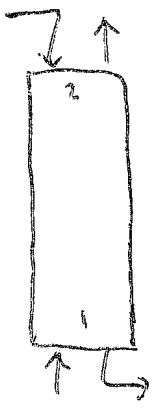
Problema 8

Deshumidificación



$T_{G_1} = 38°C$

$T_{bH_1} = 30°C$

$G_s = 1,2\ m^3/s$

$L_{op} = 1,5 L_{min}$

$T_{L_2} = 10°C$

$T_{bH_2} = 15°C$

$G_s'' = 1,25 \frac{Kg}{5\ m^2}$

$K_y = 2 \frac{Kg}{m^3 \cdot s}$

① Se calcula la Entalpía del Gas a las condiciones de Entrada

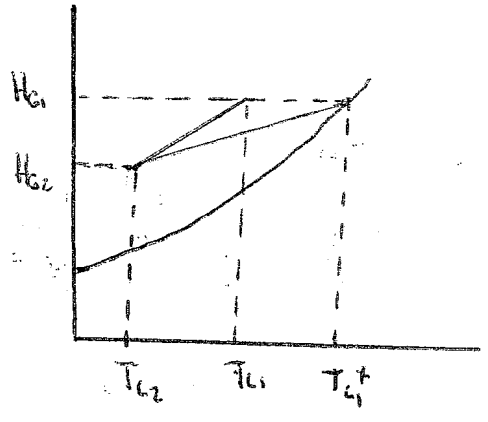
$$T_{G_1} = 38°C \\ T_{bH_1} = 30°C \Rightarrow H_{G_1} = 100 \frac{KJ}{Kg} \quad V_{H_1} = 0,915 \frac{m^3}{Kg}$$

$$G_s' = \frac{G_{s_1}}{V_{H_1}} = \frac{1,2\ m^3/s}{0,915 \frac{m^3}{Kg}} = 1,3115 \frac{Kg}{s}$$

② Asumimos que la temperatura del Gas a la salida permanece constante y calculamos la nueva entalpía:

$$T_{G_2} = 38°C \\ T_{bH_2} = 15°C \Rightarrow H_{G_2} = 41,5 \frac{KJ}{Kg}$$

③ Calculamos las condiciones mínimas de operación



$$T_{L_1}^* = T_L^* @ H_{G_1} = 30,25°C$$

$$L_{min} = \frac{G_s'}{C_{pL}} \cdot \frac{H_1 - H_2}{T_{L_1}^* - T_{L_2}}$$

$$\boxed{L_{min} = 0,9099 \frac{Kg}{s}}$$

Ahora bien, $L_{op} = 1,5 L'_{min}$

$$L'_{op} = 1,3573 \frac{Kg}{s}$$

④ Deprimimos a partir de la recta de operación el valor de T_{L_1}

$$T_{L_1} = T_{L_2} + \frac{G'_s}{L C_{pL}} (H_1 - H_2)$$

$$\boxed{T_{L_1} = 23,50^{\circ}C}$$

⑤ Verificamos la suposición inicial aplicando el método de Hickley

Para este calculo $T_{G_2} = 15^{\circ}C$

Repetimos del paso 2-5 pero $T_{G_2} = 15$

(2.B)

$$\left.\begin{array}{l} T_{G_2} = 15^{\circ}C \\ T_{BH_2} = 15^{\circ}C \end{array}\right\} \Rightarrow H_{G_2} = 42 \frac{KJ}{Kg}$$

$L_{min} = 0,8972 \frac{Kg}{s}$

$L_{op} = 1,3957 \frac{Kg}{s}$

$T_{L_1} = 23,5^{\circ}C$

$\boxed{T_{G_2} = 19,5^{\circ}C}$

Finalmente

$T_{L_1} = 23,50^{\circ}C$

$T_{G_2} = 15^{\circ}C$

$L'_{op} = 1,3957 \frac{Kg}{s}$

⑥ Se calcula el Diametro de la Columna

$$A_T = \frac{G_s'}{G_s''} = \frac{1,3115 \frac{Kg}{s}}{1,25 \frac{Kg}{s \cdot m^2}} = 1,0492 m^2$$

$$A_T = \frac{\pi D^2}{4} \Rightarrow \boxed{D = 1,16m}$$

⑦ Se calcula la Altura de la torre

$$H_{TG} = \frac{G_s'}{K_y A_T} = 0,625m \qquad Z = N_{TG} \cdot H_{TG}.$$

$$N_{TG} = \int_{H_1}^{H_2} \frac{dH}{H^* - H} \qquad h = \frac{100 - 41,5}{5} = 11,7$$

H (KJ/Kg)	H* (KJ/Kg)
41,5	29
53,2	35
64,9	93
76,6	50
88,3	59
100,0	69

$$N_{TG} = \frac{h}{2} \times 0,4569$$

$$\boxed{N_{TG} = 2,67}$$

$$\boxed{Z = 1,668m}$$