Color of Metals and Transition Heavy Metal Analysis in Water

Wang, Ethan (School: Saint Louis Catholic High School)

The transition metals exhibit various colors due to the absorption of certain wavelength of photons by electrons when they are jumping from lower to higher energy level in the d orbit. The various colors of transition metal ions in water can be used for metal analysis. Heavy transition metals such as Cr(VI), Ni, Cu, Ti, Pb released from manufacturing processes to nature have been considered as hazardous contaminants, and needs to be constantly monitored and analyzed for ground water, lake, river and their feed flows. There are various lab analytical methods for heavy metal ions, such as Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma (ICP) by mass spectrometry (MS), however, they are expensive, time consuming, and not easily available for onsite testing. In this project, based on the color properties of transition heavy metal Cr(VI), a method using 1,5-diphenylvarbazide and a spectrometer to analyze Cr(VI) ion concentration in water is developed. The analytical range of this method was determined, and interference of other metal ions such as Mg2+ and Ca2+ were studied. Results were validated by two simulated water samples with known Cr(VI) concentrations, two lake samples and one ground water sample.

Awards Won: