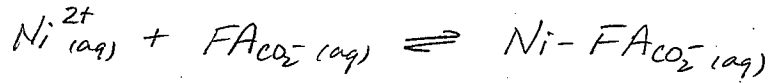


Consider a water sample containing 85 $\mu\text{g/L}$ of Ni and 8 mg/L DOM in the form of fulvic acid. Calculate the concentration of complexed ($[\text{Ni-FA}]$) and uncomplexed ($[\text{Ni}]_{\text{free}}$) nickel ion. Use a typical concentration of carboxylates for fulvic acids of $C_{\text{CO}_2^-} = 5 \text{ mmol/g}$.



$$K_f' = \frac{[\text{Ni-FAco}_2^-]}{[\text{Ni}^{2+}]_f [\text{FAco}_2^-]_f} = 1.6 \times 10^4 \quad (K_f' \text{ value at pH 5})$$

$$[\text{FAco}_2^-]_T = \frac{8 \text{ mg FA}}{\text{L}} \times \frac{5 \text{ mmol CO}_2^-}{\text{g}} \times \frac{1 \text{ g}}{10^3 \text{ mg}} = 40 \times 10^{-3} \frac{\text{mmol CO}_2^-}{\text{L}}$$

or 40 μM

$$[\text{Ni}^{2+}]_T = \frac{85 \mu\text{g}}{\text{L}} \times \frac{1 \text{ mol}}{58.7 \text{ g}} \times \frac{1 \text{ g}}{10^6 \mu\text{g}} = 1.4 \times 10^{-6} \frac{\text{mol}}{\text{L}} \text{ or } 1.4 \mu\text{M}$$

Note; $[\text{FAco}_2^-]_T \gg [\text{Ni}^{2+}]_T \therefore$ most FAco_2^- is not complexed w Ni^{2+}

let 'x' represent conc of complexed Ni-FAco_2^-

$$\text{then } K_f' = \frac{x}{(1.4 \times 10^{-6} - x)(40 \times 10^{-6} - x)} = 1.6 \times 10^4$$

and since $x \ll 40 \times 10^{-6}$, this simplifies to,

$$K_f' = \frac{x}{(1.4 \times 10^{-6} - x)(40 \times 10^{-6})} = 1.6 \times 10^4$$

Solving for x yields, $x = 5.6 \times 10^{-7} \frac{\text{mol}}{\text{L}} \quad ([\text{Ni-FAco}_2^-])$

$$\& [\text{Ni}^{2+}]_f = 1.4 \times 10^{-6} - 5.6 \times 10^{-7} = 8.8 \times 10^{-7} \frac{\text{mol}}{\text{L}}$$

i.e. $\frac{5.6 \times 10^{-7}}{1.4 \times 10^{-6}} \times 100\% = 40\%$ of Ni^{2+} is complexed to FA