

### Problem 16-08 Adsorption from solution on solids – Freundlich isotherm

---

The dependence of the adsorbed amount of an organic substance on the charcoal from aqueous solution (water is not adsorbed) at constant temperature of 29°C is expressed by Freundlich isotherm in the form

$$\Omega_2 / (\text{mol g}^{-1}) = 2.52 \cdot 10^{-3} \cdot c_2^{0.4}$$

where  $c_2$  is the concentration of the organics in equilibrium bulk solution ( $\text{mol dm}^{-3}$ ). How much of charcoal (in grams) should be added to 350  $\text{cm}^3$  of aqueous solution of concentration 0.45  $\text{mol dm}^{-3}$ , to reduce its concentration to one third of initial value?

$$[m_s = 89 \text{ g}]$$

Solution:

$$c_2^0 = 0.45 \text{ mol dm}^{-3}$$

$$c_2 = c_2^0 / 3 = 0.15 \text{ mol dm}^{-3}$$

$$V^0 = 350 \text{ cm}^3 = 0.35 \text{ dm}^3$$

$$m_s = ?$$

$$\Omega_2 = \frac{V^0}{m_s} \cdot (c_2^0 - c_2) = \frac{0.35}{m_s} \cdot (0.45 - 0.15) = \frac{0.105}{m_s} \text{ mol g}^{-1} \left[ \frac{\text{dm}^3}{\text{g}} \cdot \text{mol dm}^{-3} = \text{mol g}^{-1} \right]$$

$$\frac{0.105}{m_s} = 2.52 \cdot 10^{-3} \cdot 0.15^{0.4} = 1.1799 \cdot 10^{-3}$$

$$m_s = \frac{0.105}{1.1799 \cdot 10^{-3}} = 88.99 \text{ g}$$