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Comparison of Microporous Minerals for Potential Contaminant Uptake

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Microporous minerals have many industrial applications, from filtration to contaminant immobilization. Natural and synthetic minerals, including zeolites, clays, and silica aerogel, represent a few examples of microporous minerals with distinctive structures, surface charges, and porosity. Analysis and comparison of their crystal structures are necessary to determine how each mineral may be suited for contaminant uptake. Here we assessed the structure of microporous minerals, specifically rowleyite, clinoptilolite, vermiculite, and silica aerogel. Raman spectroscopy, X-ray fluorescence, and X-ray powder diffraction were used to create and model atomic mineral structures to visualize atomic and macroscopic features. Taking into account pore size and surface charge each mineral was reviewed to find the best fit with regards to heavy metal uptake, mainly Pb (lead). Overall, we provide a comparative framework to assess microporous minerals that will inform future flow-through experiments for heavy metal uptake.