Equações:

$$\vec{\tilde{N}} = \vec{\tilde{N}}_A + \vec{\tilde{N}}_B ; \vec{\tilde{N}}_A = \vec{\tilde{I}}_A + \tilde{x}_A \vec{\tilde{N}} ; \vec{\tilde{I}}_A = -\tilde{\rho} D_{AB} \, grad \, \tilde{x}_A$$

$$\rho \frac{dx_A}{dt} = \frac{\partial \rho_A}{\partial t} + \mathrm{div}(\rho_A \vec{v}) = -\mathrm{div} \, \vec{J}_A + r_A ; \frac{\partial \rho_A}{\partial t} + \mathrm{div} n_A = r_A$$

$$\tilde{\rho} \frac{d\tilde{x}_A}{dt} = \frac{\partial \tilde{\rho}_A}{\partial t} + \mathrm{div}(\tilde{\rho}_A \vec{\tilde{v}}) = -\mathrm{div} \vec{\tilde{I}}_A + \tilde{r}_A ; \frac{\partial \tilde{\rho}_A}{\partial t} + \mathrm{div} \vec{\tilde{N}}_A = \tilde{r}_A$$

$$\mathrm{div} \vec{\tilde{N}}_A = \frac{\partial}{\partial x}(\tilde{N}_{A,x}) + \frac{\partial}{\partial y}(\tilde{N}_{A,y}) + \frac{\partial}{\partial z}(\tilde{N}_{A,z})$$

$$\tilde{N}_A = k_{\tilde{y}}(\tilde{y}_A - \tilde{y}_{Ai}) = k_C (C_{Ai} - C_A) \quad ; \quad n_A = k_y (y_A - y_{Ai}) = k_\rho (\rho_{Ai} - \rho_A)$$

$$\tilde{N}_A = k_{\tilde{x}}(\tilde{x}_{Ai} - \tilde{x}_A) = k_{\tilde{\rho}} (\tilde{\rho}_{Ai} - \tilde{\rho}_A) \quad ; \quad n_A = k_x (x_{Ai} - x_A) = k_\rho (\rho_{Ai} - \rho_A)$$

$$\frac{1}{K_{\tilde{y}}} = \frac{1}{k_{\tilde{y}}} + \frac{m}{k_{\tilde{x}}} \quad ; \quad \frac{1}{K_{\tilde{x}}} = \frac{1}{m k_{\tilde{y}}} + \frac{1}{k_{\tilde{x}}}$$

$$equilíbrio \Rightarrow \tilde{y} = m\tilde{x} \quad ; \quad Henry : P_A = H_A \tilde{x}_A \quad ; \quad Raoult : P_A = \tilde{x}_A P_A^V$$

<u>Modelo do filme</u>: $k_\rho = \frac{D_{AB}}{\delta}$ <u>Modelo de Higbie</u>: $k_\rho = \sqrt{\frac{4D_{AB}}{\pi t_C}}$

<u>Analogia de Colburn:</u> $\frac{\mathrm{Sh}}{\mathrm{Re\,Sc}^{1/3}} = j_M$; $\frac{\mathrm{Nu}}{\mathrm{Re\,Pr}^{1/3}} = j_H$; $j_H = j_M = \frac{f}{2}$

PLACA PLANA

Regime	Sherwood local	Sherwood médio
Laminar	$Sh_x = 0{,}33 Re_x^{1/2} Sc^{1/3}$	$Sh_L = 0{,}66 Re_L^{1/2} Sc^{1/3}$
Turbulento	$Sh_x = 0{,}0292 Re_x^{4/5} Sc$	$Sh_L = (0{,}037 Re_L^{4/5} - 527) Sc$ *

* médio calculado a partir de $Re_c = 5\mathrm{x}10^5$ $Sh_x = \frac{k_\rho x}{D_{AB}}$; $Sc = \frac{\nu}{D_{AB}}$

<u>Escoamento sobre esferas:</u> $\mathrm{Sh} = \frac{\mathrm{k_\rho D}}{\mathrm{D_{AB}}} = 2 + 0{,}6\,\mathrm{Re}^{0,5}\,\mathrm{Sc}^{1/3}$

<u>Escoamento em leitos:</u> $\varepsilon\, \mathrm{j_D} = \frac{0{,}765}{\mathrm{Re}^{0,82}} + \frac{0{,}365}{\mathrm{Re}^{0,386}}$ $\mathrm{Re} = \frac{\rho U' d_P}{\mu}$

<u>Escoamento interno em tubos:</u>

<u>Turbulento:</u> $\frac{k_\rho D}{D_{AB}} = Sh = 0{,}023\, Re^{0,8}\, Sc^{0,33}$

<u>Laminar</u>: Concentração constante na parede e perfil de velocidade parabólico e desenvolvido.

$$\frac{\mathrm{k_{\rho LN} D}}{\mathrm{D_{AB}}} = \mathrm{Sh_{LN}} = 3{,}66 + \frac{0{,}0668 (\mathrm{D/L}) \mathrm{Re\,Sc}}{1 + 0{,}04 [(\mathrm{D/L}) \mathrm{Re\,Sc}]^{2/3}}$$

<u>Laminar:</u> Fluxo de massa constante na parede e perfil de velocidade parabólico e desenvolvido.

$$\frac{\mathrm{k_{\rho LN} D}}{\mathrm{D_{AB}}} = \mathrm{Sh_{LN}} = 4{,}36 + \frac{0{,}023 (\mathrm{D/L}) \mathrm{Re\,Sc}}{1 + 0{,}0012 [(\mathrm{D/L}) \mathrm{Re\,Sc}]}$$