Rowan University
Chemical Engineering Department - 09.06-314 Spring
RO-2

1. GIVEN:

$$S_A = \frac{\pi (7.5\,cm)^2}{4} = 44.18\,cm^2$$

$$C_F = 6000\ mg/L \quad ; \quad C_p = 170\ mg/L$$

$$\Delta P = 500\ psi$$

$$Q_p = 0.014\ cm^3/sec$$

a) $$J_w = \frac{Q_p}{S_A} = \left(\frac{0.014\ cm^3}{sec}\right)\left(\frac{1}{44.18\,cm^2}\right)$$

$$\boxed{J_w = 3.17 \times 10^{-4}\ cm^3/cm^2 \cdot sec}$$

$$J_w = A_w(\Delta P - \Delta\pi) \qquad J_s = B_s(C_F - C_p)$$

$$A_w = \frac{J_w}{(\Delta P - \Delta\pi)} \qquad \Delta\pi = \pi_F - \pi_p$$

b)

$$J_s = \frac{J_w C_p}{C_{wp}} = \left(3.17\times10^{-4}\ \frac{cm^3}{cm^2 sec}\right)\left(\frac{170\ mg/L}{10^6\ mg/L}\right)\left(\frac{1g}{cm^3}\right)$$

$$\boxed{J_s = 5.39\times10^{-8}\ g/cm^2 sec}$$

c)

GIVEN : $\frac{\pi}{C} = 0.0114\ \frac{psi}{mg/L}$

$$\pi_F = \left(0.0114\ \frac{psi}{mg/L}\right)(6000\ mg/L) = 68.4\ psi$$

$$\pi_P = \left(0.0114\ \frac{psi}{mg/L}\right)(170\ mg/L) = 1.94\ psi$$

$$\Delta\pi = 68.4 - 1.94 = 66.46\ psi$$

$$A_w = \frac{\left(3.17\times10^{-4}\ \frac{cm^3}{cm^2 sec}\right)\left(1g/cm^3\right)}{\left(500 - 66.46\ psi\right)\left(6.895\times10^4\ \frac{dynes}{cm^2 psi}\right)}$$

dyne = $\frac{g\cdot cm}{s^2}$

$$\boxed{A_w = 1.06\times10^{-11}\ \frac{sec}{cm}}$$

d) $J_s = B_s (C_f - C_p)$

$$B_s = \frac{J_s}{C_f - C_p} = \frac{(5.39 \times 10^{-8}\ g/cm^2 sec)}{(6000 - 170\ mg/L)\left(\frac{g}{1000\ mg}\right)\left(\frac{L}{1000\ cm^3}\right)}$$

$$B_s = 9.25 \times 10^{-6}\ \frac{cm}{sec}$$

e) $$\% R = \left(1 - \frac{C_p}{C_F}\right) 100$$

$$= \left(1 - \frac{170\ mg/L}{6000\ mg/L}\right) 100$$

% REJECTION = 97.2 %