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ChE 3853
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HW 6

1) a) $P_1^{Sat} = {}_{10}A - \frac{B}{T+C}$

Toluene
A = 6.95087
B = 1343.31
C = 219.187

$P_1^{Sat} = 244.4\ mmHg \cdot \frac{0.133\ KPa}{1\ mmHg} = 32.6\ KPa$

$y_1 = \frac{P_1^{Sat} x_1}{P} = \frac{32.6 \cdot 0.7}{30} = 0.76 \rightarrow$ **76.0% = y_1**

$y_2 = 1 - y_1$ **= 24.0%**

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b) $P_r = 10^{\wedge}\left(\frac{7}{3}(1+\omega)\cdot\left(\frac{1}{1-T_r}\right)\right)$

$P = P_r * P_c$

$\omega = 0.264$

$T_r = \frac{75+273}{591.8}$

$P_c = 4.109\ MPa$

$P_r = 0.0086 \rightarrow P = 0.0086 \cdot 4.109 = 0.0354\ MPa$

$P = 35.4\ KPa$

$y_1 = \frac{P_1^{Sat} x_1}{P} = \frac{35.4 \cdot 0.7}{30} = 0.827$

y_1 = 82.7%

$y_2 = 1 - y_1$ **= 17.3%**

HW 6

2) ethyl Bromide : 1 $P_1^{Sat} = 0.7569$ Bar $x_1 = 0.4723$
n-heptane : 2 $P_2^{Sat} = 0.0773$ bar $x_2 = 0.5277$

$BP = P_1 x_1 + P_2 x_2 = 0.7569 \cdot 0.4723 + 0.0773 \cdot 0.5277$
$= 0.398$ Bar

$y_1 = \frac{x_1 \cdot P_1^{Sat}}{P} = \frac{0.4723 \cdot 0.7569}{0.398} = 0.8976 \simeq 89.8\%$

$y_2 = 1 - y_1 = 0.1024 \simeq 10.2\%$

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3) $z_1 = 0.07$ $P = 4$ bar
$z_2 = 0.12$
$z_3 = 0.41$ $P_r = 10^{\left(\frac{7}{3}(1+\omega)\cdot\left(\frac{1}{1-T_r}\right)\right)}$
$z_4 = 0.40$

a) T_{BP}: $P = \sum x_i P_i^{Sat}(T) \rightarrow$ excel $\rightarrow T_{BP} = 279$ K

b) T_{DP}: ~~$P = \sum \frac{y_i}{P_i^{Sat}(T)}$~~ $\rightarrow$ excel $\rightarrow T_{DP} = 304$ K

$P_i = \frac{1}{\sum \frac{y_i}{P_i^{Sat}}}$

c) $K_i = \frac{P^{Sat}}{P} \rightarrow 0 = \sum \frac{z_i(1-K_i)}{K_i + \frac{L}{F}(1-K_i)} \rightarrow$ Excel

$\frac{L}{F} = 0.0688$
$\simeq 6.88\%$

$\therefore 93.1\%$ vap $\therefore$ 93.12%

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4) a) P = 15 $z_1 = 0.45$ $z_2 = 0.55$

$$P_{DP} = \frac{1}{\sum \frac{y_i}{P_i^{Sat}[T]}}$$

Set $P_{DP} = 15 \rightarrow$ excel $\rightarrow$ **T = 405 K**

$$x_i = \frac{y_i * P_{DP}}{P_i^{Sat}} \rightarrow x_1 = 0.264 \quad x_2 = 0.735$$

first drop': 26.4% but 73.6% pent

b) $P_{BP} = 15 = \sum x_i \cdot P_i^{Sat} \rightarrow$ excel $\rightarrow$ **T = 395 K**

last drop': 65.7% but 34.3% pent