Reactores não isotérmicos

Balanço de energia

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Calor fornecido - Trabalho realizado + Energia que entra - Energia que sai = Energia acumulada

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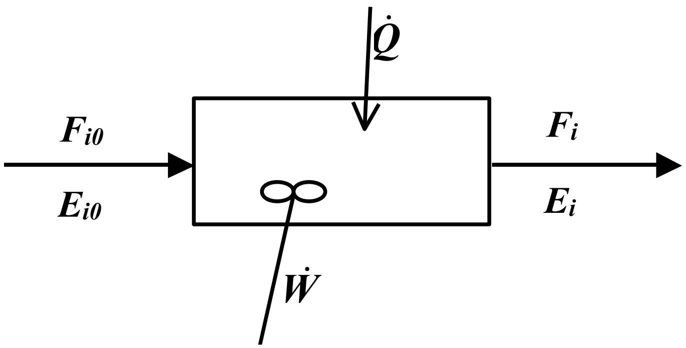

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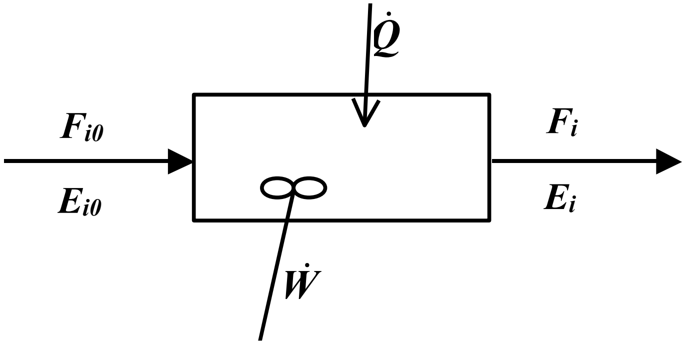
Calor fornecido - Trabalho realizado + Energia que entra - Energia que sai = Energia acumulada

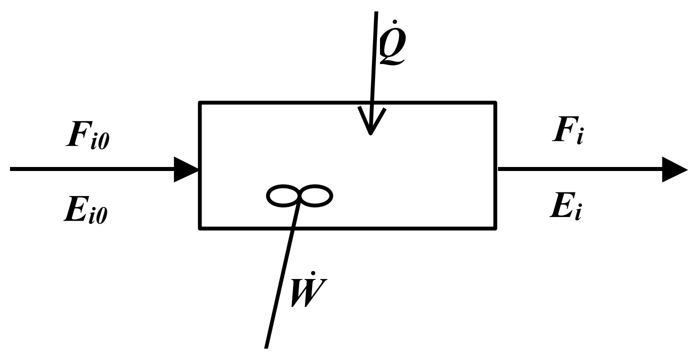


$$\therefore \quad \dot{Q} - \dot{W} + \sum_i F_{i0}\, E_{i0} - \sum_i F_i\, E_i = \frac{dE}{dt}$$

Reactores não isotérmicos

Balanço de energia

Calor fornecido - **Trabalho realizado** + **Energia que entra** - **Energia que sai** = **Energia acumulada**



$$\therefore \quad \dot{Q} - \dot{W} + \sum_i F_{i0}\, E_{i0} - \sum_i F_i\, E_i = \frac{dE}{dt}$$

$$\dot{W} = \dot{W}_{term} + \dot{W}_{mec}$$

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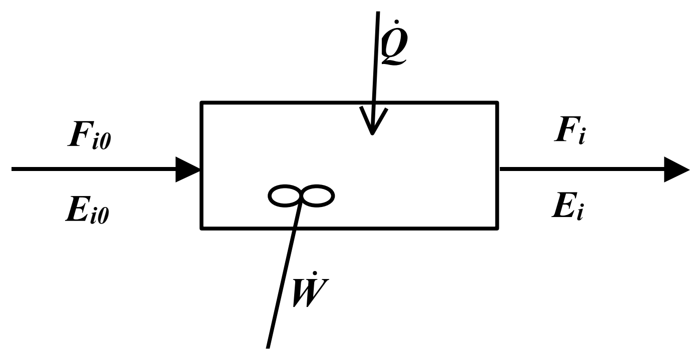
Balanço de energia

Calor fornecido	-	Trabalho realizado	+	Energia que entra	-	Energia que sai	=	Energia acumulada



$$\therefore \quad \dot{Q} - \dot{W} + \sum_i F_{i0}\, E_{i0} - \sum_i F_i\, E_i = \frac{dE}{dt}$$

$$\dot{W} = \dot{W}_{term} + \dot{W}_{mec}$$

$$\therefore \quad \dot{W} = -\sum_i F_{i0}\, P V_{i0} + \sum_i F_i\, P V_i + \dot{W}_{mec}$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + PV_{i0}\right) - \sum_i F_i\left(E_i + PV_i\right) = \frac{dE}{dt}$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + PV_{i0}\right) - \sum_i F_i\left(E_i + PV_i\right) = \frac{dE}{dt}$$

$$E_i = \underbrace{U_i}_{\text{E. int.}} + \underbrace{\frac{u_i^2}{2}}_{\text{E. cin.}} + \underbrace{g\,z_i}_{\text{E. pot.}} + outras$$

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$$E_i = U_i$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + P V_{i0}\right) - \sum_i F_i\left(E_i + P V_i\right) = \frac{dE}{dt}$$

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$$E_i = U_i \qquad H_i = U_i + P\, V_i$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + P\,V_{i0}\right) - \sum_i F_i\left(E_i + P\,V_i\right) = \frac{dE}{dt}$$

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$$\mathbf{A} + \frac{b}{a}\mathbf{B} \qquad \frac{c}{a}\mathbf{C} + \frac{d}{a}\mathbf{D}$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + P V_{i0}\right) - \sum_i F_i\left(E_i + P V_i\right) = \frac{dE}{dt}$$

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$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\, H_{i0} - \sum_i F_i\, H_i = \frac{dE}{dt}$$

$$\mathbf{A} + \frac{b}{a}\mathbf{B} \qquad \frac{c}{a}\mathbf{C} + \frac{d}{a}\mathbf{D}$$

$$F_A = F_{A0}\left(1 - X\right)$$

$$F_B = F_{A0}\left(\theta_B - \frac{b}{a}X\right)$$

$$F_C = F_{A0}\left(\theta_C + \frac{c}{a}X\right)$$

$$F_D = F_{A0}\left(\theta_D + \frac{d}{a}X\right)$$

$$F_I = F_{A0}\,\theta_I$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + PV_{i0}\right) - \sum_i F_i\left(E_i + PV_i\right) = \frac{dE}{dt}$$

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$$\mathbf{A} + \frac{b}{a}\mathbf{B} \qquad \frac{c}{a}\mathbf{C} + \frac{d}{a}\mathbf{D}$$

$$F_A = F_{A0}\left(1 - X\right)$$

$$\sum_i F_{i0}\,H_{i0} = F_{A0}\,H_{A0} + F_{B0}\,H_{B0} + F_{C0}\,H_{C0} + F_{D0}\,H_{D0} + F_{I0}\,H_{I0}$$

$$F_B = F_{A0}\left(\theta_B - \frac{b}{a}X\right)$$

$$F_C = F_{A0}\left(\theta_C + \frac{c}{a}X\right)$$

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$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + P V_{i0}\right) - \sum_i F_i\left(E_i + P V_i\right) = \frac{dE}{dt}$$

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$$\mathbf{A} + \frac{b}{a}\mathbf{B} \qquad \frac{c}{a}\mathbf{C} + \frac{d}{a}\mathbf{D}$$

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$$\sum_i F_{i0}\, H_{i0} = F_{A0}\, H_{A0} + F_{B0}\, H_{B0} + F_{C0}\, H_{C0} + F_{D0}\, H_{D0} + F_{I0}\, H_{I0}$$

$$F_B = F_{A0}\left(\theta_B - \frac{b}{a}X\right)$$

$$\sum_i F_i\, H_i = F_A\, H_A + F_B\, H_B + F_C\, H_C + F_D\, H_D + F_I\, H_I$$

$$F_C = F_{A0}\left(\theta_C + \frac{c}{a}X\right)$$

$$F_D = F_{A0}\left(\theta_D + \frac{d}{a}X\right)$$

$$F_I = F_{A0}\,\theta_I$$

$$\Rightarrow \quad \dot{Q} - \dot{W}_{mec} + \sum_i F_{i0}\left(E_{i0} + PV_{i0}\right) - \sum_i F_i\left(E_i + PV_i\right) = \frac{dE}{dt}$$

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$$\sum_i F_{i0}\,H_{i0} = F_{A0}\,H_{A0} + F_{B0}\,H_{B0} + F_{C0}\,H_{C0} + F_{D0}\,H_{D0} + F_{I0}\,H_{I0}$$

$$\sum_i F_i\,H_i = F_A\,H_A + F_B\,H_B + F_C\,H_C + F_D\,H_D + F_I\,H_I$$

$$\therefore \sum_i F_{i0}\,H_{i0} - \sum_i F_i\,H_i = F_{A0}\begin{bmatrix}\left(H_{A0} - H_A\right) + \left(H_{B0} - H_B\right)\theta_B + \\ + \left(H_{C0} - H_C\right)\theta_C + \left(H_{D0} - H_D\right)\theta_D + \\ + \left(H_{I0} - H_I\right)\theta_I\end{bmatrix} -$$

$$- \underbrace{\left(-H_A - \frac{b}{a}H_B + \frac{c}{a}H_C + \frac{d}{a}H_D\right)}_{\Delta H_R} F_{A0}\,X$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i \left(H_{i0} - H_i\right)\theta_i - \Delta H_R F_{A0} X$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i \left(H_{i0} - H_i \right) \theta_i - \Delta H_R F_{A0} X$$

$$\dot{Q} - \dot{W}_{mec} + \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = \frac{dE}{dt}$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i \left(H_{i0} - H_i\right)\theta_i - \Delta H_R F_{A0} X$$

$$\dot{Q} - \dot{W}_{mec} + F_{A0} \sum_i \left(H_{i0} - H_i\right)\theta_i - F_{A0} \Delta H_R X = \frac{dE}{dt}$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i (H_{i0} - H_i)\theta_i - \Delta H_R F_{A0} X$$

estado estacionário: $\dot{Q} - \dot{W}_{mec} + F_{A0} \sum_i (H_{i0} - H_i)\theta_i - F_{A0} \Delta H_R X = 0$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i \left(H_{i0} - H_i \right) \theta_i - \Delta H_R F_{A0} X$$

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$$H_i = H_i^o \left(T_R \right) + \int_{T_R}^{T} C_{pi} \, dT$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i (H_{i0} - H_i)\theta_i - \Delta H_R F_{A0} X$$

estado estacionário: $$\dot{Q} - \dot{W}_{mec} + F_{A0} \sum_i (H_{i0} - H_i)\theta_i - F_{A0} \Delta H_R X = 0$$

$$H_i = H_i^o(T_R) + \int_{T_R}^{T} C_{pi}\, dT$$

$$H_i - H_{i0} = \left[H_i^o(T_R) + \int_{T_R}^{T} C_{pi}\, dT \right] - \left[H_i^o(T_R) + \int_{T_R}^{T_0} C_{pi}\, dT \right] =$$

$$= \int_{T_R}^{T} C_{pi}\, dT - \int_{T_R}^{T_0} C_{pi}\, dT = \int_{T_0}^{T_R} C_{pi}\, dT + \int_{T_R}^{T} C_{pi}\, dT = \int_{T_0}^{T} C_{pi}\, dT$$

$$\Rightarrow \sum_i F_{i0} H_{i0} - \sum_i F_i H_i = F_{A0} \sum_i (H_{i0} - H_i)\theta_i - \Delta H_R F_{A0} X$$

estado estacionário: $$\dot{Q} - \dot{W}_{mec} + F_{A0} \sum_i (H_{i0} - H_i)\theta_i - F_{A0} \Delta H_R X = 0$$

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$$= \int_{T_R}^{T} C_{pi}\, dT - \int_{T_R}^{T_0} C_{pi}\, dT = \int_{T_0}^{T_R} C_{pi}\, dT + \int_{T_R}^{T} C_{pi}\, dT = \int_{T_0}^{T} C_{pi}\, dT$$

$$\Rightarrow \sum_i F_{i0}\,H_{i0} - \sum_i F_i\,H_i = F_{A0}\sum_i \left(H_{i0} - H_i\right)\theta_i - \Delta H_R\,F_{A0}\,X$$

estado estacionário: $$\dot{Q} - \dot{W}_{mec} + F_{A0}\sum_i \left(H_{i0} - H_i\right)\theta_i - F_{A0}\,\Delta H_R\,X = 0$$

$$H_i = H_i^o\left(T_R\right) + \int_{T_R}^{T} C_{pi}\,dT$$

$$H_i - H_{i0} = \left[H_i^o\left(T_R\right) + \int_{T_R}^{T} C_{pi}\,dT\right] - \left[H_i^o\left(T_R\right) + \int_{T_R}^{T_0} C_{pi}\,dT\right] =$$

$$= \int_{T_R}^{T} C_{pi}\,dT - \int_{T_R}^{T_0} C_{pi}\,dT = \int_{T_0}^{T_R} C_{pi}\,dT + \int_{T_R}^{T} C_{pi}\,dT = \int_{T_0}^{T} C_{pi}\,dT$$

$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0}\sum_i \theta_i \int_{T_0}^{T} C_{pi}\,dT - F_{A0}\,\Delta H_R\,X = 0$$

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i\, C_{pi}$$

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$$\Delta H_R(T) = \Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT$$

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$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0} \left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT \right] X = 0$$

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i\, C_{pi}$$

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Trabalho mecânico desprezável

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i\, C_{pi} \qquad\qquad \Delta H_R(T) = \Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT$$

$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

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$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

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Uso de calores específicos médios

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i\, C_{pi}$$

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$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Trabalho mecânico desprezável

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Uso de calores específicos médios

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} \overline{C}_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} \overline{C}_{pi}\, dT\right] X = 0$$

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i C_{pi} \qquad \Delta H_R(T) = \Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT$$

$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Trabalho mecânico desprezável

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Uso de calores específicos médios

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} \overline{C}_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} \overline{C}_{pi}\, dT\right] X = 0$$

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \overline{C}_{pi} \int_{T_0}^{T} dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \overline{C}_{pi} \int_{T_R}^{T} dT\right] X = 0$$

$$\frac{d\,\Delta H_R}{dT} = \sum_i \upsilon_i\, C_{pi}$$

$$\Delta H_R(T) = \Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT$$

$$\therefore \quad \dot{Q} - \dot{W}_{mec} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Trabalho mecânico desprezável

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} C_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} C_{pi}\, dT\right] X = 0$$

Uso de calores específicos médios

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i \int_{T_0}^{T} \overline{C}_{pi}\, dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \int_{T_R}^{T} \overline{C}_{pi}\, dT\right] X = 0$$

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i\, \overline{C}_{pi} \int_{T_0}^{T} dT - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i\, \overline{C}_{pi} \int_{T_R}^{T} dT\right] X = 0$$

$$\therefore \quad \dot{Q} - F_{A0} \sum_i \theta_i\, \overline{C}_{pi}(T - T_0) - F_{A0}\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i\, \overline{C}_{pi}(T - T_0)\right] X = 0$$

Operação adiabática

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$$\dot{Q} = 0$$

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CSTR

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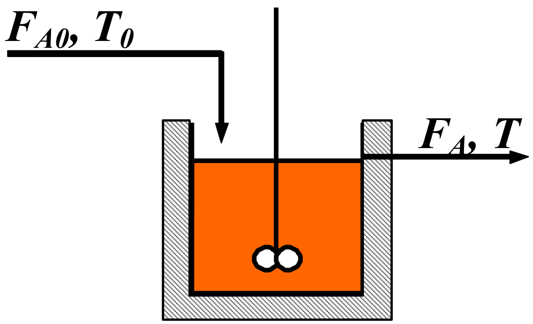
CSTR



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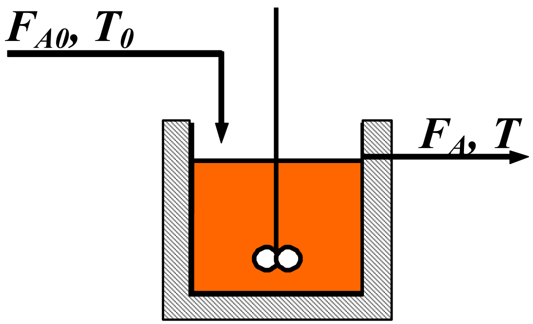
CSTR

A ⟶ **B**



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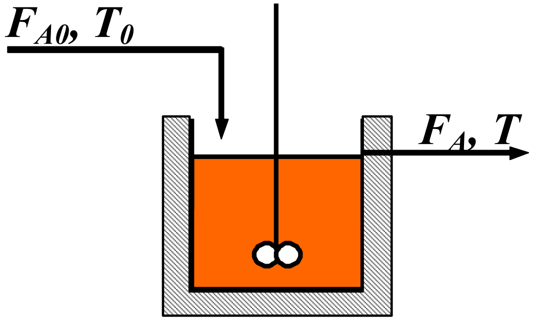
CSTR

A ⟶ B

Cinética: 1ª Ordem



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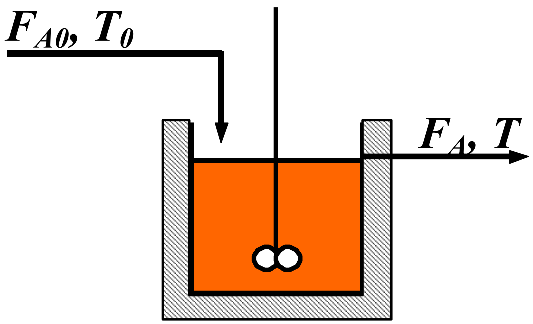
CSTR A ⟶ B **Cinética: 1ª Ordem**

$$-r_A = k\,C_A = k\,C_{A0}\left(1 - X\right)$$



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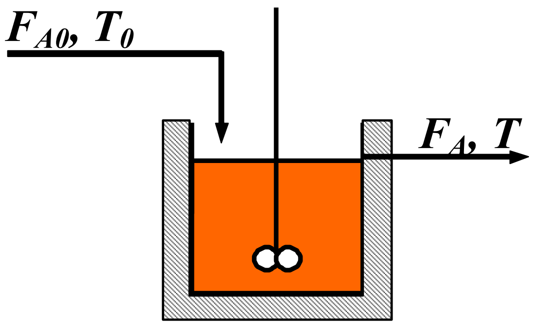

Balanço molar:

$$X = \frac{\tau k}{1 + \tau k}$$

Operação adiabática

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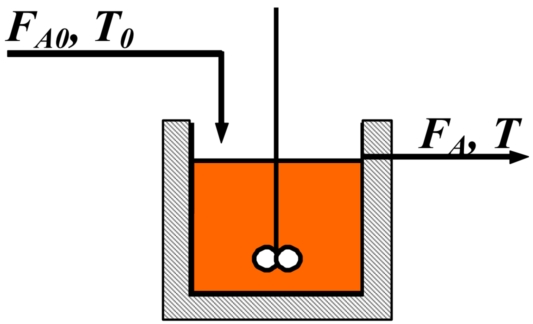

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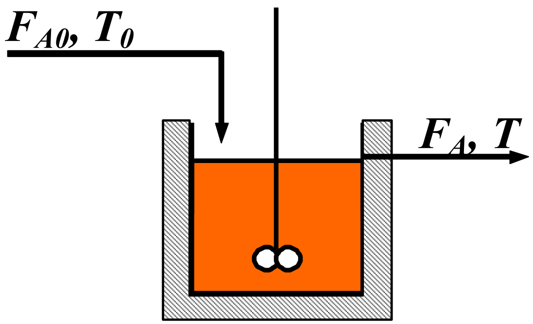

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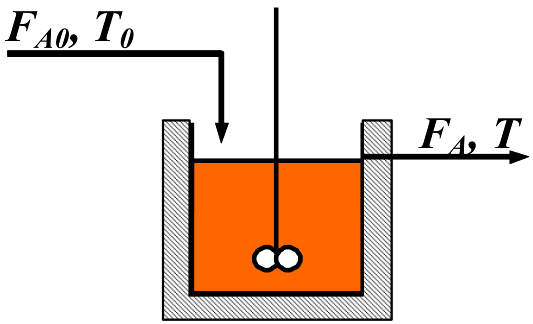

Balanço de energia:

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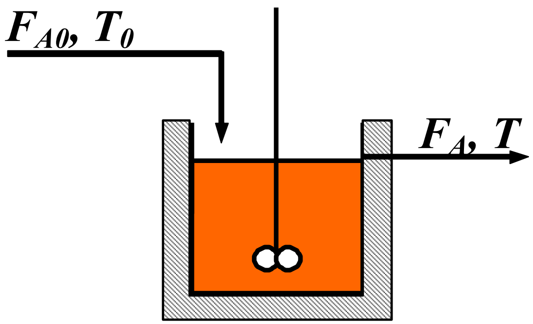

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$$X = \frac{\sum_i \theta_i \overline{C}_{pi}(T - T_0)}{-\left[\Delta H_R^o(T_R) + \sum_i \upsilon_i \overline{C}_{pi}(T - T_0)\right]}$$

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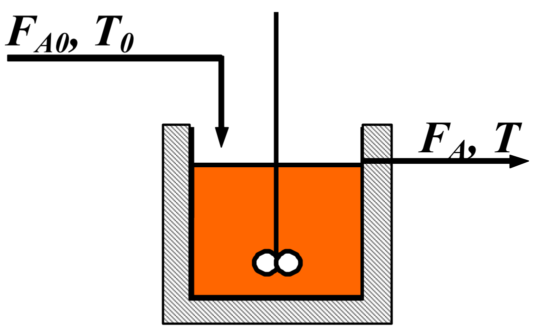

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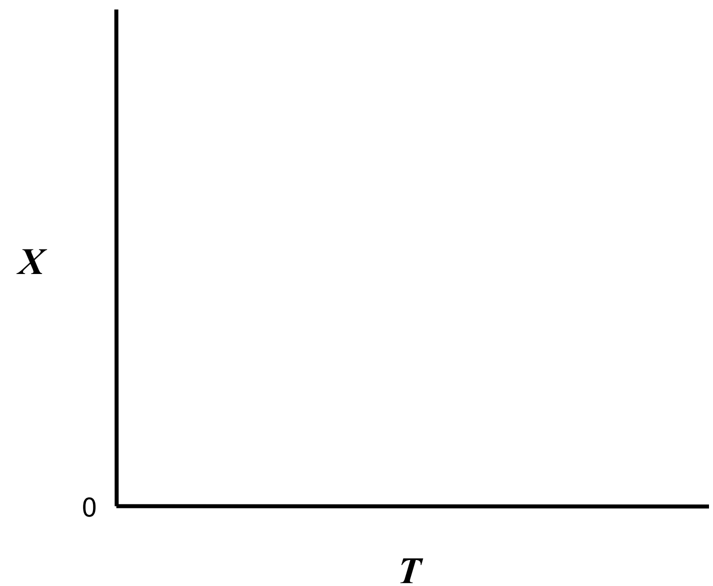

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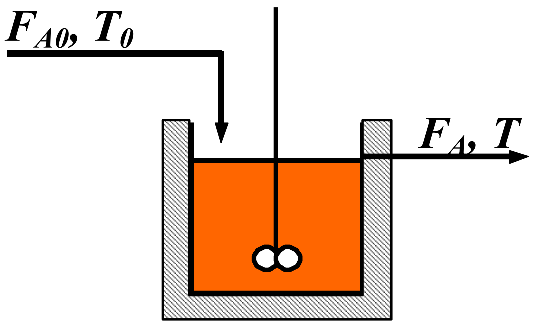

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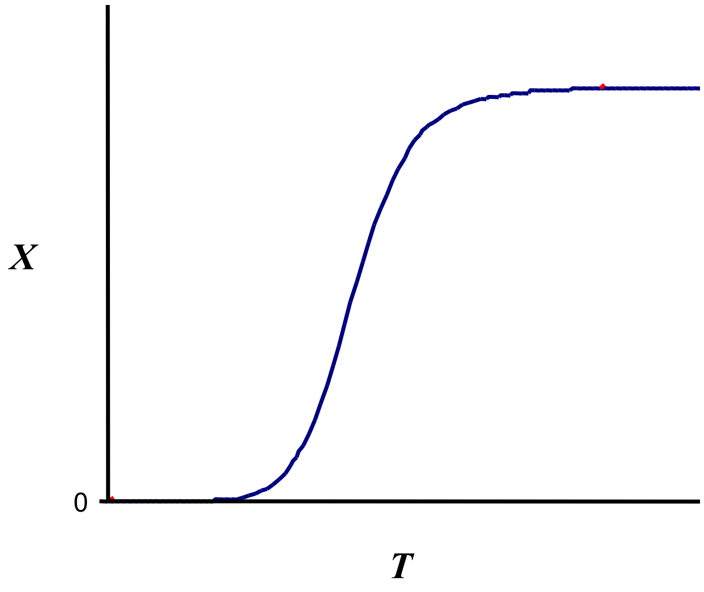

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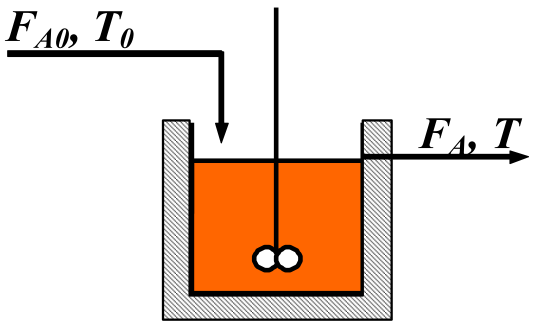

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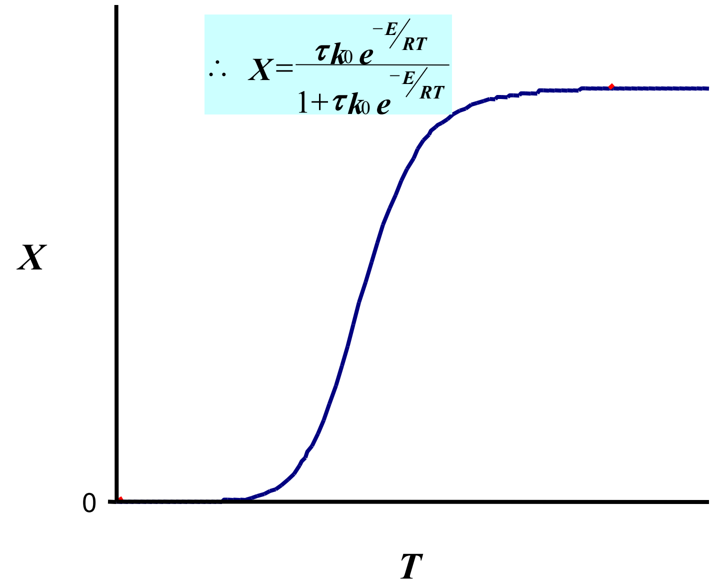

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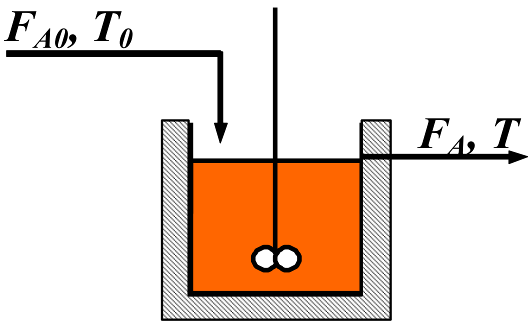

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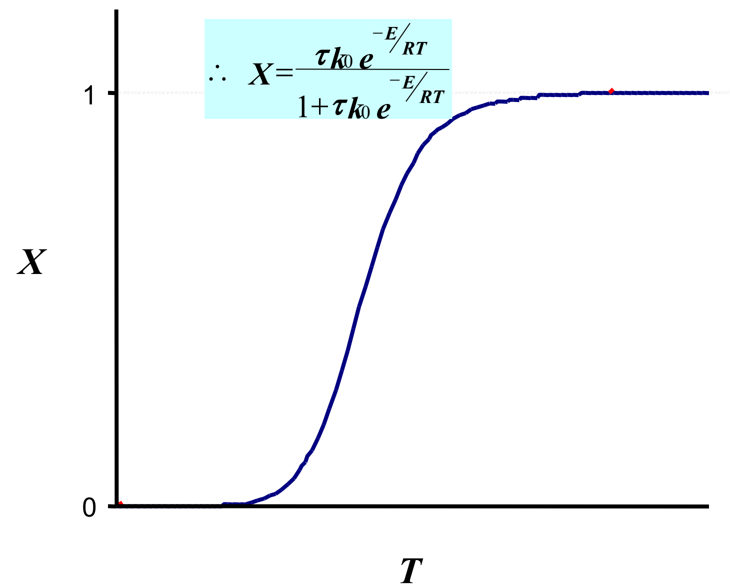

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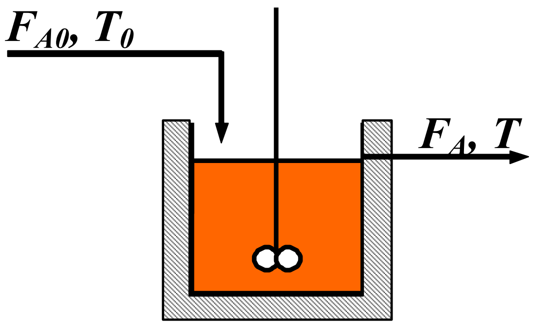

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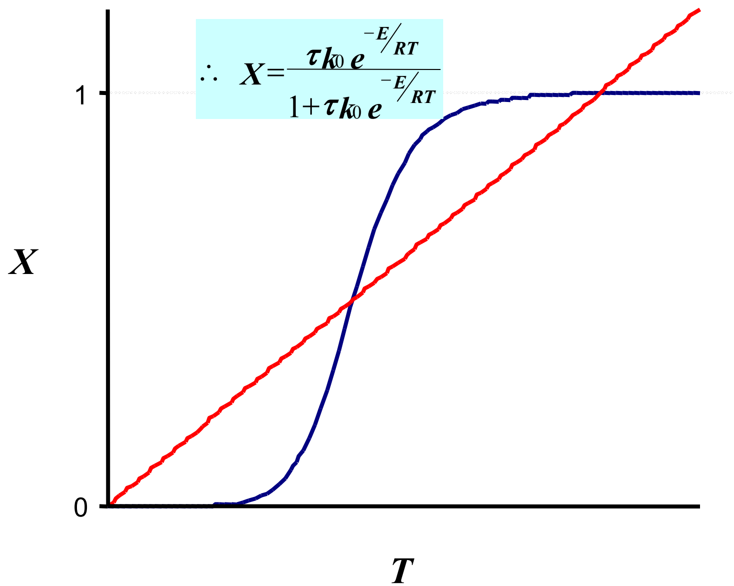

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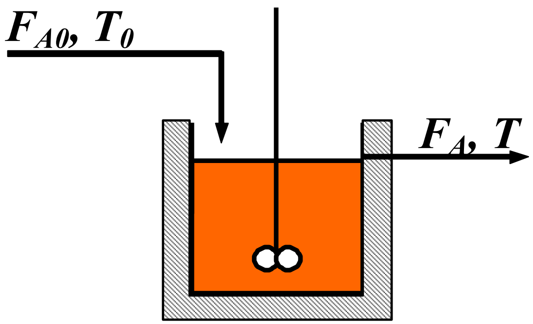

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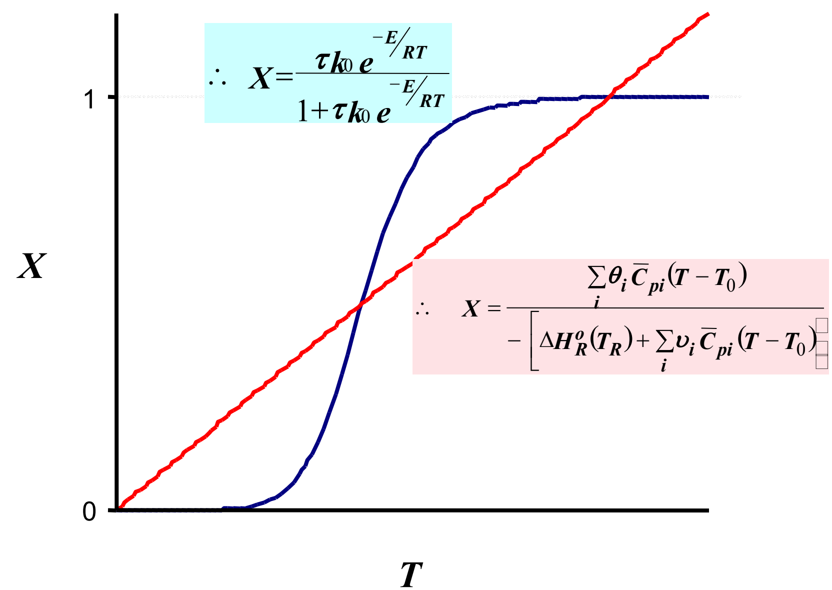

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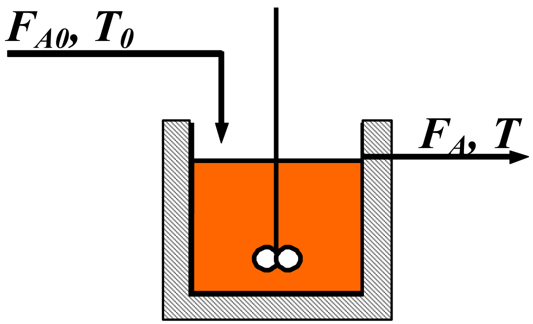

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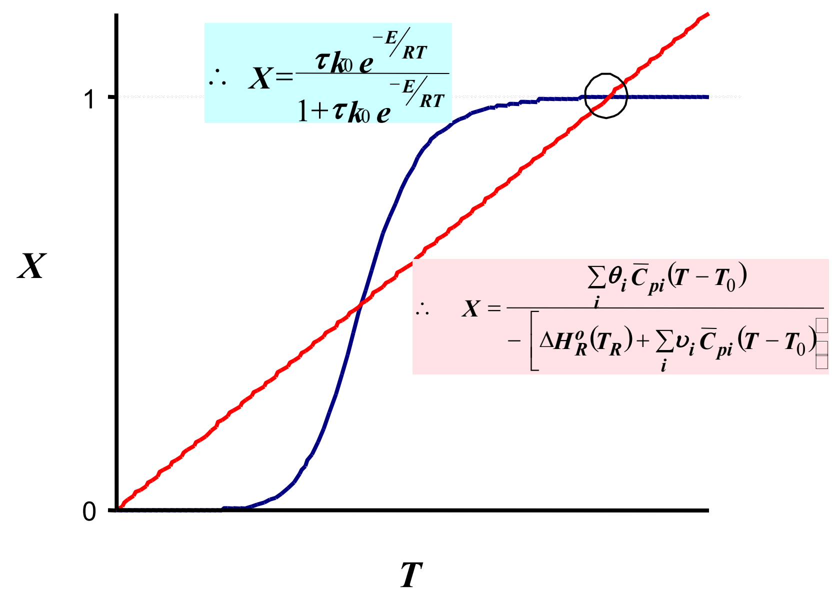

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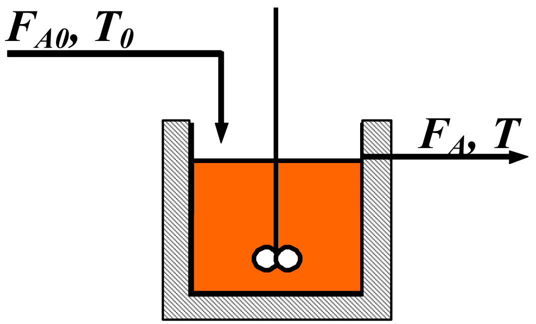

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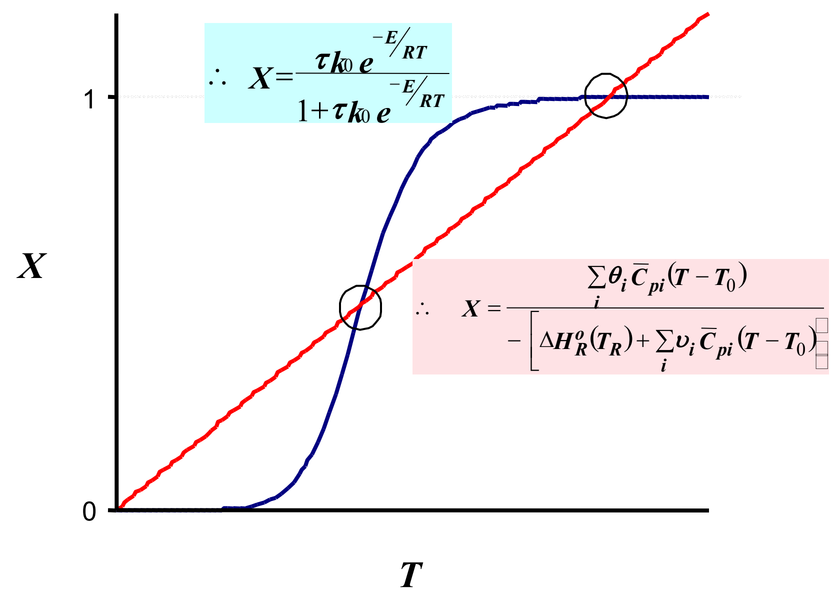
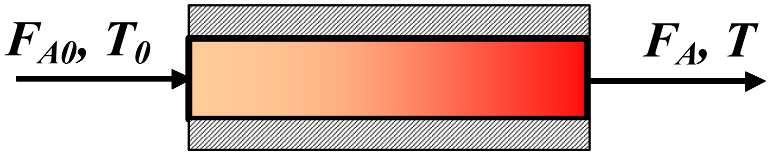


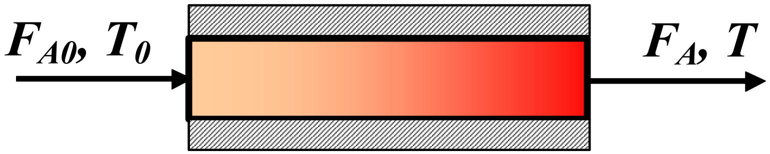
PFR

PFR



PFR

$A \longrightarrow B$



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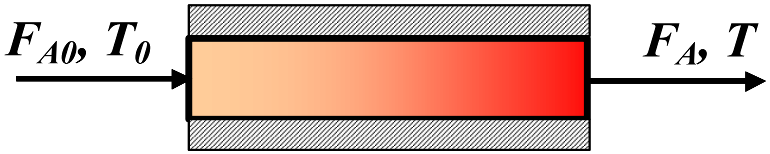

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Cinética: 1ª Ordem

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PFR

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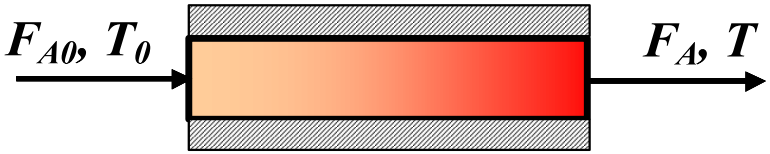


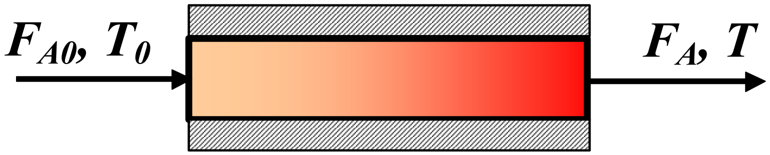
Cinética: 1ª Ordem

$$-r_A = k\,C_A = k\,C_{A0}\left(1-X\right)$$

Balanço molar:

$$V = v_0 \int_0^X \frac{dX}{k\left(1-X\right)}$$

PFR



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PFR

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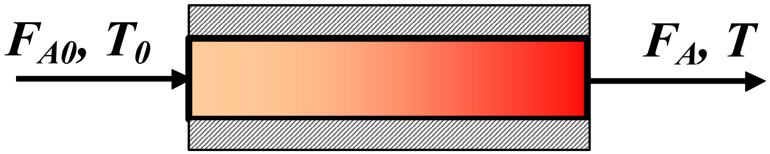

Cinética: **1ª Ordem**

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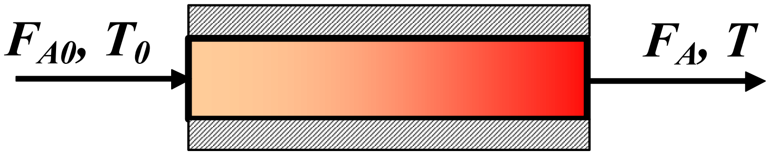
Balanço de energia:

PFR

A $\longrightarrow$ B



Cinética: 1ª Ordem

$$-r_A = k\,C_A = k\,C_{A0}\left(1 - X\right)$$

Balanço molar:

$$V = v_0 \int_0^X \frac{dX}{k\left(1 - X\right)}$$

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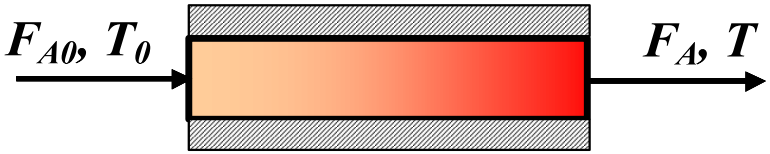
Balanço de energia:

$$-\sum_i \theta_i \,\overline{C}_{pi}\left(T - T_0\right) - \left[\Delta H_R^o\left(T_R\right) + \sum_i \upsilon_i \,\overline{C}_{pi}\left(T - T_0\right)\right] X = 0$$

PFR



$$A \longrightarrow B$$

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PFR

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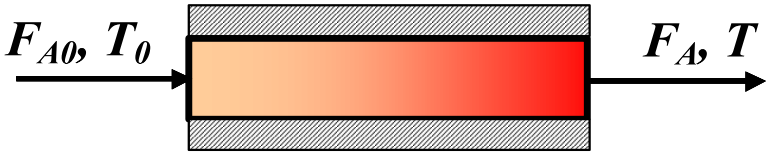

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$$\therefore \quad T\left(\sum_i \upsilon_i\, \bar{C}_{pi} X + \sum_i \theta_i\, \bar{C}_{pi}\right) = T_0\left(\sum_i \theta_i\, \bar{C}_{pi} + \sum_i \upsilon_i\, \bar{C}_{pi} X\right) - \Delta H_R^o\left(T_0\right)X$$

PFR

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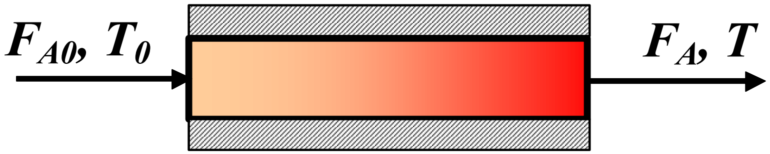

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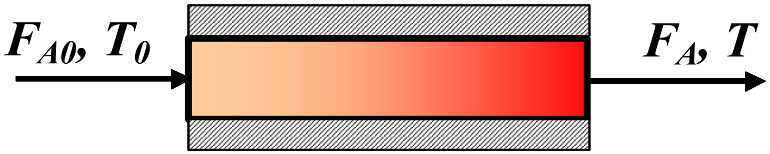
$$\therefore \quad T\left(\sum_i \upsilon_i \bar{C}_{pi} X + \sum_i \theta_i \bar{C}_{pi}\right) = T_0\left(\sum_i \theta_i \bar{C}_{pi} + \sum_i \upsilon_i \bar{C}_{pi} X\right) - \Delta H_R^o\left(T_0\right)X$$

$$V = v_0 \int_0^X \frac{dX}{k_0\, e^{\frac{-E}{RT}}\left(1-X\right)}$$

$$T = \frac{T_0\left(\sum_i \theta_i \bar{C}_{pi} + \sum_i \upsilon_i \bar{C}_{pi} X\right) - \Delta H_R^o\left(T_0\right)X}{\left(\sum_i \upsilon_i \bar{C}_{pi} X + \sum_i \theta_i \bar{C}_{pi}\right)}$$

PFR



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$$\begin{cases} V = v_0 \displaystyle\int_0^X \frac{dX}{k_0\,e^{\frac{-E}{RT}}\left(1-X\right)} \\[2ex] T = \dfrac{T_0\left(\displaystyle\sum_i \theta_i\,\bar{C}_{pi} + \sum_i \upsilon_i\,\bar{C}_{pi}X\right) - \Delta H_R^o\left(T_0\right)X}{\left(\displaystyle\sum_i \upsilon_i\,\bar{C}_{pi}X + \sum_i \theta_i\,\bar{C}_{pi}\right)} \end{cases}$$

Reacções reversíveis

Reacções reversíveis

Conversão de equilíbrio e temperatura de equilíbrio adiabáticas

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Exemplo 1: $A \rightleftharpoons B$

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Conversão de equilíbrio e temperatura de equilíbrio adiabáticas

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Fase líquida:

$$K_e = K_C = \frac{C_{Be}}{C_{Ae}}$$

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Conversão de equilíbrio e temperatura de equilíbrio adiabáticas

