Example

There is a styrene-based ion exchange resin for removal of chlorate (ClO_3^-) from water. The selectivity coefficients for nitrate (NO_3^-) and chlorate over chloride (Cl^-) on the given resin are 2 and 125, respectively.

Determine the adsorption densities of nitrate and chlorate in equivalents per gram (eq/g) on the resin with a total site density of 1.7 meq/g , when the resin reaches equilibrium with water containing 31 mg/L NO_3^- , 199 μg/L CLO_3^- and negligible Cl^- .

K NO_3/Cl = 2

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C NO_3= 31 mg/L

C ClO_3= 199 microg/L

qmax= 1.7 meq/g

adsorption density equation for nitrate:

$$q_{NO3} = \left(K_{NO3/Cl} \times C_{NO3}\right) / \left(\left(K_{NO3/Cl} \times C_{NO3}\right) + K_{ClO3/Cl} \times C_{ClO3}\right) \times q_{max}$$

$K\ NO_3/Cl = 2$

$K\ ClO_3/Cl = 125$

Considering the units:

C_{NO3} = 31 mg/L / 62 mg/meq = 0.5 meq/L

C_{ClO3} = 199 µg/L / (99.45 x 1000000 µg/meq) = 0.002 meq/L

qmax= 1.7 meq/g

Inserting the values in the equation with the correct units:

-----> $q_{NO3} = \left(2 \times 0.5\ meq/L\right) / \left(2 \times 0.5\ meq/L + 125 \times 0.002\ meq/L\right) \times 1.7\ meq/g$

-----> $q_{NO3} = 1.36\ meq/g$