Tutorial - 10, CHL 352

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P1) Given; $F = 200$ kmol/h

(a) $z_f = 0.4$, $x_D = 0.95$, $x_W = 0.04$

Reflux Ratio, $R = 2.0$

Material Balance,

$$F = D + W$$

$$D + W = 200$$

Also Benzene balance,

$$Fz_F = Dx_D + Wx_W$$

$$200 \times 0.4 = D \times 0.95 + W\ 0.04$$

$$\Rightarrow \boxed{D = 79.1 \text{ kmol/hr}} \quad \boxed{W = 120.9 \text{ kmol/hr}}$$

also $R = 2.0 = \frac{L_0}{D} = \frac{L_0}{79.1} \Rightarrow \boxed{L_0 = 158.2 \text{ kmol/hr}}$

Vapor rate, $V_1 = D(R+1) = 237.3$ kmol/hr

Since the feed is a liq, vapor rate remains constant at $V = V_1 = 237.3$ kmol/hr (in rectifying section)

(b) Eq^n of operating line in the rectifying section,

$$y_{n+1} = \frac{R}{R+1} x_n + \frac{x_D}{R+1}$$

$$\frac{x_D}{R+1} = 0.317, \quad \frac{R}{R+1} = 0.667$$

$$\boxed{y_{n+1} = 0.667 x_n + 0.317}$$

for Stripping section,

$$y_{m+1} = \frac{\bar{L}}{\bar{L} - W} x_m - \frac{W}{\bar{L} - W} x_W$$

$y_{n+1} = 1.509 x_m - 0.0207$

Boil up ratio $R_v = \frac{\bar{V}}{\bar{W}} = \underline{\underline{1.963}}$