CHE407: Separation Processes

Tutorial-2   Due: 08/06/1440

QUESTION (1)

(a) Derive an equilibrium equation for an ideal binary system of (**A**) and (**B**) in terms of vapor pressures. Where **A** is the more volatile component.

(b) Derive an equilibrium equation for an ideal binary system of (**A**) and (**B**) in terms of average relative volatility. Where **A** is the more volatile component.

QUESTION (2)

Develop an equilibrium Table as shown below for ethanol (**A**) and water (**B**) system at 1.0 atm using hand calculations and then plot:

(a) The equilibrium curve.

(b) T-x-y diagram.

	Vapor Pressure		Equilibrium concentration		K_i		Relative volatility
	Ethanol (P_A)	Water (P_B)					
T(°C)	kPa	kPa	$x_A = \frac{P_t - P_B^o}{P_A^o - P_B^o}$	$y_A = \frac{P_A^o}{P_t} x_A$	K_A	K_B	α_{AB}

QUESTION (3)

(a) Calculate the average relative volatility (α_{av}) for the above system.

(b) Plot the equilibrium curve.

QUESTION (4)

Repeat questions (2) and (3) using Matlab.

QUESTION (5)

Repeat questions (2), (3) and (4) for benzene-toluene system.

QUESTION (6)

Find the bubble-point and dew-point temperatures and the corresponding vapor and liquid compositions for a mixture of 45.0 mol% ethanol and 55 mol% water at 1.0 atm total pressure. Using:

(a) Numerical methods.

(b) Graphical method.

(c) T-x-y diagram in Question (2).

QUESTION (7)

A vapor at the dew point and 1.0 atm containing a mole fraction of 0.4 benzene and 0.60 toluene and 100 kgmol total is contacted with 110.0 kgmol of a liquid at the boiling a point containing a mole fraction of 0.30 benzene and 0.7 toluene. The two streams are contacted in a single stage (stage 1), and the outlet streams leave in equilibrium with each other. Assume constant molar flow rates (input=output for each phase).

(a) Draw the flowsheet.

(b) Find the composition of the exit streams analytically.

(c) Find the composition of the exit streams graphically.