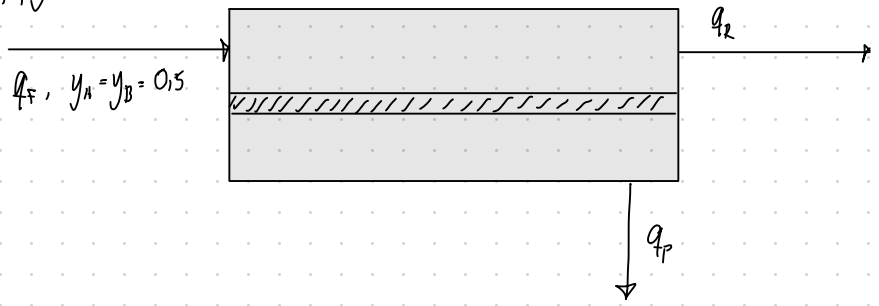
Oppgave 1



a)

$$y_{om} = \frac{y_F\left[1+(\alpha^*-1)\frac{p_R}{p_c}(1-y_F)\right]}{\alpha^*(1-y_F)+y_F}$$

$$= \frac{0,5\left[1+(30-1)\frac{1}{10}(1-0,5)\right]}{30(1-0,5)+0,5} = 0,08$$

$$\Rightarrow \underline{y_B = 0,92}$$

b) $0,08 \cdot 1,25 = 0,1$

$$q_F y_A = q_R y_{R_A} + q_P y_{P_A}$$

$$2 \cdot 0,5 = q_R \cdot 0,1 + q_P y_{P_A}$$

$$y_{P_A} = \frac{1 - 0,1 \cdot 0,94}{1,06}$$

$$\underline{y_{P_A} = 0,855}$$

$$\Theta = \frac{q_P}{q_f} \Rightarrow q_P = \Theta q_f = 0,53 \cdot 2 = 1,06$$

$$\Rightarrow q_r = 0,94$$

$$y_{P_B} = 0,145$$

$$q_{P_B} = q_P \cdot y_{P_B} = 1,06 \cdot 0145$$

$$\% \text{ loss} = \frac{1{,}06 \cdot 0{,}145}{0{,}5 \cdot 2} = \underline{\underline{15{,}4\%}}$$

c) Se LF

$A = 357\,m^2$

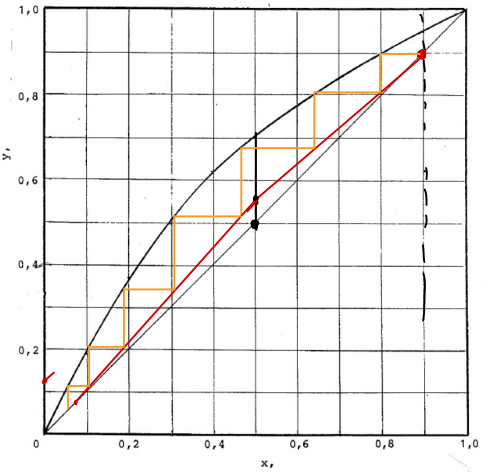
d) - Cascade
- Pressure ratio
- Increase selectivity

2

Mass balance top:

$$D \cdot x_d + L_n x_n = V_{n+1} y_{n+1}$$

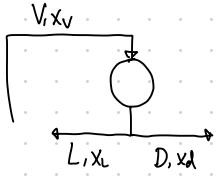
$$y_{n+1} = \frac{L_n}{V_{n+1}} x_n + \frac{D x_d}{V_{n+1}}$$



$D = V - L$

$$\Rightarrow y_{n+1} = \frac{L}{V} x_n + \frac{V}{V} x_d - \frac{L}{V} x_d$$

$$y_{n+1} = \frac{L}{V}(x_n - x_d) + x_d \qquad , x_d = 0{,}9 \qquad \frac{L}{V} = 0{,}86$$



$$y_{n+1} = 0{,}86\,(0 - 0{,}9) + 0{,}9 = 0{,}126$$

$$y_{n+1} = 0{,}86\,(0{,}9 - 0{,}9) + 0{,}9 = 0{,}9$$

Feed is liquid
$\Rightarrow$ q-line = vertical

Vet ikke X_B, og mic finne med prøv og feil $x_B = 0{,}07$

X_B for oss finne D og B

$F = D + B \Rightarrow B = F - D$

$F x_F = D y_d + B x_B$

$10 \cdot 0{,}5 = D \cdot 0{,}9 + (10 - D) \cdot 0{,}07$

$\Rightarrow D = \frac{10(0{,}5 - 0{,}07)}{0{,}9 - 0{,}07} = \underline{5{,}18}$

$B = \underline{4{,}82}$

ii) Moving it changes the composition $X_B \approx 0{,}8$

b)

MV / CV	L	VB/QB	D	B	LCw(Qc)
L/V	•				
yd		•			
MD					•
MB				•	
P			•		

Disturbances F, xF

Se lf.

3 a) $V_1 = 3000$ mol/s $y_1 = 0{,}002$

$L_2 = 90\,000$ mol/s $x_2 = 0$

Veldig fortynnet => Anter $V_1 = V_2 = V$, $L_1 = L_2 = L$

Ved likevekt: $P_{SO_2} = Hx \Rightarrow yP = Hx \Rightarrow y = \frac{H}{P}x$, $\frac{H}{P} = m$

1 bar, 25°C

$$m = \frac{46}{1} = 46$$

$$A = \frac{L/V}{m} = \frac{90\,000/3000}{46} = 0{,}652$$

Like vekt på bunnen:

$$x_1 = x^*$$

$$x^* = \frac{y_1}{m} = \frac{0{,}002}{46} = 4{,}35 \cdot 10^{-5}$$

Finner y_2 ved massebalanse av SO_2

$$Inn = Ut$$

$$V y_1 = V y_2 + L x_1$$

$$y_2 = y_1 - \frac{L}{V} x_1$$

$$y_2 = y_1 - \frac{L}{V} \cdot \frac{y_1}{m}$$

$$y_2 = y_1 \left(1 - \frac{L}{Vm}\right) = y_1 (1 - A)$$

$$y_2 = 0{,}002(1 - 0{,}652)$$

$$y_2 = 6{,}96 \cdot 10^{-4} \gg \text{ønsket}$$

Må øke væskestrømmen.

b) For ab $y_1' = y_2$

$\Rightarrow y_2' = y_1'(1-A)$

$\Rightarrow y_2' = 0{,}1000242$ fortsatt for stort

c) Alle oker A, og gir greit resultat

Se LF

d) a) Assumes dilute mixtures with m and $\frac{L}{V}$ constant

b) "Imaginary" vapor compositions in equilibrium with x_1 and x_2

$y_1^* = mx_1$

$y_2^* = mx_2$

c) Se LF

4) $T = 26°C$, $H = 0{,}3$, $\rho_b = 712{,}8\ kg/m^3$

$C_p = 0{,}01\ \frac{kg\ H_2O}{kg\ part}$

$V = 4052\ \frac{kg}{m^2 \cdot h}$, $C_0 = 926 \cdot 10^{-6}\ \frac{kg\ H_2O}{kg\ H_2}$

a) Gidder ikke

b) $\tau_b = \int_0^{t_b} \left(1 - \frac{c}{c_0}\right) dt = t_b$

$t_b \approx 9{,}58\ h$

c) $H_{unb} = \left(1 - \frac{t_b}{t_s}\right) H_T = \left(1 - \frac{9{,}56}{12{,}6}\right) 0{,}3 = 0{,}072\ m$

$\tau_T = t_b + \frac{t_d - t_b}{2} = 11{,}19 = t_s$

Frem til t_b: $\frac{t_b}{t_s} = 85{,}6\%$

d) Etter 12,6 h, er absorbert H_2O:

$$m_{H_2O} = 4052 \frac{\text{kg } H_2O}{m^2 \cdot h} \cdot 926 \cdot 10^{-6} \frac{\text{kg } H_2O}{\text{kg } H_2}$$

$$= 3{,}75 \frac{\text{kg } H_2O}{m^2 \cdot h} \cdot 9{,}58\ h$$

$$= 35{,}95\ \text{kg } H_2O/m^2$$

$$= \frac{35{,}95\ \text{kg } H_2O/m^2}{(0{,}3 - 0{,}075)\ m} = \underline{160\ \text{kg } H_2O/m^3}$$