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Investigating Cadmium Sorption to Microbialites through FTIR and Raman Spectroscopy

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Microbialites are organic-sedimentary deposits that are capable removing and transforming metal and metalloid contaminants from aqueous environments.[1,2] Environmental concerns over bioaccumulation of trace elements in aqueous environments emphasizes the need for research in remediation biogeochemistry.[2] Our research seeks to characterize the sorption properties of microbialites collected from Adams Lake, a carbonate-rich mountain lake in western Alberta, Canada. Microbialites were exposed to 10-100 ppm cadmium (Cd) and sorption and precipitation of Cd was studied across a pH range of 4- 11. Cd concentrations from each experiment were determined using inductively coupled plasma optical emission spectroscopy (ICP-OES). The microbialites were then measured using Fourier transform infrared (FTIR) spectroscopy in order to characterize and track variations of Cd sorption or precipitation on the microbialites. Raman spectroscopy was used to complement the FTIR spectroscopy and further characterize the sorption or precipitation, since Cd-O bonds can only be seen at far IR or those available to Raman spectroscopy. Sorption to the microbialites increased with increasing pH. At pH values above 8, Cd was found to precipitate out of solution in our negative controls and on the microbialites in our experiments. Cd sorption experiments were run over the course of 48h to study the kinetics of Cd removal from solution, with increasing sorption over time. These data help us to understand the rate and mechanism of Cd sorption to microbial-sediment composites and better understand environmental sinks for heavy metals.

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