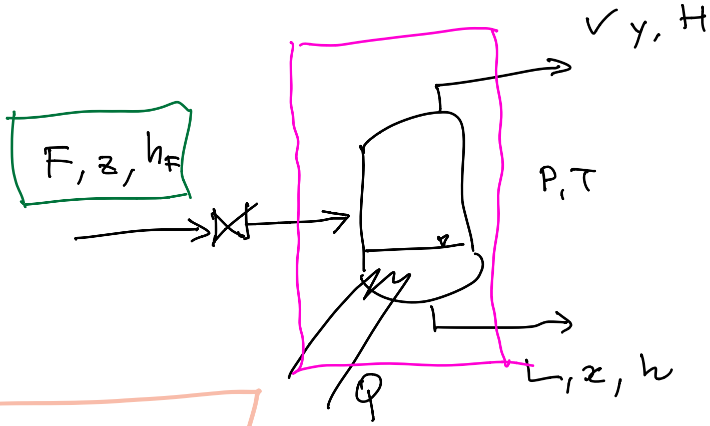
FLASH EVAPORATION

BINARY



continuous mode

F, V, L $\left[\frac{mol}{s}\right]$

x, y, z mole fraction of the more volatile component

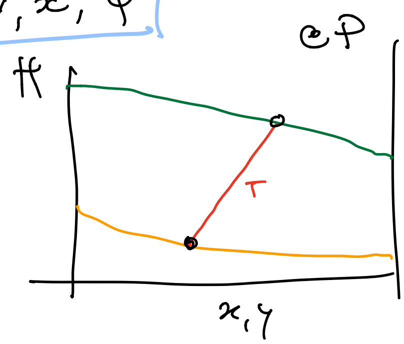
h, H, h_F $\left[\frac{J}{mol}\right]$

Q $\left[\frac{J}{s}\right]$

Goal: $x < z < y$

7 Variables: P, T, V, L, y, x, Q

Data: F, z, h_F



Assumptions
- steady state
- at equilibrium LVE
- no heat loss
- no azeotrops

Mat. bal ②

① $F = L + V$

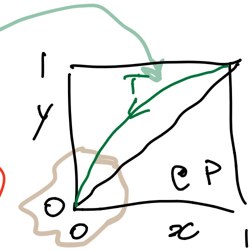
② $Fz = Lx + Vy$

$\Rightarrow F(1-z) = L(1-x) + V(1-y)$

Eq. cond ②

③ $Py = p_1^v(T)\, x\, \gamma_1(T, P, x)$

④ $P(1-y) = p_2^v(T)\,(1-x)\,\gamma_2(T, P, x)$



Energy balance ①

⑤ $Fh_F + Q = Lh + VH$

$\Rightarrow$ 5 eqs $\Rightarrow$ 2 d.o.f.

P

T, Q(=0), y, V

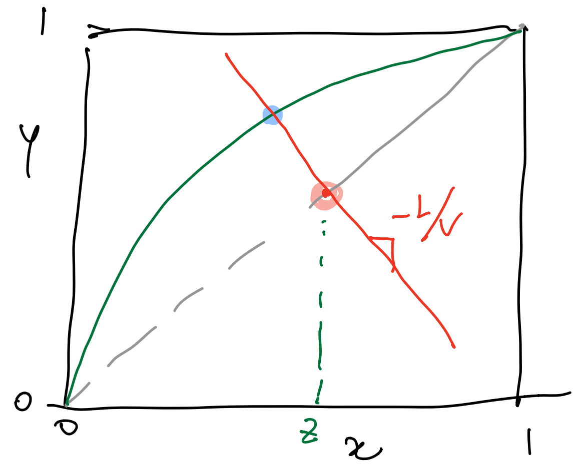
energy balance decoupled from Eqs ① to ④

①

mat. bal (2)

$$y = -\frac{L}{V}x + \frac{F}{V}z$$

operating line



$y = x$

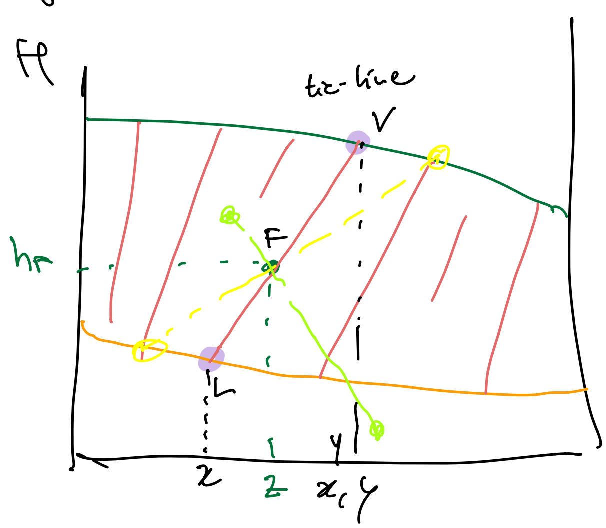
$y + \frac{L}{V}y = \frac{F}{V}z$

$y\left(\frac{L+V}{V}\right) = \frac{F}{V}z$

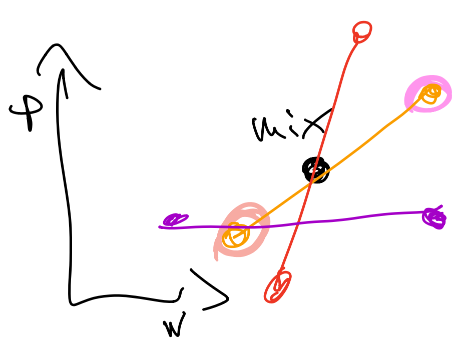
(3)

(4)

adiabatic flash : $Q = 0$



$$h_F + \frac{Q}{F} = \frac{L}{F}h + \frac{V}{F}H$$



lever arm rule

$$z = \frac{L}{F}x + \frac{V}{F}y$$

$$\left(h_F + \frac{Q}{F}\right) = \frac{L}{F}h + \frac{V}{F}H$$