

**CENG 122 Separation Processes**  
**Homework Assignment #2**, Due on **11-05-09** (in class)  
 Homework office hour: Tuesday 5:00PM – 6:00PM

**PROBLEM 1 (45 points):**

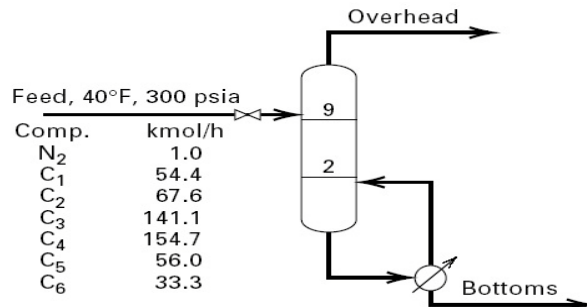
A 20 wt% solution of uranyl nitrate (UN) in water is to be treated with tributyl phosphate (TBP) to remove 90% of the uranyl nitrate. All operations are to be batch-wise equilibrium contacts. Assuming that water and TBP are mutually insoluble, how much TBP is required to extract 100 g of UN solution if equilibrium  $(g\ UN/g\ TBP) = 5.5 * (g\ UN/g\ H_2O)$  and:

- (a) All the TBP is used at once in one stage?
- (b) Half is used in each of two consecutive stages?
- (c) Two countercurrent stages are used?
- (d) An infinite number of crosscurrent stages is used?
- (e) An infinite number of countercurrent stages is used?

**PROBLEM 2 (40 points):**

A reboiled stripper as shown in the right figure is to be designed for the task shown. Determine:

- (a) The number of variables.
- (b) The number of equation relating the variables.
- (c) The number of degrees of freedom and indicate.
- (d) Which additional variables, if any, need to be specified?



**PROBLEM 3 (15 points):**

Volatile organic compounds (VOCs) can be removed from water effluents by stripping in packed tower. Possible stripping agents are steam and air. Alternatively, the VOCs can be removed by carbon absorption. The U.S. Environmental Protection Agency (EAP) has identified air stripping as the best available technology from an economic standpoint. What are the advantages and disadvantages of air compared to steam as a stripping agent?