Effects of solid-to-solution ratio on copper (II) and zinc (II) adsorption onto natural sediment: an experimental and modeling study

KAZUHITO MIZUTANI*

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, A1C 5S7

Adsorption of heavy metal ions to sediments in the subsurface significantly influences the fate and transport of heavy metals. Laboratory batch experiments, in which sediment samples are mixed with heavy metal-spiked solution, are frequently used to study heavy metal adsorption and to determinate partition coefficient (*K*D) for heavy metals. However, the solid-to-solution ratio in most laboratory experiments is much lower than that in natural soil or aquifers. Therefore, it is not clear that if those batch experiments can mimic heavy metal adsorption in natural environment. The objective of this study is to investigate if solid-to-solution ratio influences heavy metal adsorption. Copper and zinc adsorption onto a natural sediment was examined in the pH range of 3.0 to 8.0 using batch experiments at solid-to-solution ratio of 25 and 250 g/L respectively, and results showed that the partition coefficient is strongly influenced by solid-to-solution ratio for certain pH ranges. Cu and Zn adsorption to the sediment was simulated using surface complexation modeling approach via computer software Visual MINTEQ, and model prediction showed that Cu and Zn adsorption is controlled by solid-to solution ratio under specific conditions, in agreement with the experimental measurements. This study demonstrates that the partition coefficients of heavy metals measured by laboratory batch experiments could not be an appropriate proxy for partition coefficients in natural environments under certain conditions.

Winner of the Atlantic Geoscience Society Award for the best Environmental Science presentation

Atlantic Geology, 2015, Volume 51, Number 1
Atlantic Universities Geoscience Conference 2015: 65th Annual Conference – Abstracts
doi: 10.4138/atlgeol.2015.015