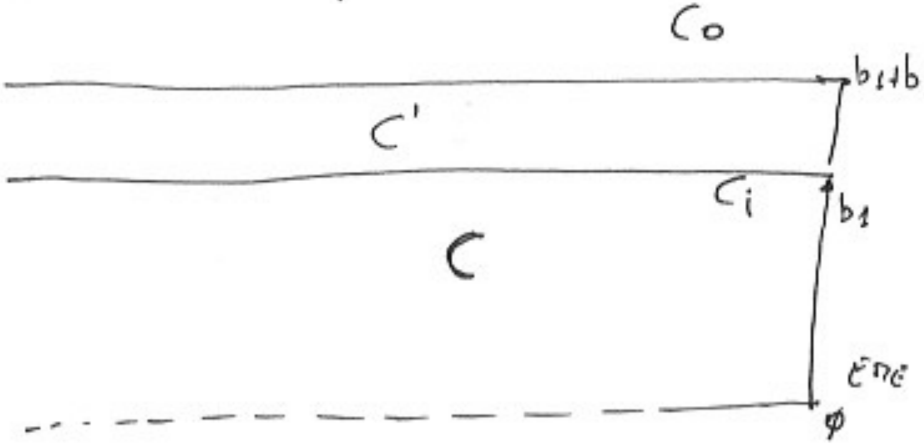
1




$$\begin{cases} \dfrac{\partial c'}{\partial t} = D_2 \dfrac{\partial^2 c'}{\partial x^2} \\ \dfrac{\partial c}{\partial t} = D_1 \dfrac{\partial^2 c}{\partial x^2} + K'(y_0 - y) - Kcy \\ \dfrac{\partial y}{\partial t} = D_{Hb} \dfrac{\partial^2 y}{\partial x^2} + K'(y_0 - y) - Kcy \end{cases}$$

$c'(b_1+b_2) = C_0$

$c(b_1) = c'(b_1) = C_i$

$y(0) = y_0$

$c = \alpha c'$

$D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x}$

Stazionarietà

$\frac{\partial c}{\partial t} = \phi \quad \frac{\partial c'}{\partial t} = \phi$

$D_{Hb} = \phi \quad K' \neq \phi$

$$\begin{cases} D_2 \dfrac{\partial^2 c'}{\partial x^2} = \phi & (1) \\ D_1 \dfrac{\partial^2 c}{\partial x^2} = Kcy - K'(y_0 - y) & (2) \\ \dfrac{\partial y}{\partial t} = K'(y_0 - y) - Kcy & (3) \end{cases}$$

1

$\frac{\partial^2 c'}{\partial x^2} = \phi \quad \frac{\partial c'}{\partial x} = A$

$\int_{c'(b_1)}^{c'(x)} \partial c' = \int_{b_1}^{x} A\,dx$

$c'(x) - C_i = A(x - b_1)$

(2)

$$c'(b_1+b_2)=c_0$$

$$c'(b_1+b_2)-c_i = A[b_1+b_2-b_1]$$

$$c_0 - c_i = A\,b_2 \rightarrow A = \frac{c_0-c_i}{b_2}$$

$$c'(x) = c_i + \frac{(c_0-c_i)}{b_2}(x-b_1)$$

$$\begin{cases} D_1 \dfrac{\partial^2 c}{\partial x^2} = k c y - k'(y_0 - y) & (2) \\ \dfrac{\partial y}{\partial t} = k'(y_0-y) - k c y & (3) \end{cases}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} + \frac{\partial y}{\partial t} = \phi$$

$$\frac{\partial y}{\partial t} = -D_1 \frac{\partial^2 c}{\partial x^2} \qquad \alpha D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x}$$

$$\frac{\partial y}{\partial t} = -\frac{\partial}{\partial x}\left(D_1 \frac{\partial c}{\partial x}\right) = -\frac{\partial}{\partial x}\left(\alpha D_2 \frac{\partial c'}{\partial x}\right) = -\alpha D_2 \frac{\partial^2 c'}{\partial x^2} = \phi$$

$$\frac{\partial y}{\partial t} = \phi \quad \Rightarrow \quad y = \underline{y}^{*} \ \text{cost}$$