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$$K_e = K_p = \frac{P_{Be}}{P_{Ae}} = \frac{C_{Be}\,RT}{C_{Ae}\,RT} = \frac{C_{Be}}{C_{Ae}} = K_C$$

Reacções reversíveis

Conversão de equilíbrio e temperatura de equilíbrio adiabáticas

Exemplo 1: $A \rightleftharpoons B$

$$\therefore \quad K_e = \frac{C_{Be}}{C_{Ae}} = \frac{C_{A0} X_e}{C_{A0}\left(1 - X_e\right)} = \frac{X_e}{1 - X_e}$$

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$$\therefore \quad K_e = \frac{C_{Be}}{C_{Ae}} = \frac{C_{A0}\,X_e}{C_{A0}\left(1 - X_e\right)} = \frac{X_e}{1 - X_e}$$

$$\therefore \quad X_e = \frac{K_e}{1 + K_e}$$

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Lei de van't Hoff:

$$\frac{d \ln K_e}{dT} = \frac{\Delta H_R^o}{RT^2}$$

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Conversão de equilíbrio e temperatura de equilíbrio adiabáticas

Exemplo 1: A $\rightleftarrows$ B

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$$K_e(T) = K_e(T_R)\, e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}$$

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$$X_e = \frac{K_e(T_R)\, e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R} - \frac{1}{T}\right)}}{1 + K_e(T_R)\, e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R} - \frac{1}{T}\right)}}$$

$$K_e(T) = K_e(T_R)\, e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R} - \frac{1}{T}\right)}$$

$$X_e = \frac{K_e(T_R)e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}{1+K_e(T_R)e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}$$

$$X_{BE} = \frac{\sum_i \theta_i \overline{C}_{pi}(T-T_0)}{-\Delta H_R^o(T_R)}$$

Equação de recta

$$X_e = \frac{K_e(T_R)e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}{1+K_e(T_R)e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}$$

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Equação de recta

Reacção exotérmica: $\Delta H_R^o < 0$

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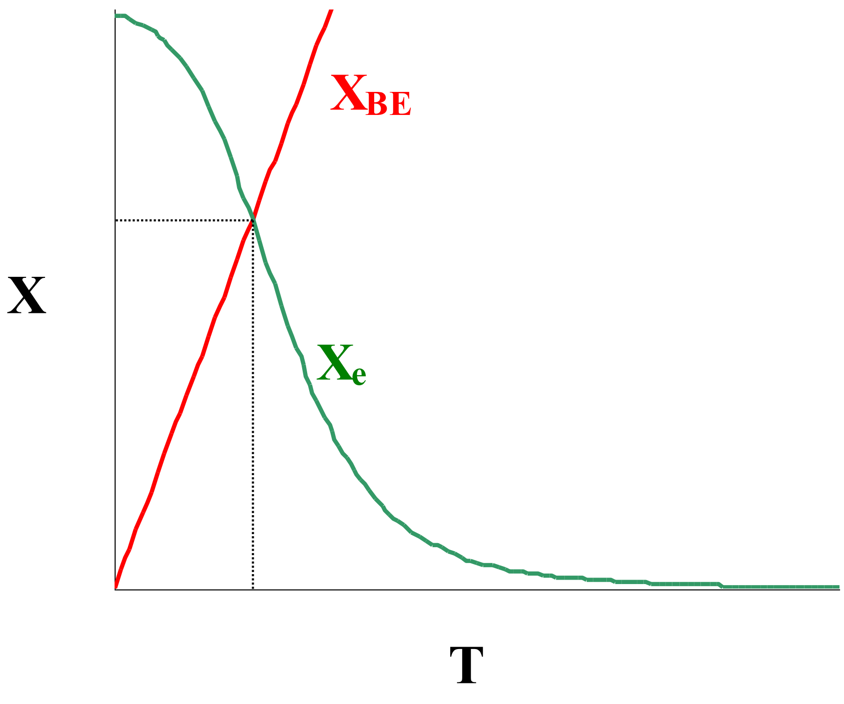

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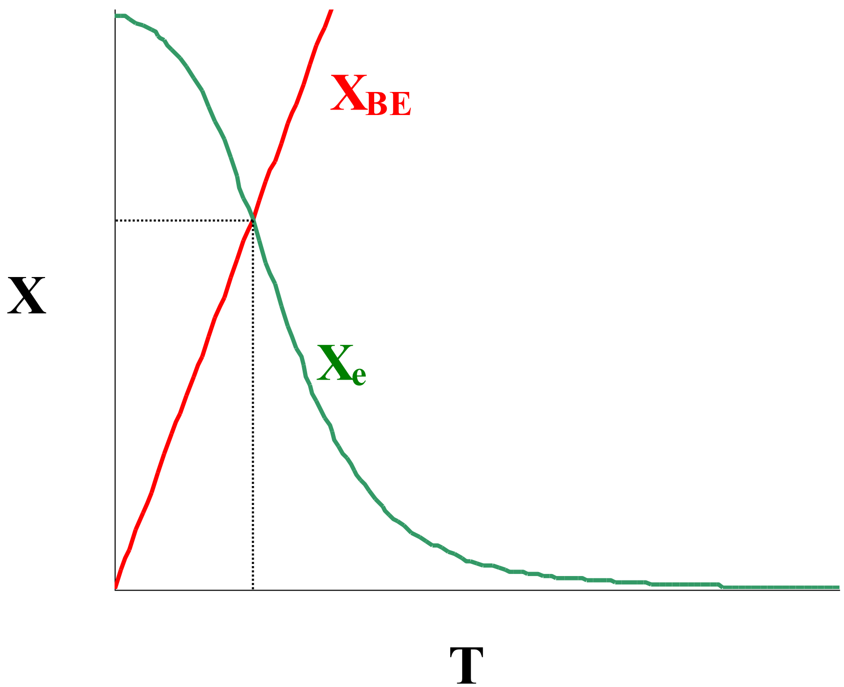
Equação de recta

Reacção exotérmica: $\Delta H_R^o < 0$

Reacção endotérmica: $\Delta H_R^o > 0$



$$X_e = \frac{K_e(T_R)\,e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}{1 + K_e(T_R)\,e^{\frac{\Delta H_R^o}{R}\left(\frac{1}{T_R}-\frac{1}{T}\right)}}$$

$$X_{BE} = \frac{\sum_i \theta_i \,\overline{C}_{pi}\,(T - T_0)}{-\,\Delta H_R^o(T_R)}$$

Equação de recta

Reacção exotérmica: $\Delta H_R^o < 0$

Reacção endotérmica: $\Delta H_R^o > 0$