Supramolecular Arsenic Coordination Chemistry

An Emerging Approach for the Remediation and Sensing of Toxic Metals

Many of the "main-group" elements – including arsenic, tin and lead – are legendary for their toxicity. Arsenic in particular is one of the most toxic and carcinogenic compounds known to humans; its name alone is synonymous with poison. An abundant element in the earth's crust, arsenic is found all too frequently as an environmental contaminant. Despite the concern over arsenic toxicity, poisoning and contamination, surprisingly few organic ligands (or chelators) designed to interact specifically with these hazardous ions exist. A new supramolecular design strategy for forming self-assembled arsenic-based assemblies is presented, and we report the first members of this new class of compounds. Supramolecular chemists use the tools of self-assembly to create molecular architectures that are typically more stable than the sum of their parts. By incorporating the tools of supramolecular chemistry into a design strategy for making specific metal chelators, stable complexes that are expected to be selective for the targeted metal ion result. The design strategy presented incorporates the unusual coordination geometry of arsenic and relies on high-yielding self-assembly reactions to form selective and very stable complexes. We selected As(III) as a design component due to its unusual coordination geometry and a general lack of specific and powerful chelators for this highly toxic ion. Preliminary studies reveal the organic ligands are selective for arsenic and form extremely stable complexes in solution. Ongoing research focusing on developing similar design strategies for other main-group elements is also described.