

Pb(II) Coordination, Extraction, and Sensing by Disulfonamide Ion-Exchangers

Konstantinos Kavallieratos¹, Jay M. Rosenberg¹, Robert J. Alvarado¹, Weihua Zhang¹, Aileen Andreu¹, Wei-Zhong Chen², and Tong Ren²

¹Department of Chemistry and Biochemistry, Florida International University, Miami, Florida, and ²Department of Chemistry, University of Miami, Coral Gables, Florida

There is currently a need for effective ligand design approaches for toxic metals, and Pb(II) in particular, for probing Pb(II) coordination and reactivity in biological systems, as well as for separation and sensing applications. Ion-exchange extraction is a potentially powerful approach, which combines coordination chemistry principles with variations in metal extractability in order to optimize selectivity. We have recently reported Pb(II) synergistic ion-exchange extraction by 2,2'-bipyridine and readily available low-coordinate disulfonamide ligands derived from *o*-phenylenediamine (Kavallieratos, K.; Rosenberg, J. M.; Bryan, J. C. *Inorg. Chem.* **2005**, *44*, 2373-2375, Figure 1). We now wish to report more efficient ion-exchangers based on analogous disulfonamide frameworks, which do not require the presence of a co-ligand for extraction and show high selectivity for Pb(II). Specifically, a bis-dansylated fluorescent analog showed selective extraction for Pb(II) over both Zn(II), ($D_{Pb}/D_{Zn} = 1400$) and Cu(II), ($D_{Pb}/D_{Cu} = 130$), with concurrent fluorescent sensing (Figure 2). The formed complexes in the organic phase were identified by NMR, and Electrospray Ionization Mass Spectrometry (ESI-MS). ESI-MS was also found to be a valuable method for evaluation of various Pb(II) coordination environments in ligand mixtures, thus providing a potential evaluation tool for ligand libraries. X-ray structural characterization of Pb-sulfonamido complexes showed coordination patterns that provide insight to the extraction mechanism by these chelates. This ligand design approach may eventually be applied to a wide range of biological applications, such as the design of novel sensors and biomarkers for investigating toxic metal accumulation and biodistribution, and the development of novel selective and non-toxic agents for treatment of lead poisoning.

Figure 1:

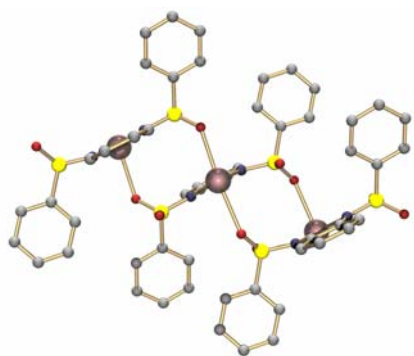


Figure 2:

