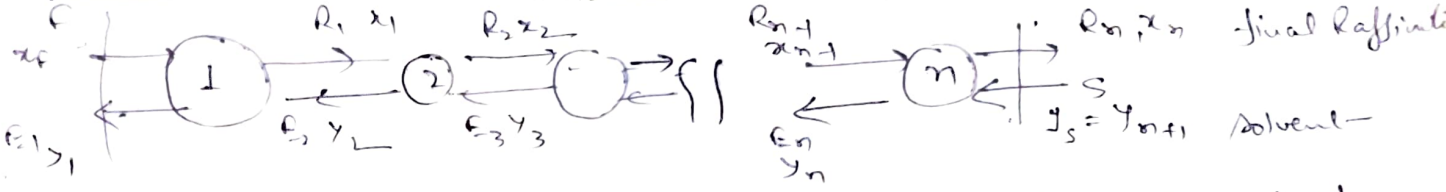
6 Continuous Counter current Multistage Extraction ⇒ fewer no. of stage required



→ for a given degree of separation → fewer stages required and solvent

Ques. $F + S = E_1 + R_n = M$ — (1)

point M can be located at - F S — (2)

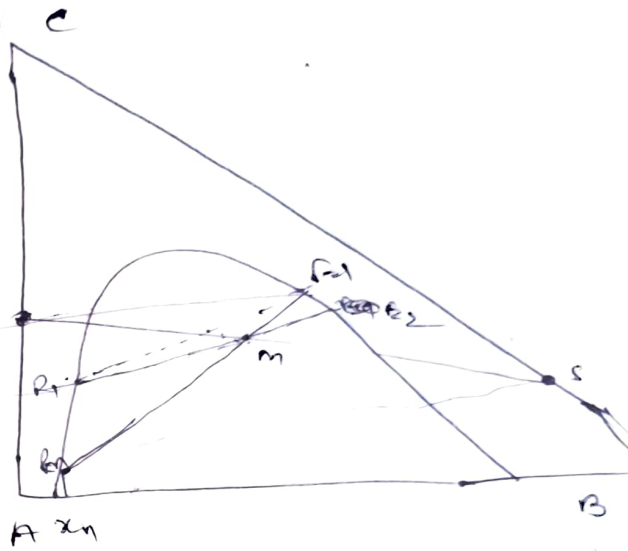
$F x_f + S y_s = E_1 y_1 + R_n x_n = M x_m$ — (3)

$$x_m = \frac{F x_f + S y_1}{F + S} \quad \text{— (4)}$$

By eq (1) M is point on line — F S
— E_1 R_n

Rearranging eq (1)

$R_n - S = F - E_1 = \Delta R$



↳ Difference point ⇒ ⇓ net flow outward at each stage.

- Extended lines E_1 F and S R_n must intersect at ΔR

Procedure ⇒

- extended line E_1 F and R_n S intersect at ΔR
- join line ΔR and R_1 ⇒ to get E_2 by extended
- E_2 eqm^{n} R_2
- joint R_2 ΔR and extend → E_3.
- Repeat till R_n is reached.

max. Solvent

Amount of Solvent (↑) → M shift towards S
→ ΔR moves farther to the left

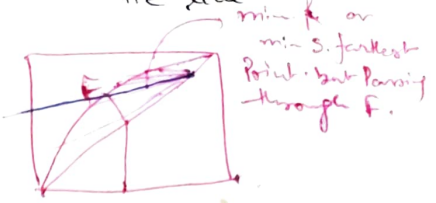
Special Case: when E_1 F and R_n S are Parallel → ΔR at ∞.
As keep on increasing solvent ⇒ ΔR point shifted to Right of B.
Solvent (↑) ⇒ → y_1 (↓)
(less conc. of product)
— no. of stages (↓)

min Solvent

→ ΔR coincide with tie line ⇒ infinite no. of stage required.
⇓ min S/F ratio.

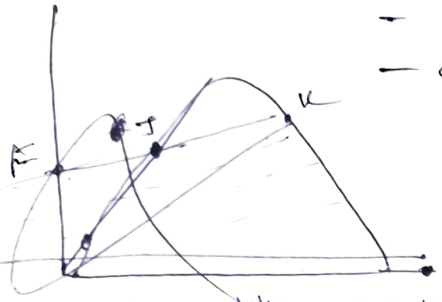
CoCube

min (S/F) ⇒ greatest amount of solvent where tie line coincide with ΔR)



Minimum Solvent)

Procedure — All tie line from F and below F and drawn
- R & S are drawn
- all line extended.
- Intersection farthest from S (if on left hand side) or nearest to S (if on right hand side)

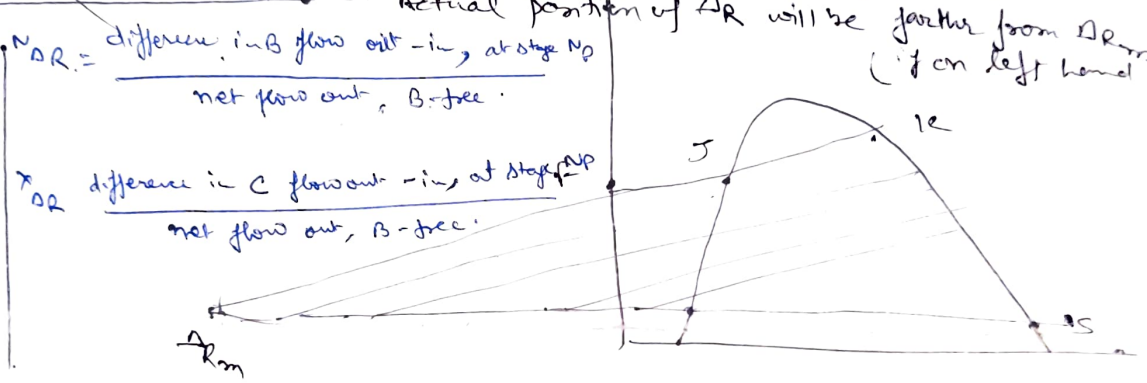


- Actual position of Δ_R will be farther from Δ_{R_m} (if on left hand side)

$\Delta_R' \Rightarrow$

$N_{\Delta R}$ = difference in B flow out - in, at stage N_p / net flow out, B-free.

$x_{\Delta R}$ difference in C flow out - in, at stage N_p / net flow out, B-free.



- ~~less~~ amount of solvent (↑) ⇒ no. of stages (↓)
- tie line passing through F (JK) ⇒ locate the Δ_{R_m} point for min solvent.

~~when~~ when no. of stages very large ⇒
- draw at Random line from ΔR ⇓
- extend it to get operating line on x-y plot.
- from tie line get the equⁿ curve
- Count the no of stages as distillation

(N) Solvent free Basis

$F' + S' = E_1' + R_{N_p}' = M' \Rightarrow R_{N_p}' - S = F' - E_1' = \Delta R$

$F' x_F + S' y_S = M' x_M$.

C Balance for stage s: $R_{s-1}' x_{s-1} - E_s' y_s = \Delta_R' x_{\Delta R}$.

B Balance: $R_{s-1}' N_{R_{s-1}} - E_s' N_{E_s} = \Delta R' N_{\Delta R}$.

$\frac{R_{s-1}'}{E_s'} = \frac{y_s - x_{\Delta R}}{x_{s-1} - x_{\Delta R}}$, $\frac{N_{E_s} - N_{\Delta R}}{N_{R_{s-1}} - N_{\Delta R}}$.