

#1 An absorber is to be designed to absorb SO_2 from air using water. For a bubble of gas rising through a liquid, the mass transfer coefficient on the liquid side has been correlated with the following equation:

$$\text{Sh} = 2 + 0.6 \text{Re}^{1/2} \text{Sc}^{1/3}$$

where the characteristic length is the bubble diameter.

Estimate the liquid phase mass transfer coefficient for a 1 cm diameter bubble of a mixture of SO_2 in air rising at a rate of 0.2 m/s through water at a temperature of 298 K and pressure of 20 atm.

#2 A packed bed is to be used to strip toluene from ground water using N_2 . Correlations for mass transfer for the packing used are given as follows:

For the gas phase, the correlations is: $\text{Sh} = 1.2\text{Re}^{0.64} \text{Sc}^{0.33}$

where the characteristic length is the packing size.

For the liquid phase, the correlation is: $\text{Sh} = 0.1\text{Re}^{0.3}\text{Sc}^{0.5}$

where the characteristic length is the packing size.

Estimate the mass transfer coefficients (k_x and k_y) for the liquid and gas for toluene being stripped from ground water into N_2 under the following conditions:

$T=298 \text{ K}$

$P = 1 \text{ atm}$

Packing size = 5 cm

Gas velocity = 1 ft/s

Liquid velocity = 1 ft/s

You can assume dilute solutions. For the liquid and gas, use the physical properties of pure water and nitrogen respectively. Use the methods we have covered in class to estimate the diffusivities.