CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
S1520

Project Title
Measuring the Toxicity of ZnO Nanoparticles in Pseudomonas stutzeri

Abstract

Objectives/Goals
This project aimed to determine that ZnO nanoparticles are antibacterial agents through measuring their toxicity in Pseudomonas stuzeri. This is a denitrifying bacterium commonly found in the rizhosphere and groundwater (Lulacat et al, 2006). The relationship between Zn2+ ions and number of viable cells was measured. By exposing the nanoparticles to ambient laboratory lighting, it was also observed whether it has an effect on the concentration of Zn2+ ions and the toxicity of ZnO nanoparticles.

Methods/Materials
In order to test the variables for this experiment, five sterile culture tubes containing different combinations of nanoparticles, bicarbonate solution, cell pellets, and exposure to light were created. Viable cells and concentration of Zn2+ ions were measured during a 90-minute interval. Viable cell counts were obtained using serial dilutions and media plating, and the concentration of Zn2+ was measured utilizing an Induced Coupled Plasma (ICP) spectrometer.

Results
ZnO nanoparticles are toxic to P.stuzeri. When nanoparticles are not exposed to light, they are more bactericidal. Light also appears to promote more release of Zn2+ ions from ZnO nanoparticles.

Conclusions/Discussion
There may be an unidentified toxic mechanism which acts under dark conditions. The research of Adams and collaborators (2006) suggests that an alternate toxic mechanism may exist in ZnO nanoparticles under dark conditions.

Summary Statement
This project determined that zinc oxide nanoparticles are toxic to Pseduomonas stutzeri, and it also observed how different conditions of light affect the nanoparticle's toxicity.

Help Received
Under the supervision of a graduate student, I worked in Stanford's Environmental Earth System Science Department. My research is not the same research the graduate student conducts.