows Henry's law, $P_{NH_3,G} = Hx_{NH_3,L}$, where the partial pressure of ammonia in the gas is proportional to the molar fraction in the liquid phase, and $H = 2.7$ atm/mole fraction. A 90% absorption of ammonia is needed. Using the network modeling approach covered in this course, address the items to follow (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 absorber?
3. What are the masses of CO_2 and NH_3 per day leaving the tower in the gas phase?
4. Describe the hazards to humans if the exiting air is inhaled.

Answers: