

$$1. \quad K_{G_{SO_2}} = 0.768 \frac{\text{kmol}}{\text{h m}^2 \text{atm}} \quad \frac{1}{K_G} = \frac{H}{K_L}$$

$$K_{G_{NH_3}} = 2.217 \frac{\text{kmol}}{\text{h m}^2 \text{atm}}$$

$$K_G = A D^\alpha$$

$$D_{SO_2} = 0.041 \text{ m}^2/\text{s}$$

$$D_{NH_3} = 0.083 \text{ m}^2/\text{s}$$

$$\frac{H_{SO_2}}{H_{NH_3}} = \frac{1}{0.018}$$

$$D_{SO_2-H_2O} \approx D_{NH_3-H_2O}$$

↓

$$K_{L_{SO_2}} = K_{L_{NH_3}}$$

(SO<sub>2</sub>)

$$\frac{1}{0.768} = \frac{1}{K_{G_{SO_2}}} + \frac{H_{SO_2}}{K_L}$$

$$1.302 = 0.651 + 0.651$$

(NH<sub>3</sub>)

$$\frac{1}{2.217} = \frac{1}{K_{G_{NH_3}}} + \frac{H_{NH_3}}{K_L}$$

$$\frac{H_{SO_2}}{K_L} = 0.651$$

$$H_{NH_3} = 0.018 H_{SO_2}$$

$$\frac{1}{2.217} = \frac{1}{K_{G_{NH_3}}} + \frac{0.018 H_{SO_2}}{H_{SO_2}/0.651}$$

$$K_{G_{NH_3}} = 2.276 \frac{\text{kmol}}{\text{h m}^2 \text{atm}}$$

$$\frac{1}{K_{G_{SO_2}}} = 0.651$$

$$K_{G_{SO_2}} = 1.536 \frac{\text{kmol}}{\text{h m}^2 \text{atm}}$$

$$\frac{1.536}{2.276} = \left( \frac{0.041}{0.083} \right)^\alpha$$

$$\alpha = 0.56$$

$$Sh = 0.023 Re^{0.8} Sc^{0.44}$$

$$K_G \propto D^{1-0.44} \propto D^{0.56}$$

$$2. K_G (p_{A0} - p_A^*) = \underbrace{K_G}_{K_{GC}} RT (C_{A0} - C_A^*)$$

$$k_L (C_{Ai} - C_{AL}) = k_L C_L (x_{Ai} - x_A)$$

$$p_{Ai} = H x_{Ai} = 10^5 H x_{Ai}$$

$$k_L \propto \sqrt{D_L}$$

$$k_{L_{O_2}} = 0.2 \times 10^{-3} \text{ m/s}$$

$$k_L = \frac{k_{L_{O_2}}}{\sqrt{D_{L_{O_2}}}} \cdot \sqrt{D_L}$$

$$k_L = \frac{0.2 \times 10^{-3} \sqrt{D_L}}{\sqrt{2.1 \times 10^{-9}}} = 4.364 \sqrt{D_L}$$

$$b = \frac{10^5}{C_L RT} = 7.39 \times 10^{-4}$$

$$Sh = 0.023 Re^{0.8} Sc^{0.44}$$

$$\frac{k_G d}{D?} = 0.023 \left( \frac{ud}{\nu} \right)^{0.8} Sc^{0.44}$$

$$k_G = \frac{17.1}{0.03} Sc^{0.44} D_G$$

$$k_G = 56.97 Sc^{0.44} D_G$$

$$p_{An} = \frac{p_{An}}{RT}$$

$$p_{An} = \frac{5 \times 10^{-5} \times 29 \times 10^{-3}}{8.314 \times 293.15}$$

$$p_{An} = 5.94 \text{ kg/m}^3$$

$$\nu = \frac{\mu}{\rho}$$

$$Re = \frac{5.94 \times 0.4 \times 3 \times 10^{-2}}{1.84 \times 10^{-5}}$$

$$Re = 3880$$

ver ficheiro Excel

3.

$$G \text{ (kmol/s)}$$

$$0.04$$

$$0.10$$

$$K_G \text{ (kmol/m}^2\text{sPa)}$$

$$8.4 \times 10^{-5}$$

$$10 \times 10^{-5}$$

$$\frac{1}{K_G} = \frac{1}{K_G} + \frac{H}{K_L}$$

$$\frac{1}{K_G} = \frac{1}{a G^{0.8}} + b$$

$$y = \frac{1}{a} G^{-0.8} + b$$

$$1.19 \times 10^4 = \frac{1}{a} * 13.13 + b$$

$$b = \frac{1.19 \times 10^4}{a} - 13.13$$

$$b = 1.19 \times 10^4 - \frac{13.13}{a}$$

$$1 \times 10^4 = \frac{1}{a} 6.31 + b$$

$$1 \times 10^4 = \frac{6.31}{a} + 1.19 \times 10^4 - \frac{13.13}{a}$$

$$\frac{13.13 - 6.31}{a} = 0.19 \times 10^4$$

$$a = \frac{13.13 - 6.31}{0.19 \times 10^4} = 3.58 \times 10^{-3}$$

$$b = 1.19 \times 10^4 - \frac{13.13}{3.58 \times 10^{-3}} = 8.24 \times 10^3$$

$$G = 0.5 \text{ kmol/s}$$

$$K_G = a G^{0.8} = 2.06 \times 10^{-3} \frac{\text{kmol}}{\text{m}^2\text{sPa}}$$

$$\frac{H}{K_L} = b$$

$$K_L = \frac{H}{b} = \frac{20}{8.24 \times 10^3} = 2.43 \times 10^{-3} \text{ m/s}$$

$$K_G = 11.5 \times 10^{-5} \frac{\text{kmol}}{\text{m}^2\text{sPa}}$$