$$c' = c_i + \frac{(c_0 - c_i)}{b_2}(x - b_1)$$

$$D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x} = \alpha D_2 \frac{(c_0 - c_i)}{b_2}$$

$$\frac{\partial c}{\partial x} = \alpha \frac{D_2}{D_1} \frac{(c_0 - c_i)}{b_2}$$

$$\int_{c(0)}^{c(x)} \partial c = \int_0^x \alpha \frac{D_2}{D_1} \frac{(c_0 - c_i)}{b_2} \partial x$$

$$c(x) - \underset{\substack{\parallel \\ 0}}{c(0)} = \alpha \frac{D_2}{D_1} \frac{(c_0 - c_i)}{b_2} x.$$

$$c(x) = \alpha \frac{D_2}{D_1} \frac{(c_0 - c_i)}{b_2} x.$$

$$\begin{cases} \dfrac{\partial c'}{\partial t} = D_2 \dfrac{\partial^2 c'}{\partial x^2} \\ \dfrac{\partial c}{\partial t} = D_1 \dfrac{\partial^2 c}{\partial x^2} + K'(y_0 - y) - Kcy \\ \dfrac{\partial y}{\partial t} = D_{Hb} \dfrac{\partial^2 y}{\partial x^2} + K'(y_0 - y) - Kcy \end{cases}$$

Sistema non è stazionario

$$\frac{\partial c'}{\partial t} \neq 0 \quad \frac{\partial c}{\partial t} \neq 0 \quad D_{Hb} = \phi \quad K' = \phi$$

$$\begin{cases} \dfrac{\partial c'}{\partial t} = D_2 \dfrac{\partial^2 c'}{\partial x^2} & (1) \\ \dfrac{\partial c}{\partial t} = D_1 \dfrac{\partial^2 c}{\partial x^2} - Kcy & (2) \\ \dfrac{\partial y}{\partial t} = -Kcy & (3) \end{cases}$$

$$\frac{\partial c'}{\partial t} = D_2 \frac{\partial^2 c'}{\partial x^2}$$

$$c'(x,t)$$

$$\begin{cases} \dfrac{\partial c'}{\partial t} = A \\ D_2 \dfrac{\partial^2 c'}{\partial t} = A \end{cases}$$

$$\int_{c'(x,0)}^{c'(x,t)} \partial c' = \int_0^t A \, \partial t$$

$$c'(x,t) - c'(x,0) = At$$

$$c'(x,0) = \phi$$

$$c'(x,t) = At$$

$$c'(b_1 + b_2, \bar{t}) = A\bar{t}$$

$$\overset{\shortparallel}{c_0}$$

$$A = \frac{c_0}{\bar{t}} \qquad c'(x,t) = \frac{c_0}{\bar{t}} \cdot t$$

$$D_2 \frac{\partial^2 c'}{\partial x^2} = A \qquad \frac{\partial^2 c'}{\partial x^2} = \frac{A}{D_2}$$

$$\frac{\partial c'}{\partial x} = \frac{A}{D_2} x + B.$$

$$c' = \frac{A}{D_2} \frac{x^2}{2} + Bx + C$$

$$\cancel{c'(x=0, t) = \frac{A}{D_2} \cdot 0 + B \cdot 0 + C =}$$

$$c'(b_1, t) = \frac{A}{D_2} \cdot \frac{b_1^2}{2} + B \cdot b_1 + C = C_i$$

$$c'(b_1 + b_2, t) = \frac{A}{D_2} \frac{(b_1 + b_2)^2}{2} + B(b_1 + b_2) + C = C_a$$

$$c'(x, t) = \frac{C_0}{D_2 \tau} \cdot \frac{x^2}{2} + Bx + C$$

---

$$D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x} = \alpha D_2 \frac{C_0 \cdot 2x}{2 D_2 \tau} + B$$

$$D_1 \frac{\partial c}{\partial x} = \frac{\alpha \cancel{D_2} C_0 \cdot x}{2 \cancel{D_2} \bar{t}} + \alpha B D_2$$

$$\frac{\partial c}{\partial x} = \frac{\alpha C_0 x}{\cancel{2} D_1 \bar{t}} + \alpha \frac{B D_2}{D_1}$$

