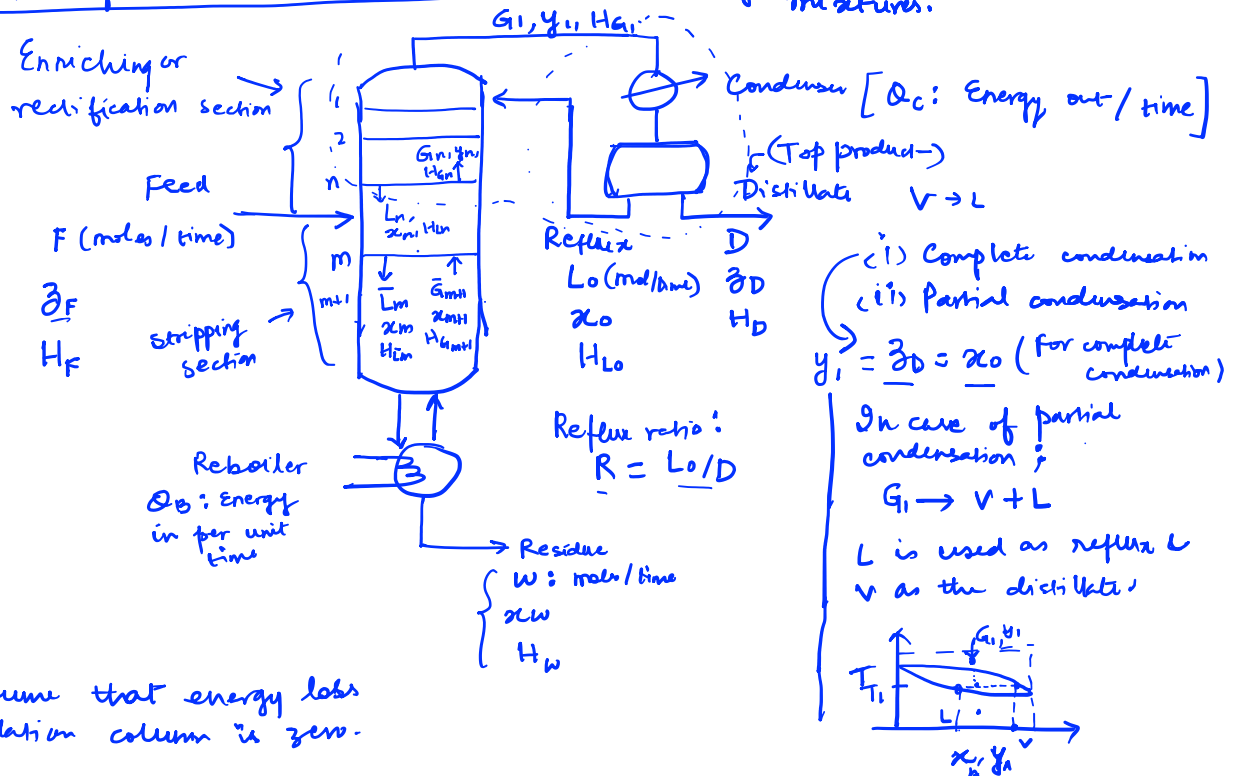


Continuous Rectification (Binary System)

• Multistage countercurrent distillation operation

• Schematics of the distillation column : Limiting discussion to binary mixtures.



• We will assume that energy loss from distillation column is zero.

(i) Consider Envelope 1:

Mass Balance:

$$G_1 = L_0 + D$$

Reflex Ratio

$$R = L_0/D$$

$$\Rightarrow G_1 = (R+1)D$$

Species balance:

$$G_1 y_1 = L_0 x_0 + D z_D$$

Enthalpy balance:

$$G_1 H_{G_1} = Q_c + D H_D + L_0 H_{L_0}$$

$$Q_c = D [(R+1) H_{G_1} - R H_{L_0} - H_D] \leftarrow \text{Condenser load}$$

(ii) Apply balance on the entire column ?

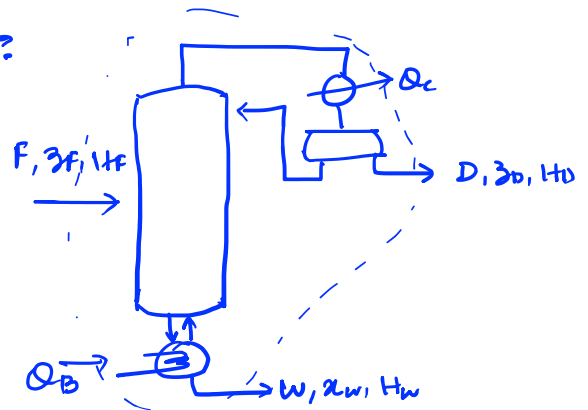
From energy balance:

$$F H_F + Q_B = Q_c + D H_D + W H_W$$

$$\Rightarrow Q_B = D H_D + W H_W - F H_F + Q_c$$

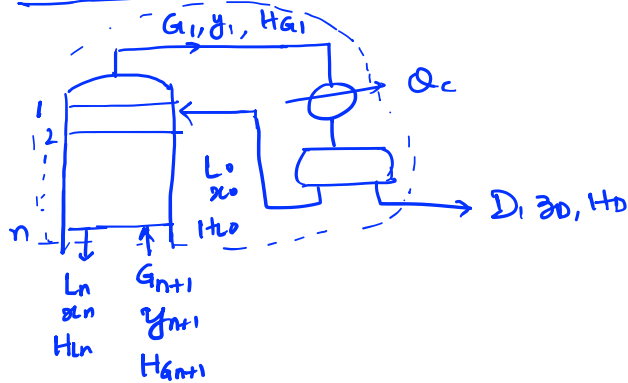
[Neglecting heat loss]

Reboiler Duty



Similarly, energy/species & overall mass balance can be applied on the enriching & the stripping sections.

Enriching section



Mass Balance:

$$G_{n+1} = D + L_n$$

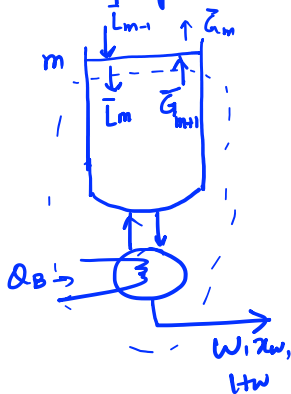
Species balance:

$$y_{n+1} G_{n+1} = D z_D + L_n x_n$$

Energy balance:

$$G_{n+1} H_{G_{n+1}} = L_n H_{L_n} + D H_D + Q_c$$

Stripping section:



Apply energy & mass balances:

$$\bar{L}_m = \bar{G}_{m+1} + W \quad \text{--- (i)}$$

$$\bar{L}_m x_m = \bar{G}_{m+1} y_{m+1} + W x_W \quad \text{--- (ii)}$$

$$\bar{L}_m x_m + Q_B = W H_W + \bar{G}_{m+1} H_{G_{m+1}}$$

- Two methods will be discussed to relate number of trays, liquid/vapor ratio & product composition. We will begin with McCabe - Thiele method.