CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
S0507

Project Title
Luminescent Silole Nanoparticles for Chromium (VI) Detection

Abstract

Objectives/Goals
The U.S. Environmental Protection Agency mandates that there be no more than 0.1 ppm of chromium in drinking water. To be able to determine whether a water sample had reached an acceptable chromium level, a reliable detector needed to be created. As it had already been determined by the Trogler group that silole nanoparticles could detect chromium through luminescence quenching, the focus of this experiment was to determine the best silole solution for Cr(VI) detection.

Methods/Materials
To find the solution that would most precisely measure the chromium concentration, three variables were tested: silole concentration, pH level, and the percentage of water in the solution. Luminescence spectra were taken for each solution, showing the fluorescence intensity of the solution. Using the results from the luminescence scans, the most luminescent solutions were chosen for chromium quenching. Chromium was added to each solution in increasing intervals, and luminescence spectra were taken for each solution at each chromium concentration to determine the effect of chromium on the luminescence intensity of the solution. An additional test was done at the end of the experiment to determine the effect of light on the solution over time and the point in time at which the luminescence remains stable for solutions kept in the dark or in the light.

Results
The results showed that with an increase in percentage of water came an increase in luminescence intensity. This fluorescence increase was also noted when silole concentration was increased in the solution, and again when the pH was non-neutral. When samples were tested for chromium-induced luminescence quenching, three samples had a clearly higher efficiency than the rest. The 4 mg/L silole concentration with 95% water, 6 mg/L silole concentration with 95% water, and 6 mg/L with 90% water all detected chromium at a highly efficient level (all pHs were neutral).

Conclusions/Discussion
The solutions with a 4 mg/L silole concentration with 95% water, 6 mg/L silole concentration with 95% water, or 6 mg/L silole concentration with 90% water were the best solutions for detecting the presence of Cr(VI), not because they were the most luminescent of the solutions tested (as was predicted), but because they were most efficiently quenched by the presence of Chromium.

Summary Statement
The purpose of this project is to develop a new and reliable detector for Chromium, an EPA-regulated water contaminant, by calculating the quenching effect of Cr(VI) on the luminescence of various siloleamine solutions.

Help Received
Professor William Trogler of UCSD provided all lab equipment, materials, and the opportunity to research. Sarah Toal (Graduate Student) mentored me through the project.