9.2.5.6 Distribution Constants

A *Distribution Constant* is the concentration of a component in the ion exchanger (the stationary phase) divided by its concentration in the external solution (the mobile phase) in equilibrium. The concentration in the external solution is always calculated per unit volume. Depending on the way the concentration in the ion exchanger is expressed three forms of the distribution constant may exist.

Below, $W_{i\,(\mathrm{IE})}$ and $W_{i\,(\mathrm{sol})}$ are the amounts of the component *i* in the ion exchanger and in the external solution; V_{SIE} and V_{DIE} are the volumes of the swollen and dry ion exchanger, respectively; and $V_{(\mathrm{sol})}$ is the volume of the external solution.

Distribution Constant (K_{c})

In this case the concentration in the ion exchanger is calculated as mass (weight)/volume and it refers to the swollen ion exchanger:

$$K_{\mathrm{c}} = \frac{W_{i(\mathrm{IE})} / V_{(\mathrm{SIE})}}{W_{i(\mathrm{sol})} / V_{(\mathrm{sol})}}$$

Distribution Constant (K_{g})

In this case the concentration in the ion exchanger is calculated as mass/mass (weight/weight) and it refers to dry ion exchanger:

$$K_{\mathrm{g}} = \frac{W_{i(\mathrm{IE})} / V_{(\mathrm{DIE})}}{W_{i(\mathrm{sol})} / V_{(\mathrm{sol})}}$$

Distribution Constant (K_{v})

In this case, the concentration in the ion exchanger is calculated as volume/volume and it refers to the dry ion exchanger:

$$K_{\mathrm{v}} = \frac{V_{i(\mathrm{IE})} / V_{(\mathrm{DIE})}}{W_{i(\mathrm{sol})} / V_{(\mathrm{sol})}}$$

If the *Bed Density* is ρ, expressed in grams of dry resin per cm^3 of bed, then
$K_{\mathrm{v}} = K_{\mathrm{g}}\ \rho$