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Mathematical modelling of metal ion chromium (Cr) bio-sorption by biomass

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Bio-sorption is an innovative low-cost and effective procedure for the removal of heavy metal ions from wastewater. It primarily depends on the diffusion of metal ions through a porous structure of biomass (Ulva lactuca) and the resistance effects arisen as the result of electrostatic repulsive interactions between ions within the sorbent. The intra-particle diffusion of metal ion Cr from aqueous solution by biomass was investigated in order to develop a mathematical model that would describe the phenomenon of different ions transport through porous algae matrices. FTIR analysis of algal biomass revealed the presence of amino, carboxyl, hydroxyl and carbonyl groups, which are responsible of metal ions bio-sorption. The results obtained have shown a particle diffusion coefficient Dint=0.1363(mgg-1.min-1/2), R^2=0.99, and partition coefficients greater than 0.95, showing that the bio-sorption process is very fast at the beginning and mainly indicated by the diffusion of the ions through the porous algae structure. However, over a period the bio-sorption slows down due to the increase of the resistance to the further transport of metal ions through the Algae. A mathematical model based on the second Fick's law determined the profile of heavy metal ion concentration in the algae and the effectiveness of sorption and optimize the bio-sorption of heavy metal ions by means of connecting the model parameters with the Algae performances.

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