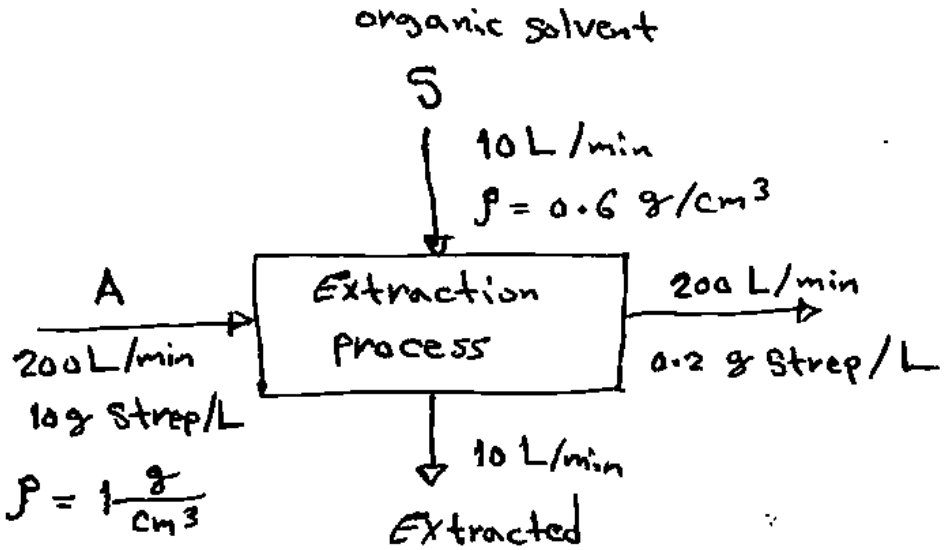
Example 9



$\frac{g\ Strep}{g\ Solvent} = ?$

mass fraction strep = ?

Basis: 1 min

In = out Strep M.B.

$$200\,\cancel{L} * \frac{10\ g}{\cancel{L}} + 0 = 200\,\cancel{L} * \frac{0.2\ g}{\cancel{L}} + 10\,\cancel{L} * \frac{X\ g}{\cancel{L}}$$

$$2000\ g = 40\ g + 10X$$

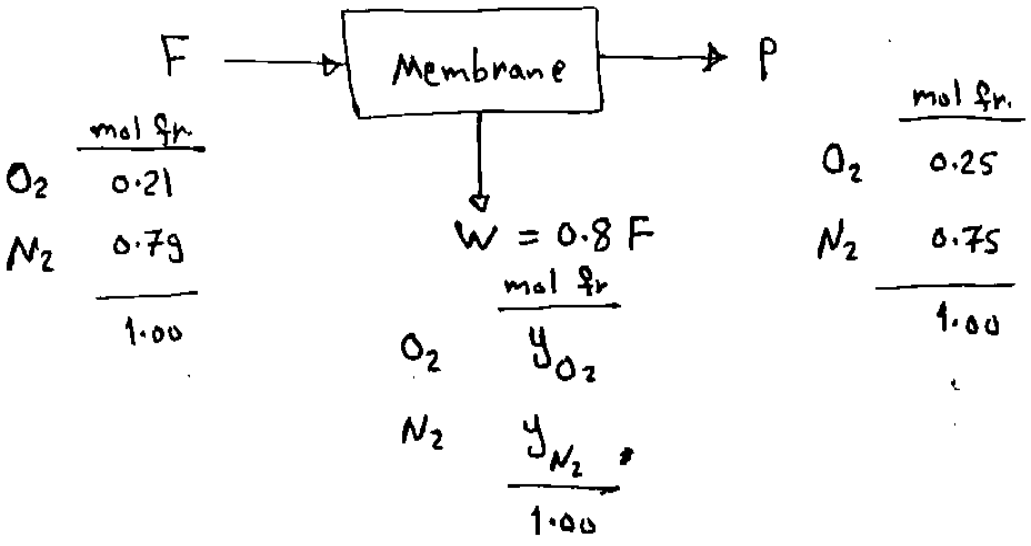
$$X = \frac{2000 - 40}{10} = 196\ \frac{g\ Strep}{L\ Solvent}$$

$$\frac{g\ Strep}{g\ Solvent} = 196\ \frac{g\ Strep}{\cancel{L\ Solvent}} \left| \frac{1\ \cancel{L\ Solvent}}{1000\ \cancel{cm^3\ Solvent}} \right| \frac{1\ \cancel{cm^3\ Solvent}}{0.6\ g\ Solvent}$$

$$= 0.3267\ \frac{g\ Strep}{g\ Solvent} \quad \begin{matrix} 0.3267\ g\ Strep \\ 1\ g\ Solvent \end{matrix}$$

Then I fraction Strep $= \frac{0.3267}{1 + 0.3267} = 0.246$

Example 10



Basis: 100 gmol (F)

In = out

over all M.B

$$F = W + P \Rightarrow 100 = W + P \quad \text{——— (1)}$$

O_2 M.B

$$0.21 * 100 = 0.25\,P + y_{O_2} W \quad \text{——— (2)}$$

N_2 M.B

$$0.79 * 100 = 0.75\,P + y_{N_2} W \quad \text{——— (3)}$$

$\because W = 0.8F = 0.8 * 100 = 80$ gmol

Sub in eq. (1)

$100 = 80 + P \Longrightarrow P = 20$ gmol

Sub in eq.(2)

$0.21 * 100 = 0.25 * 20 + 80\, y_{O_2}$

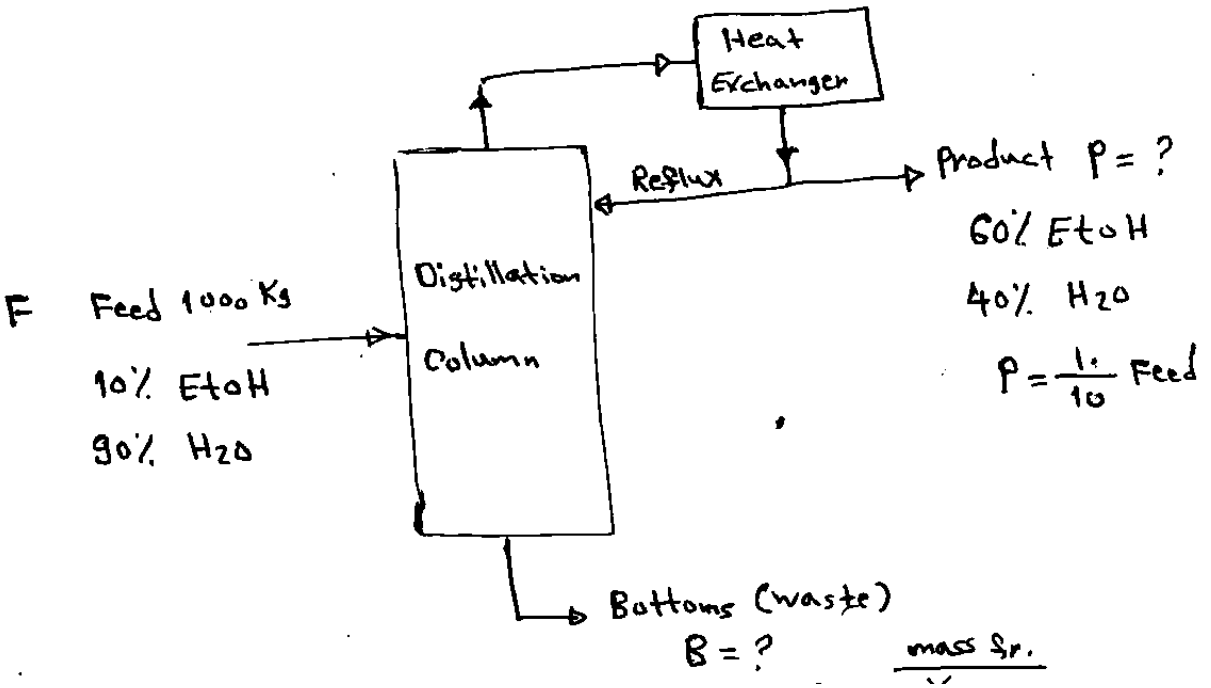
$y_{O_2} = \frac{21-5}{80} = \frac{16}{80} = 0.2$ $\quad y_{O_2} + y_{N_2} = 1 \Rightarrow y_{N_2} = 0.8$

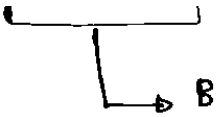
Check eq. (3)

$0.79 * 100 = 0.75 * 20 + 0.8 * 80$

$79 = 79$

Example 11





Bottoms (waste)

B = ? mass fr.

EtOH = ? X_{EtOH}

H_2O = ? X_{H_2O}

$$P = \frac{1}{10} Feed = \frac{1}{10} \times 1000\ Kg = 100\ Kg$$

In = Out

over all M.B.

$$F = P + B$$

$$1000 = 100 + B \Longrightarrow B = 900\ Kg$$

EtOH M.B.