$$C(x,t) - \underset{\phi}{\underset{\shortparallel}{c(0,t)}} = \frac{\alpha C_0 x^2}{2 D_1 \bar{t}} + \alpha \frac{B D_2}{D_1} x + \Gamma$$

$$C(x,t) = \frac{\alpha C_0 x^2}{2 D_1 \bar{t}} + \alpha \frac{B D_2}{D_1} x + \Gamma$$

$$c(b_1, t) = c_i$$

$$\Gamma = c_i - \frac{\alpha c_0 b_1^2}{2 D_1 \bar{t}} - \frac{\alpha B D_2 b_1}{D_1}$$

$$\frac{\partial Y}{\partial t} = -k c Y \Rightarrow \frac{\partial Y}{\cancel{Y}} = -k c\, dt$$

$$\int_{Y(x,0)}^{Y(x,t)} \frac{dY}{Y} = -k \int_0^t c(x,t)\,dt \qquad \ln \frac{Y(x,t)}{Y(x,0)} = -k c \cdot t \Rightarrow \ln \frac{Y(x,t)}{Y_0} = -k c t$$

$$Y(x,t) = Y_0\, e^{-k c(x,t) \cdot t}$$

$$D_1 \frac{\partial^2 c}{\partial x^2} = - K_{c_{O_2}} c$$

$$\underline{D_1} \frac{\partial^2 c}{\partial x^2} + \underline{K_{c_{O_2}}} c = \phi$$

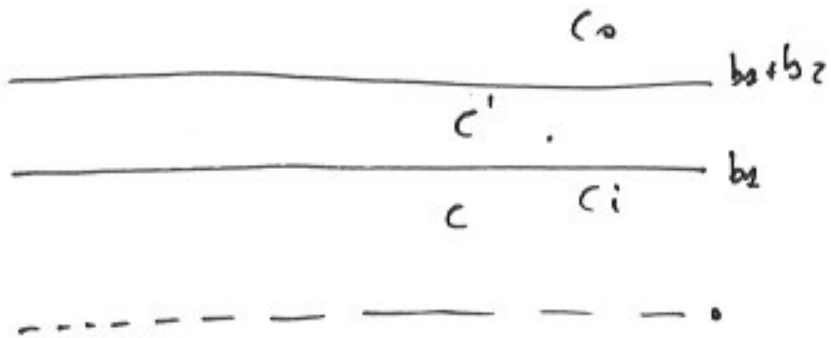
$$D_1 \cdot \lambda^2 + K_{c_{O_2}} = \phi \qquad \lambda^2 = - \frac{K_{c_{O_2}}}{D_1} = \pm i \sqrt{\frac{K_{c_{O_2}}}{D_1}}.$$

$$c(x,t) = A e^{-\lambda_1 x} + B e^{-\lambda_2 x}.$$

$$c(0,t) = \phi$$

$$c(b_1,t) = c_i$$

Co? ⑧




1) $\frac{\partial c'}{\partial t} = -D_2 \frac{\partial^2 c'}{\partial x^2}$

2) $\frac{\partial c}{\partial t} = -D_1 \frac{\partial^2 c}{\partial x^2} - K_{Co} c$

3) $\frac{\partial Y}{\partial t} = D_{H_b} \frac{\partial^2 Y}{\partial x^2}$

stazionario

$\frac{\partial c'}{\partial t} = \phi \qquad \frac{\partial c}{\partial t} = \phi \qquad D_{Hb} = \phi$

$$\begin{cases} -D_2 \frac{\partial^2 c'}{\partial x^2} = \phi & (1) \\ D_1 \frac{\partial^2 c}{\partial x^2} = -K_{Co} c & (2) \\ \frac{\partial Y}{\partial t} = \phi & (3) \end{cases}$$

$\frac{\partial Y}{\partial t} = \phi \qquad Y = Y_0^* = \text{cost.}$

$4+3+2+1+0$

$\frac{\partial^2 c'}{\partial x^2} = \phi \qquad \frac{\partial c'}{\partial x} = A$

$c'(x) = Ax + B$

$c'(b_1) = c_i$

$c'(b_1+b_2) = c_0$

$c_i = Ab_1 + B$

$c_0 = A(b_1+b_2) + B$

Monossido di Carbonio

1) $$\frac{\partial c'}{\partial t} = D_2 \frac{\partial^2 c'}{\partial x^2}$$

2) $$\frac{\partial c}{\partial t} = D_1 \frac{\partial^2 c}{\partial x^2} - Kcy$$

3) $$\frac{\partial y}{\partial t} = D_{Hb} \frac{\partial y}{\partial t} - Kcy$$

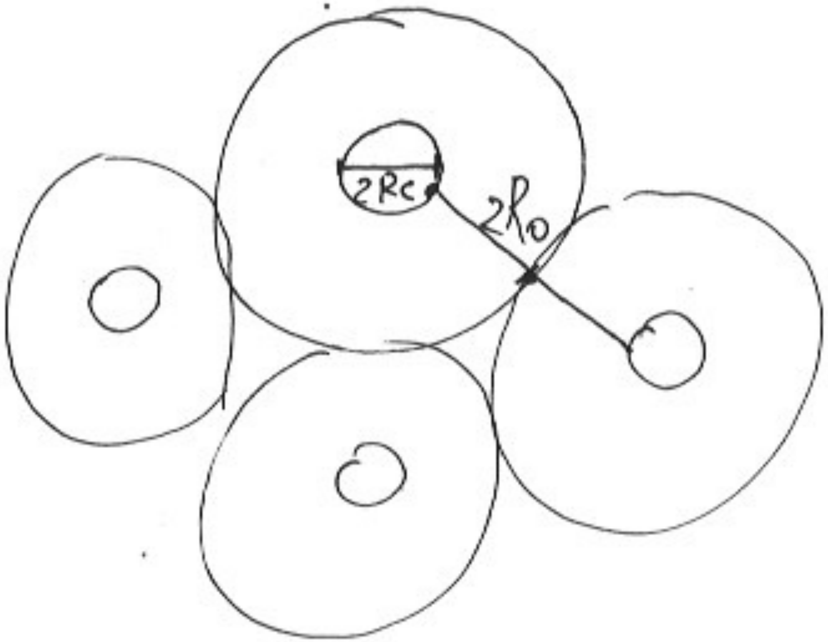
$$\frac{\partial c'}{\partial t} = \phi \qquad \frac{\partial c}{\partial t} = \phi \qquad D_{Hb} = \phi$$

$$\begin{cases} D_2 \frac{\partial^2 c'}{\partial x^2} = \phi \\ D_1 \frac{\partial^2 c}{\partial x^2} = Kcy \\ \frac{\partial y}{\partial t} = \cancel{K} cy. \end{cases}$$

$$c = \alpha c'$$

$$D_1 \frac{\partial c}{\partial x} = \alpha D_2 \frac{\partial c'}{\partial x}.$$

# Modello di Krogh - $O_2$




$$\frac{D_{O_2}}{r}\frac{\partial}{\partial r}\left(r\frac{\partial c}{\partial r}\right) = \overset{Cons_{O_2}}{\cancel{R_{O_2}}} = \left[\frac{mol}{cm^3 \cdot s}\right]$$

$$\frac{\partial}{\partial r}\left(r\frac{\partial c}{\partial r}\right) = \frac{Cons_{O_2} \cdot r}{D_{O_2}}$$

$$r\frac{\partial c}{\partial r} = \frac{Cons_{O_2} \cdot r^2}{2 D_{O_2}} + B$$

$$\frac{\partial c}{\partial r} = \frac{Cons_{O_2} \cdot r}{2 D_{O_2}} + \frac{B}{r}$$

$$c(r) = \frac{Cons_{O_2} \cdot r^2}{4 D_{O_2}} + B\ln r + C$$

$C(R_c) = C_0 = HP(104\ mmHg)$

$C(R_0) = \emptyset$

$R_0 = 50\,\mu m$

Modello di Krogh $CO_2$

$$-\frac{D_{CO_2}}{r}\frac{\partial}{\partial r}\left(r\frac{\partial c}{\partial r}\right) = C_{ons\,CO_2}$$