Ebulliometer (VLE lab)

Using the ebulliometer, determine binary interaction parameters for either the Wilson or NRTL activity coefficient model using measured data for an ethanol-cyclohexane mixture at ambient pressure. Use the data to estimate

a. the binary interaction parameters for the activity coefficient model you chose,
b. if there is an azeotrope in the system and, if so, at what composition,
c. the values of the activity coefficients at the infinitely dilute compositions,
d. the T-xy diagram over the entire temperature and composition range of the two-phase region at ambient pressure.
e. the lowest dew point temperature and composition at ambient pressure for this mixture.

Using these results, design a pressure-swing distillation process with one column at 1 bar and a second column at either 1 psi or 10 bar that will produce 99% pure ethanol with 90% ethanol recovery from an initial equimolar mixture of ethanol and cyclohexane. Determine the number of equilibrium and actual stages assuming Murphree vapor efficiency of 0.71 in each column, feed points, and column diameters assuming a saturated liquid feed flow rate of 1000 kg/hr. Assume a reflux ratio of 1.3 in each column. Indicate what factors go into choosing vacuum or pressure for the non-ambient pressure column.

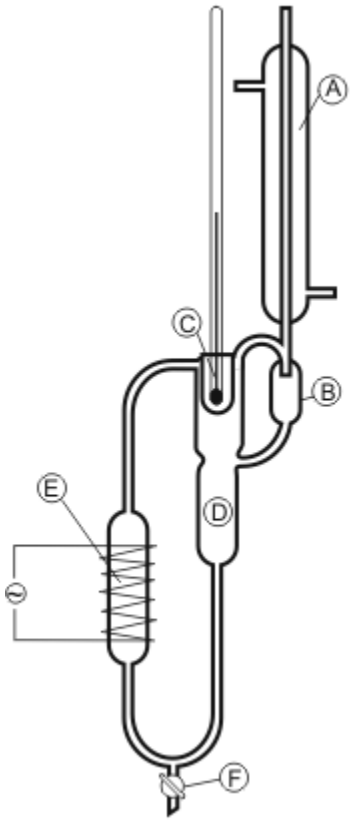

Figure 1 Major components of an ebuliometer; A) reflux condenser, B) dropper, C) thermometer socket, D) bulb, E) heating compartment with heating coil, F) draining valve