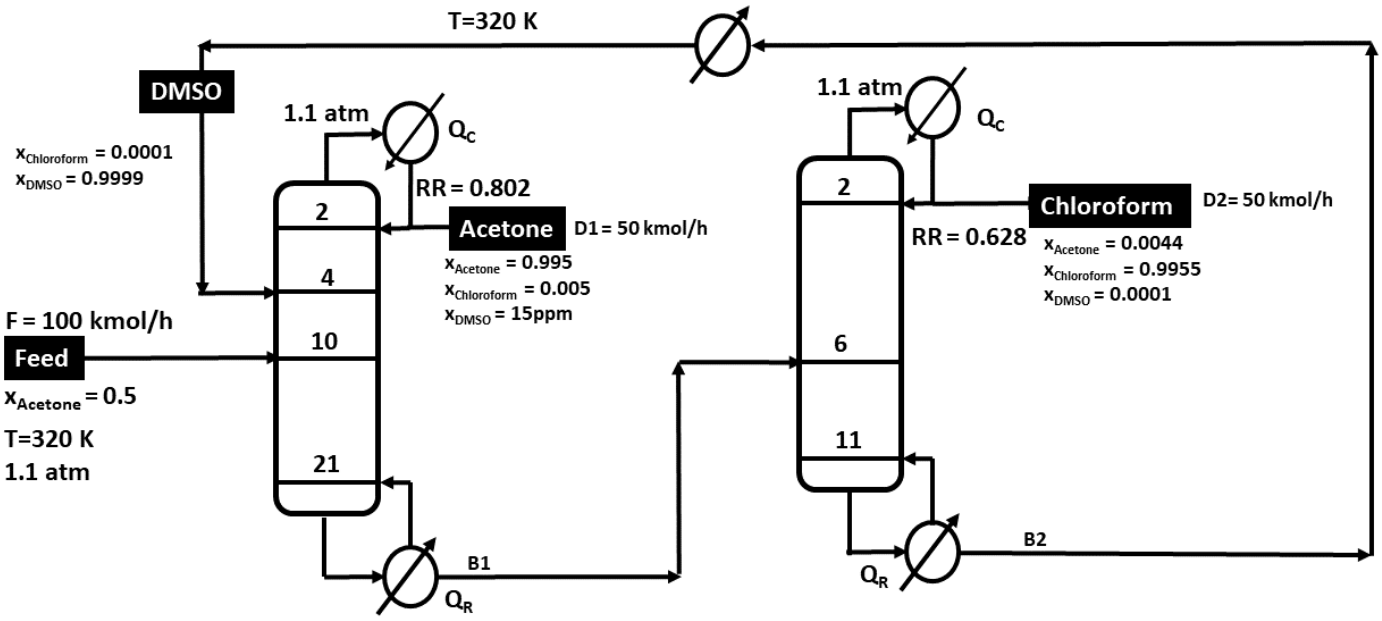
Laboratory and Homework Assignment 10

Laboratory Assignment (Due after laboratory session)

1. In this problem you are expected to work on a simulation of an azeotropic distillation of acetone-chloroform system. The feed contains 50 mol% methanol and it is desired to recover both chloroform and acetone with a purity of more than 99 mol%.

   (a) [10 points] Simulate the following arrangement of distillation column using **ASPEN**. If you are able to converge the system, complete the following flow-sheet. If not, explain why? You are expected to compute the flowrates, mole fractions, temperature and pressure of each stream. Also, compute heat duties of condensers, reboilers and exchangers. Plot the temperature and composition profiles of both the columns.

   ***Taken from Luyben, William L. "Control of the maximum-boiling acetone/chloroform azeotropic distillation system." Industrial & Engineering Chemistry Research 47, no. 16 (2008): 6140-6149.



   (b) [40 points] Now break the DMSO recycle stream, i.e., take out B2 as the product stream and there will be a separate feed stream (DMSO) to the first column. Slowly increase the flow rate of DMSO stream till you get the required purities at the top of both the columns. This should be the minimum flow rate of DMSO at which the required purities are obtained. You are expected to compute the flow rates, mole fractions, temperature and pressure of each stream. Also, compute heat duties of condensers, re-boilers and exchangers. Plot the temperature and composition profiles of both the columns. Compare B2 and DMSO stream. Are they very different? Propose a small modification of the flow sheet in (c) for it to work as a feasible design.

   (c) [100 points] Reproduce Figure 5 of Luyben, William L. "Control of the maximum-boiling acetone/ chloroform azeotropic distillation system." Industrial & Engineering Chemistry Research 47, no. 16 (2008): 6140-6149 in ASPEN.