CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31869

Project Title

Utilizing a Magnetic Field to Reclaim Nanoparticles in Water Treatment Process

Abstract

Objectives/Goals

A novel approach was proposed to test the viability of utilizing magnetic silver nanoparticles as a primary method for a water treatment plant#s disinfection process. The conventional methods are through contact with sodium hypochlorite or ozone, both of which yield potentially hazardous byproducts. The proposed magnetic silver nanoparticles could eliminate reliance on these current methods for disinfection. Most importantly, they will be retained and reused to prevent these nanoparticles from entering into the environment.

Methods/Materials

1:3 and 1:4 ratios of silver to iron by mass were produced as the nanoalloys to be tested. First, a control and control duplicate were taken by placing 1 mL of raw plant influent water from Anaheim#s Lenain Water Treatment Plant. Next, the 1:3 ratio was tested by placing those particles in plant influent water. 1 mL samples were taken at each of 10, 20 and 30 minutes. Two electromagnets were employed to collect the nanoparticles, and the water was pumped out. More plant influent water was added, and the process was repeated twice. The test for the 1:4 ratio was the same as the test for the 1:3 ratio. Lastly, to prove that the nanoparticles would escape to the environment without the magnets, the final test had the 1:4 ratio in plant influent water, but did not collect the particles between trials.

Results

Both the 1:3 and 1:4 ratios of silver to iron by mass yielded positive results. Bacterial colonies formed in all of my tests, though significantly less were counted in the tests utilizing nanoparticles. On average, the control had around 50 cfu#s, while the trials utilizing nanoparticles only had a few colonies of bacteria each.

Conclusions/Discussion

In conclusion, both ratios of nanoparticles worked effectively in eliminating bacteria. Also, electromagnets allowed the magnetic silver nanoparticles to be retained and reused. These conclusions display the possibility of eventually incorporating nanoparticles into conventional water disinfection processes.

Summary Statement

An environmentally sound approach for water disinfection was proposed by utilizing novel magnetic silver nanoparticles that could be retained and reused by an induced magnetic field.

Help Received

Mentored by Dr. Shaily Mahendra; Used City of Anaheim's Lenain Water Treatment Plant's Water Quality Lab; advised by Mr. Peter Starodub