1. Problem 28.1-1

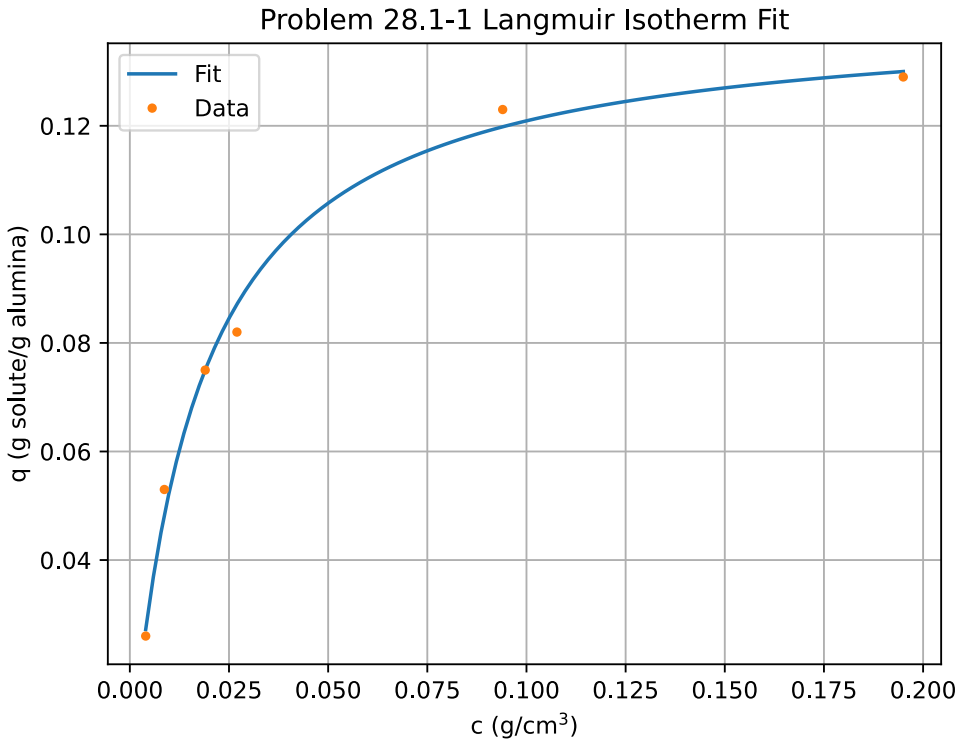
Fit the data in Problem 28.1-1 to the Langmuir isotherm

$$q = \frac{q_0 c}{K + c}$$

$$\boxed{q_0 = 0.1412}$$

$$\boxed{K = 0.01675}$$

Compare fit parameters to data.



2. Problem 28.3-1

(a)

Parameters for original column from Example 28.3-1

$$t_b = 3.65$$
$$H_B = 9.9$$
$$H_{\text{UNB}} = 4.1$$

Find new H_B

$$t_b = 8.5$$
$$H_B = \frac{8.5}{3.65} \cdot 9.9$$
$$H_B = 23.1$$
$$H_T = H_{\text{UNB}} + H_B$$
$$H_T = 23.1 + 4.1$$
$$\boxed{H_T = 27.2 \text{ cm}}$$
$$\text{fraction} = \frac{23.1}{27.3}$$
$$\boxed{\text{fraction} = 0.849}$$

Flow and velocity are the same, and so the diamter is the same.

$$\boxed{D = 4 \text{ cm}}$$

(b)

Find new diamter to keep velocity the same

$$u = \frac{Qt}{A}$$
$$\frac{Q_1 t_1}{A_1} = \frac{Q_2 t_2}{A_2}$$
$$t_1 = t_2$$
$$\frac{Q_1}{\pi/4 D_1^2} = \frac{Q_2}{\pi/4 D_2^2}$$
$$D_2^2 = \frac{Q_2}{Q_1} D_1^2$$
$$D_2 = \sqrt{\frac{Q_2}{Q_1} D_1^2}$$
$$D_1 = 4$$
$$Q_1 = 754$$
$$Q_2 = 2000$$
$$D_2 = \sqrt{\frac{2000}{754} \cdot 4^2}$$
$$\boxed{D_2 = 6.52 \text{ cm}}$$

3. Problem 28.3-2

(a)

Using the data in Problem 28.3-2, compute $1 - c/c_0$

$$c_0 = 926 \cdot 10^{-6}$$

Interpolate time for $c/c_0 = 0.02$

$$\boxed{t_b = 9.546 \text{ hr}}$$

Calculate the following integrals numerically from the data

$$A_1 = \int_0^{t_b} \left(1 - \frac{c}{c_0}\right) dt$$

$$A_2 = \int_{t_b}^{t_d} \left(1 - \frac{c}{c_0}\right) dt$$

$$A_1 = 9.54$$

$$A_2 = 1.38$$

$$t_t = A_1 + A_2$$

$$t_t = 9.54 + 1.38$$

$$t_t = 10.9$$

$$\text{fraction} = \frac{A_1}{t_t}$$

$$\text{fraction} = \frac{9.54}{10.9}$$

$$\boxed{\text{fraction} = 0.873}$$

$$H_T = 0.268 \text{ m}$$

$$H_{\text{UNB}} = 0.268 \cdot (1 - 0.873)$$

$$\boxed{H_{\text{UNB}} = 0.03396 \text{ m}}$$

$$\text{Saturation capacity} = \dot{m} c_0 t_I$$

$$\dot{m} = 4052$$

$$\text{Saturation capacity} = 4052 \cdot 926 \cdot 10^{-6} \cdot 10.9$$

$$\boxed{\text{Saturation capacity} = 40.98 \text{ kg water}/m^2}$$

(b)

H_{UNB} is the same

$$\begin{aligned} H_T &= 0.4 \\ H_B &= 0.4 - 0.03398 \\ H_B &= 0.366 \\ \text{fraction} &= \frac{0.366}{0.4} \\ \boxed{\text{fraction} &= 0.9151} \end{aligned}$$

Old H_B

$$\begin{aligned} H_B &= 0.268 - 0.03398 = 0.234 \\ t_b &= \frac{0.366}{0.234} \cdot 9.54 \\ \boxed{t_b &= 14.93 \text{ hr}} \end{aligned}$$