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Zinc immobilization through sorption to diatomaceous earth

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Zinc contamination can cause severe effects on both terrestrial and aquatic environments, such as a loss of biodiversity in soil or growth inhibition in fish (Singh et al. 2022, Kelly and Tate 1998). This project aims to test the zinc uptake of washed and unwashed diatomaceous earth to better understand what conditions impact it. Zinc concentrations between 0-100 ppm were reacted at a pH range between 3-11 in the presence of diatomaceous earth. The diatomaceous earth was characterized by Fourier transform infrared (FTIR) spectroscopy and scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDS). SEM-EDS was used to image morphology and determine the elemental composition of the diatomaceous earth and to observe any changes in the system after being exposed to Zn. FTIR spectroscopy was used to probe for surface active functional groups on the diatomaceous earth and determine which functional groups were responsible for binding Zn. Samples were then analyzed by inductively coupled plasma optical emission spectroscopy or ICP-OES to find and quantify metal elements within the solution. These concentrations are then plotted along with negative and positive controls to see the amount of zinc diatomaceous earth sorbed. It was found that as pH increased, the concentration of zinc sorbed increased, and SEM-EDS showed that there was no change in the morphology of the diatomaceous earth after sorption. The speciation of the Zn is pH dependent, being present as a sorbed or dissolved species above pH 7, and this will be important in predicting Zn mobility in freshwater systems.

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