

6.1 SORPTION PROCESSES

- Adsorption: Solute clings to surface - chemical capture on clay particles
 - Absorption: Solute diffuses into interior of a particle.
- Both result in "partitioning" of solute to solid phase i.e. removed.

Test: Mix solid with solute at known concentration
- measure amount removed per unit volume of solid
→ Equilibrium sorption isotherm.

also: Kinetic sorption isotherm (reaction slow but not reaching equilibrium).

Isotherms provide a convenient way of accommodating sorption in the "advection-dispersion" equation representing retardation effects.

Rewrite "advection-dispersion" equation for reactive (non conservative) system to accommodate retardation.

$$\frac{\partial c}{\partial t} = D_L \frac{\partial^2 c}{\partial x^2} - v_x^a \frac{\partial c}{\partial x} - \frac{\rho_d}{\theta} \frac{\partial c^*}{\partial t} + \left(\frac{\partial c}{\partial t} \right)_r \quad (1)$$

(Dispersion)
(Advection)
(Sorption)
(Reaction)

"equilibrium"

(solute is removed)

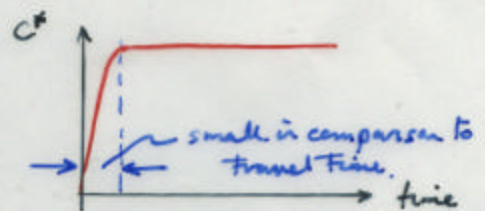
ρ_d = bulk density of aquifer

θ = volumetric moisture content (n if saturated)

c^* = amount of solute sorbed per unit weight of solid (aquifer)

r = subscript for biological or chemical reaction

Assume that reactions in groundwater are fast compared to flow rates. Then amount of solid sorbed is related to solute concentration, directly.

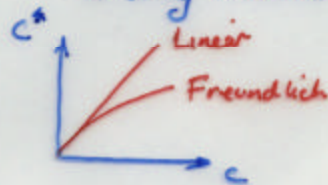


then $c^* = f(c)$

Therefore $\frac{\partial c^*}{\partial t} = \left(\frac{\partial c^*}{\partial c} \right) \frac{\partial c}{\partial t}$

Resubstitute into (1) and defines c (concentration in solute) as only variable

\therefore Determine $\frac{\partial c^*}{\partial c}$



Defined as distribution coefficient, $k_d = \frac{\partial c^*}{\partial c}$