Kaolinite-Facilitated Mercury Transport in Saturated Porous Media

Yingjia Zhu[1], Lena Q Ma [1*], Bin Gao[2] and Wille Harris[1]

1 Department of Soil and Water Science, University of Florida, Gainesville, FL32611, United States
2 Department of Agricultural and Biological Engineering, University of Florida, Gainesville, FL

32611, United States

Abstract

To evaluate the risk of Hg transport and release by mobile colloids, it is important to understand how colloids and colloid-Hg complex migrate in soils. In this study, batch experiments were performed to characterize Hg sorption onto sand and natural clay kaolinite colloids over a concentration range of 0.5-100 ppm Hg. In addition, kaolinite-facilitated Hg transport in water-saturated quartz sand was evaluated in a column experiment. Mathematical modeling was used to explore their transport dynamics in water-saturated porous media. Hg sorption by kaolinite and sands was nonlinear. Simulations from the Langmuir model match the data very well, with the maximum Hg sorption capacity being 1.2 mg/g kaolinite, which was 11 times higher than that of sand at 0.11 mg/g. Results from the column breakthrough experiments showed that the presence of Hg on kaolinite and sand grain surfaces reduced kaolinite transport through the water-saturated media. However, pre-loading sand column with low Hg concentration had little influence on kaolinite transport behavior. Adding kaolinite at higher concentration (225 ppm) enhanced Hg desorption from the sand surface, thereby facilitating Hg transport in saturated porous media.