y_c	y_A	y_b	x_a	x_c	x_b
0	0	1	0.67	0	0.33
0.05	0.002	0.948	0.66	0.017	0.323
0.20	0.005	0.795	0.64	0.0723	0.287
0.25	0.007	0.743	0.625	0.0944	0.286
0.30	0.01	0.69	0.60	0.121	0.279
0.35	0.013	0.637	0.58	0.1489	0.271
0.40	0.017	0.583	0.55	0.183	0.267
0.45	0.022	0.528	0.51	0.2254	0.2647
0.50	0.029	0.471	0.46	0.278	0.262.

⇒ Solid-free Basis:- $X_c = Y_c$

$$\frac{x_c}{x_B + x_c} = \frac{y_c}{y_B + y_c}$$

$$\frac{x_c}{1 - x_A} = \frac{y_c}{y_B + y_c} \Rightarrow x_c = \frac{y_c(1 - x_A)}{y_B + y_c}.$$

Plot $(x_B - x_C)$, $(y_B - y_C)$

$\Rightarrow$ F = 1000 kg , $(x_C)_F = 0.25$, S = 1500 kg , $(y_C)_S = 0$

Stage(1):-

$$M \Rightarrow (x_C)_{M_1} = \frac{(0.25)(1000)}{1000 + 1500} = \frac{250}{2500} = 0.1$$

From Graph:-

$$(x_C)_{L_1} = 0.04 \quad , \quad (y_C)_{V_1} = 0.15$$

Material Balance:-

$$L + V = F + S = 2500 \longrightarrow (1)$$

$$L(0.04) + V(0.15) = (1000)(0.25) \longrightarrow (2)$$

$$4L + 15V = 25000$$

$$4L + 4V = 10000$$

$$11V = 15000$$

$$\Rightarrow V_1 = 1363.63 \text{ kg}$$

$$\Rightarrow L_1 = 1136.36 \text{ kg}$$

Stage(2):-

$$L_1 = F = 1136.36 \text{ kg}, \quad (x_C)_{L_1} = 0.04 , \quad S = 1500,$$

$$(x_C)_{M_2} = \frac{F(x_C)_{L_1} + S(y_C)_S}{F+S} = \frac{1000(0.04) + 0}{1135}$$

$$= \frac{(1136.36)(0.04) + 0}{1136.36 + 1500}$$

$$\boxed{(x_C)_{M_2} = 0.0172}$$

From Graph:-

$(x_c)_{L_2} = 0.01$, $(y_c)_{V_2} = 0.02$

Material Balance:-

$$L_2 + V_2 = L_1 + S = 2636.36 \longrightarrow (1)$$

$$L_2(0.01) + V_2(0.02) = (1136.36)(0.04) \longrightarrow (2)$$

$$L_2 + 2V_2 = 4545.44$$

$$L_2 + V_2 = 2636.36$$

$$\boxed{\begin{aligned} V_2 &= 1909.08 \text{ kg} \\ L_2 &= 727.28 \text{ kg} \end{aligned}}$$

* Total Oil removal from stage(1,2):-

$$= (V_1)(y_c)_{V_1} + (V_2)(y_c)_{V_2}$$

$$= (1363.63)(0.15) + (1909.08)(0.02)$$

$$= 204.5445 + 38.1816$$

$$= 242.7261$$

* Fractional Recovery $= \frac{242.7261}{250} = 0.97.$

$= 97\%$