Leading the Way: Alternate Removal of Lead From Residential Water Systems

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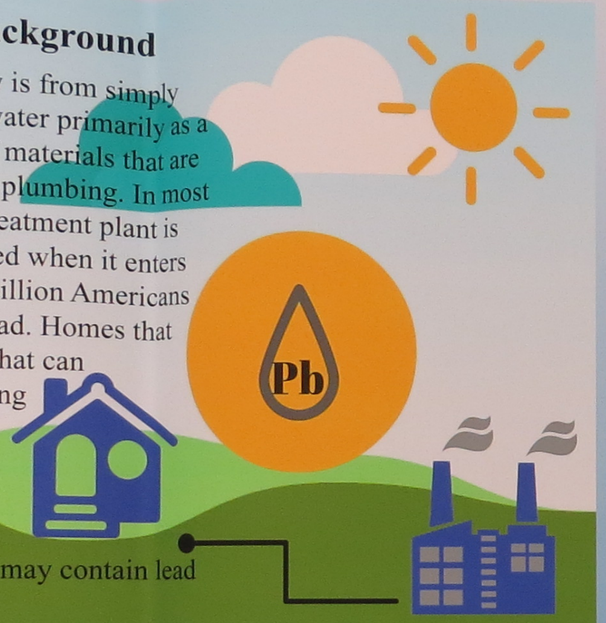
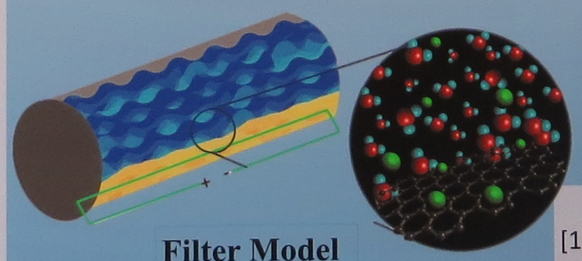
Background

The main way that lead can enter the body is from simply drinking tap water. Lead enters drinking water primarily as a result of corrosion or the wearing away of materials that are in the water supply system and household plumbing. In most cases the water entering and leaving the treatment plant is lead free, water only becomes contaminated when it enters home owners property. An estimated 47 million Americans utilize water from service lines made of lead. Homes that were built before 1986 have solder joints that can leach lead into the pipe lines, contaminating clean water [5]. Lead in drinking water cannot be seen, tasted or smelled. The only way to determine the level of lead in your water is to have it tested. Water that has gone unused for five or six hours may contain lead leached from pipes or solders[6].

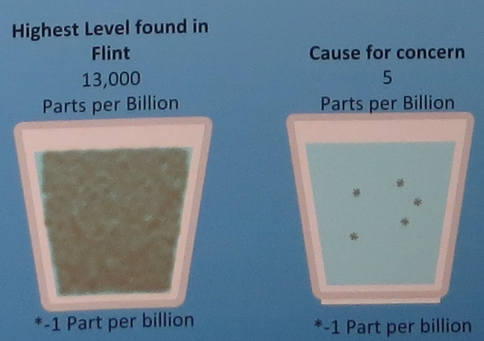


Introduction

An urgent problem that is especially important in the future development of modern society, is the practical effects of water pollution due to lead contamination [1]. The creation of new strategies to purify contaminated water have been extremely beneficial, but in a situation as that of the Flint Water Crisis which took place in Flint, Michigan, the solution to water contamination is still a work in progress. Failure to create a water filter to remove lead effectively has spurred the need for a more efficient filter. According to the Environmental Protection Agency, more than 10 million homes and buildings in America receive water from water pipes that are "at least partially lead" [2]. Lead decay from these service lines has been found to potentially leach into water used for drinking and cooking, and cause medical problems such as lead poisoning, anemia, kidney and brain problems, miscarriage and infertility. Over 600,000 cases of lead poisoning in children are reported annually and 143,000 deaths are reported due to the sickness [3]. There is no amount of lead in water considered to be healthy, but the level to begin action to remove contamination from water is when the amount exceeds 15 parts per billion [4]. *New lead filters that are low-cost and long-lasting that improve on existing technologies are warranted.*



Filter Model



Research Question

Is there a way to create a more efficient water filtration system that removes the toxic heavy metal lead from residential waterways with the utilization of carbon? Since there are many different ways that carbon could be used, which method will produce the optimum result?

Hypothesis

Our hypothesis is that porous carbon material with lead binding sites will be capable of absorbing lead and self-regenerate with electrical currents, which is electro dialysis.

Goal

Our goal is to develop a self-regenerating water filter to remove lead ions from tap water in residential homes.

Equipment

- Carbon Nanotubes
- Porous Membrane
- Pure lead (Pb)
- Metal pipe
- Closed circuit
- 120v battery

Objectives

- Design and synthesize a porous material that are electrically conductive and bind to lead ions.
- To characterize the physical and chemical properties of the material
- To evaluate the absorption properties of the material towards lead as well as other common ions such as other heavy metals.
- To study the self-regenerating properties of the material by using electro dialysis methods to desorb lead ions.

Method

- The design of the conductive porous material will be based on functionalized a graphene oxide modified will lead-binding sites.
- This will be accomplished by poking holes into graphene and attaching sulfur atoms on the edges of the pores. We expect lead ions to bind to the sulfur groups. After saturation of the lead-binding sites, we will employ an electrical current to desorb the lead ions by electro dialysis action, thus regenerating the lead filter.
- The lead flushed out of the system will be immobilized into a suitable solid waste matrix

Acknowledgement

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References

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