

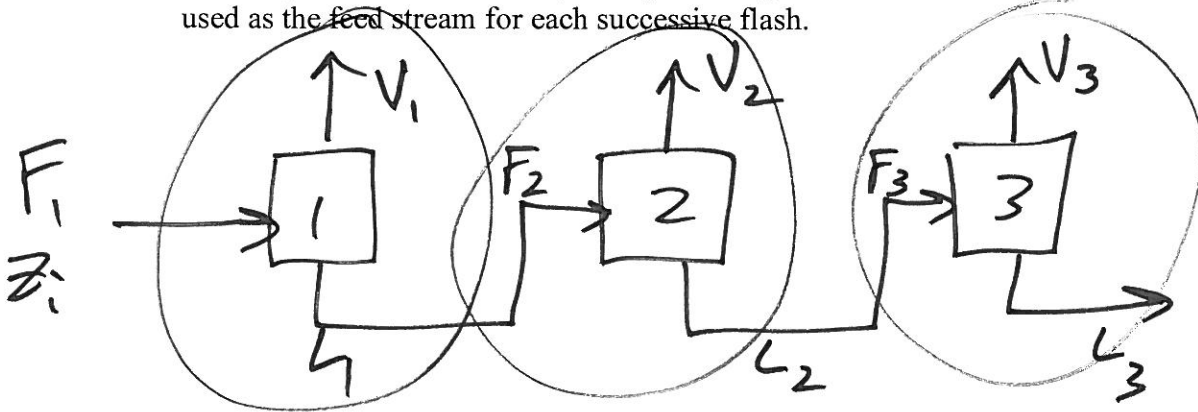
SOLUTION

CHE 305 – Separation Processes Spring 2010 – In Class on Multiple Stages 2

Use the data in the table for a cascade of single stages to answer the following questions. The cascade produces palmitic acid containing 0.1 mole% decane (light component).

Flash	Z _{Decane}	X _{Decane}	Y _{Decane}	F(moles/hr)	V(moles/hr)	L(moles/hr)	Ψ
1	0.02	0.012	0.25	100	3.4 ✓	96.6	0.034 ✓
2	0.012	0.003	0.075	96.6	12.08	84.52	0.125
3	0.003	0.001	0.025	84.52	7.02	77.5	0.083

- a. Draw a picture of the cascade, clearly showing which outlet stream from each flash is used as the feed stream for each successive flash.



- b. What is the percent vaporization in each flash? (Hint: Two points yields the slope)

Slope 1: $\frac{0.02 - 0.25}{0.02 - 0.012} = -28.75 = \frac{\Psi - 1}{\Psi} \Rightarrow -28.75\Psi = \Psi - 1$
 $1 = 29.75\Psi$

Slope 2: $\frac{0.012 - 0.075}{0.012 - 0.003} = -7 = \frac{\Psi - 1}{\Psi} \Rightarrow -7\Psi = \Psi - 1$
 $1 = 8\Psi \Rightarrow \Psi_1 = 0.034$

- c. What is molar flow rate of the final liquid stream?

Slope 3: $\frac{0.003 - 0.025}{0.003 - 0.001} = -11 = \frac{\Psi - 1}{\Psi} \Rightarrow \Psi = \frac{1}{12} = 0.083$
 $1 = 8\Psi \Rightarrow \Psi_2 = 0.125$

$\Psi_1 = \frac{V_1}{F_1} \Rightarrow 0.034 = \frac{V_1}{100} \Rightarrow V_1 = 3.4 \text{ mol/hr}$ $100 = 3.4 + L_1$

d. What is the percent recovery of palmitic acid?
 $\Psi_2 = \frac{V_2}{F_2} \Rightarrow V_2 = (0.125)(96.6) = 12.08 \text{ mol/hr}$

$\% \text{ Recovery} = \frac{77.5(1 - 0.001)}{100(1 - 0.02)} \times 100\%$

$L_3 = 77.5 \text{ mol/hr}$

Q-Line: $y_i = \left(\frac{\Psi - 1}{\Psi}\right)x_i + \left(\frac{1}{\Psi}\right)z_i = \underline{\underline{79\%}}$