Fazer a análise dimensional p/ ver se está correto o balanço!!!

hipóteses: ρ cte, ~~f cte, h cte~~, V cte

Teste 2

Balanço de massa — lado esquerdo: $\frac{cm^3}{s} \times \frac{mol}{cm^3} = \boxed{\frac{mol}{s}}$

$$\boxed{f_1 C_{A1}(t) + f_2 C_{A2}(t) - (f_1 + f_2) C_A(t) = A h \frac{dC_A(t)}{dt}}$$

↳ lado direito: $cm^2 . cm . \frac{mol}{cm^3} . \frac{1}{s}$ " $\boxed{\frac{mol}{s}}$ //

S.S:

$$f_1 \bar{C}_{A1} + f_2 \bar{C}_{A2} - (f_1 + f_2)\bar{C}_A = 0$$

Diminuindo:

$$f_1 [C_{A1}(t) - \bar{C}_{A1}] + f_2 [C_{A2}(t) - \bar{C}_{A2}] - (f_1 + f_2)[C_A(t) - \bar{C}_A] = A h \frac{d[C_A(t) - \bar{C}_A]}{dt}$$

Sendo as variáveis de desvio:

$$\hat{C}_{A1}(t) = C_{A1}(t) - \bar{C}_{A1}$$
$$\hat{C}_{A2}(t) = C_{A2}(t) - \bar{C}_{A2}$$
$$\hat{C}_A(t) = C_A(t) - \bar{C}_A$$

Temos:

$$f_1 \hat{C}_{A1}(t) + f_2 \hat{C}_{A2}(t) - (f_1 + f_2)\hat{C}_A(t) = A h \frac{d \hat{C}_A(t)}{dt}$$

$$f_1 \hat{C}_{A1}(t) + f_2 \hat{C}_{A2}(t) = A h \frac{d\hat{C}_A(t)}{dt} + (f_1 + f_2)\hat{C}_A(t)$$

Dividindo por $(f_1 + f_2)$

$$\underbrace{\frac{f_1}{f_1 + f_2}}_{k_1} \hat{C}_{A1}(t) + \underbrace{\frac{f_2}{f_1 + f_2}}_{k_2} \hat{C}_{A2}(t) = \underbrace{\frac{A h}{(f_1 + f_2)}}_{\tau} \frac{d\hat{C}_A(t)}{dt} + \hat{C}_A(t)$$

$$k_1 \hat{C}_{A1}(t) + k_2 \hat{C}_{A2}(t) = \tau \frac{d\hat{C}_A(t)}{dt} + \hat{C}_A(t)$$

Fazendo Laplace:

$$k_1 \hat{C}_{A1}(s) + k_2 \hat{C}_{A2}(s) = \tau [s \hat{C}_A(s) + \cancel{\hat{C}_A(0)}^{0}] + \hat{C}_A(s)$$

$$k_1 \hat{C}_{A1}(s) + k_2 \hat{C}_{A2}(s) = \hat{C}_A(s)[\tau s + 1]$$

$$\hat{C}_A(s) = \frac{k_1 \hat{C}_{A1}(s)}{\tau s + 1} + \frac{k_2 \hat{C}_{A2}(s)}{\tau s + 1}$$

$$\frac{\hat{C}_A(s)}{\hat{C}_{A1}(s)} = \frac{K_1}{\tau s + 1} \qquad \frac{\hat{C}_A(s)}{\hat{C}_{A2}(s)} = \frac{K_2}{\tau s + 1}$$

$$K_1 = \frac{f_1}{f_1 + f_2} = \text{adimensional}$$

$$K_2 = \frac{f_2}{f_1 + f_2} = \text{"}$$

$$\tau = \frac{A\,h}{(f_1 + f_2)} = \frac{m^2 \cdot m}{\frac{m^3}{s}} = s$$