Project # 1: Availability of Safe Drinking Water

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Abstract

Nanoparticles in water are <100 nm in at least one dimension. Zero valent iron is one of the most common nanoparticles that could find their way in the water system because of their use in remediation of contaminated soils. Other materials of concern could also be nano TiO_2 or even nano silica. Their presence in water could provide a great impact on the fate of organic pollutants removal by granular activated carbon (GAC) adsorption. Nano particles could aggregate in water and could be an adsorption site for organic pollutants which will hinder their removal by GAC adsorption. Further complications could be caused by the presence of Natural Organic Matter (NOM) in water. NOM is a complex mixture of organic compounds derived primarily from the decay of plant and animal materials. One of the primary challenges faced by drinking water treatment industries is the formation of suspected carcinogenic disinfection by-products (DBPs), which occur as a result of reactions between NOM and oxidants/disinfectants such as chlorine.

Trichloroethylene (TCE) is a contaminant commonly found in ground and surface water. Granular activated carbon (GAC) has been regarded as the best available technology for removal of organic contaminants. However, the presence of nanoparticles in water could hinder the GAC application due to the aggregation of nanoparticles which could act as an adsorption site for pollutants.

The proposed study will investigate the efficacy of GAC adsorption in the presence of nanomaterials. Three nanomaterials (titania, zero valent iron, and silica) at two concentration levels will be evaluated in the study. The goal of this study is thus to evaluate the impact of the presence of these nanoparticles on the adsorption of TCE in the presence and absence of Titanium Dioxide. During each summer the teachers will conduct experiments with one nanomaterial. Returning teachers will be able to demonstrate the difference in performance for different nanomaterials and at the same time will have the chance in training the new teachers. The objective of this project is to determine the implication of different nanomaterials on the removal of TCE. Teachers will be provided with the necessary documentation for experimental procedures and interpretation of the results and will be trained prior to conducting any experiments.

Possible Ideas for Classroom Implementation

This project is expected to open the realm of the multidisciplinary field of environmental engineering, and surface chemistry to the teachers. It will empower them to show in a meaningful manner how such integrated knowledge is used to solve a pressing community problem. It will be attractive to women and minorities, who tend to choose pathways leading to careers that improve quality of life. The teachers will be assisted in enhancing lab infrastructure at their schools by simplifying the approaches they used in this

research to suit the resources available to them. This activity, when integrated into math, science and social studies classes, exposes students to issues faced by environmental engineers as they design and build a functioning water filter using local materials to improve water quality and protect the public health.

Figure 1. Batch and Column Experimental Setup

Figure 2. Gas Chromatograph for Determining Pollutant Concentration

Figure 3. Sample Preparation