



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Andrew Kuang	Project Number J1121
---------------------------------------	---------------------------------------

Project Title
Take Lead out of Flint Water: Cilantro as a Heavy Metal Biosorbent

Abstract

Objectives/Goals
The purpose of this study is to verify that cilantro is an effective biosorbent for lead contaminated water.

Methods/Materials
For my experiment, I chose to use hydroponics systems. These modules were easy to use, they could be left running without constant supervision, and they were consistent in the cycling of nutrients around the plant roots. I used 3 systems, so I could spot any outliers. The plants I chose were basil, cilantro, and savory, and I used 3 of each plants to have some margin for error. The control was the beginning lead water content and the variables are the different plants.

Results
Cilantro root, at the fresh form, has nearly the same lead content as the water at that time (~1.92 ppm). There seems to be a near equilibrium of roots and water. The starting lead content was 4.04ppm, after the experiment, about 52.5% was absorbed by various plants. Leaves have the lowest lead content.

Conclusions/Discussion
The following conclusions were drawn from my research:
1. The plants are absorbing lead as expected; cilantro acted as an effective absorbent.
2. The lead content in the liquid samples reduced by more than 50% percent, proving that the lead is absorbed by plants.
3. Cilantro roots have the most lead concentration. Cilantro could be used as an absorbent, but the roots would need to be removed from either the holding tank or the farm with contamination.
4. After sending my conclusions to Professor Day for a second opinion, I realized that the vacuoles in the cells might have absorbed the lead before it could have traveled into the leaves. That could explain the relatively low concentrations of lead in the leaves of the trial plants.
6. The concentration of the lead was highest in the cilantro roots, nearly at equilibrium with the lead solution. It would be good to have another round of tests to find results for other roots of the plants.
7. The lead looked as if it was mainly stored inside of the cilantro root's vacuoles. On all of the plants, very little of the lead was inside of the leaves and stem.

Summary Statement
My research showed the feasibility of using cilantro as a bioabsorbent to remove lead from contaminated water, as in Flint Water Crisis

Help Received
1) My science teacher, Ms. Lindsey McVay for suggestions on improvements to this project 2) Mr. Siddhartha Roy from Virginia Tech, for information regarding lead and the Flint Water Crisis 3) My brother Simon (UC Berkeley, 2015 Sweepstake Runner-up) , for advice and a thorough critique 4) UCSD