$$0.10 * 1000 = 0.60 * 100 + X_{EtOH} * 900$$

$$X_{EtOH} = \frac{100 - 60}{900} = 0.044$$

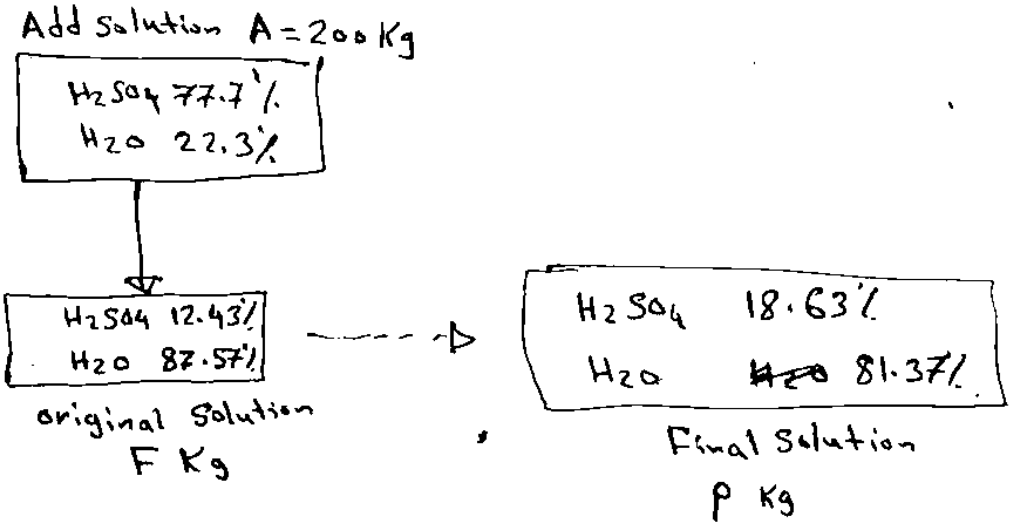
$$X_{EtOH} + X_{H_2O} = 1 \Longrightarrow X_{H_2O} = 1 - 0.044 = 0.956$$

Check

H_2O M.B. $0.9 * 1000 = 0.4 * 100 + 0.956 * 900$

900=900

Example 12



Sol.

Method 1

Unsteady State

In - Out = Accumulation

Accumulation = Final - Initial

over all M.B

$A - 0 = P - F \Rightarrow 200 = P - F$ —— (1)

$P = 200 + F$

H_2SO_4 M.B

$0.777 * 200 - 0 = 0.1863P - 0.1243F$ —— (2)

Sub eq. (1) in eq. (2)

$0.777 * 200 = 0.1863 (200 + F) - 0.1243 F$

$$155.4 = 37.26 + 0.1863F - 0.1243F$$

$$\therefore F = 1905.5 \text{ Kg}$$

sub. in eq.(1)

$$P = 200 + F = 200 + 1905.5 = 2105.5 \text{ Kg} \quad \text{I}$$

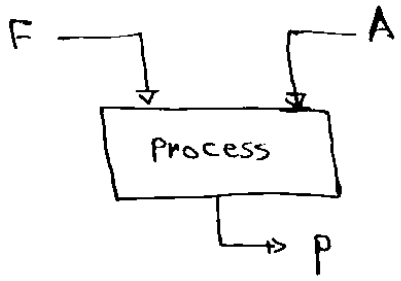
Check H_2O M.B

$$0.223 * 200 - 0 = 0.8137 * 2105.5 - 0.8757 * 1905.5$$

$$44.6 = 44.6$$

Method 2

Steady State



In = out

over all M.B.

$$F + A = P$$

$$F + 200 = P \quad \text{——} \quad \text{I}$$

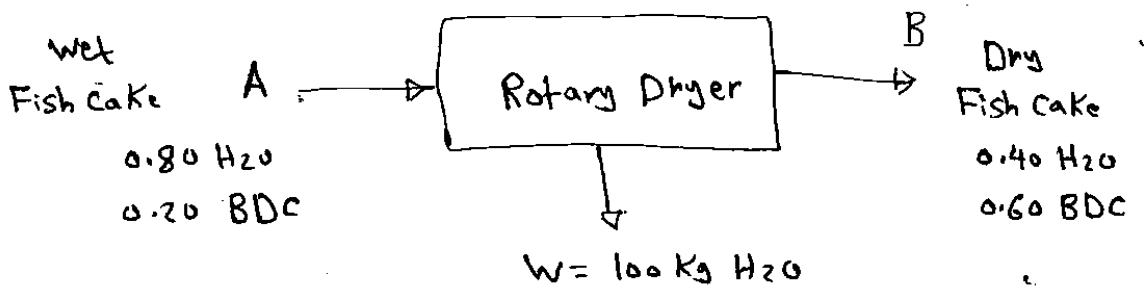
H_2SO_4 M.B.

$$0.1243\,F + 0.777\,A = 0.1863\,P \quad \text{——} (2)$$

H_2O M.B.

$$0.8757\,F + 0.223\,A = 0.8137\,P \quad \text{——} (3)$$

Example 13



In = Out

Total Balance

$$A = B + W$$

$$A = B + 100 \quad \text{——— (1)}$$

H_2O M.B.

$$0.8\,A = 0.4\,B + 100 \quad \text{——— (2)}$$

Sub. eq.(1) in eq.(2)

$$0.8(B+100) = 0.4B + 100 \Rightarrow B = 50 \text{ Kg}$$

$$A = 150 \text{ Kg}$$

Check

BDC M.B.

$$0.2\,A = 0.6\,B + [illegible]$$

$$0.2 * 150 = 0.6 * 50$$

$$30 = 30$$