Abstract

Heavy metals in the environment such as Cd, Hg and Pb are toxic to life forms. They can enter the ecological system through both natural and industrial sources. By developing chemical sensors that can detect these metals, scientists can identify problem areas and assist in the removal of the hazardous materials. Although sensors have been developed that can measure using one experimental method, the quest goes on to find sensors that have multiple routes to detection when a particular metal species becomes bound.

Ferrocene derivatives hold promise as a possible route to a multiple detector ion sensor. By changing the functional groups on the ferrocene derivative, the selectivity of the ligand system can be modified towards a particular metal cation. One reported and two unreported 1,1'-disubstituted ferrocene systems have been tested with eight metals and their complexes characterized as a means to develop a spectroscopic database. The information can be used to determine the products formed during the selectivity experiments with each system. During this research project, one system was found to be very selective for chelating Hg^{2+} in the presence of other commonly found metal cations and could be detected from other complexes in the database through three means: proton nuclear magnetic resonance (^{1}H NMR), ultraviolet-visible spectroscopy (UV-Vis) and cyclic voltammetry (CV). While a working universal heavy metal sensor was not achieved during this research project, it advanced the progress towards the formation of one.