CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Isabella G. Liu

Project Number

S2105

Project Title

A Nano Particular Conundrum: Antibacterial Activity of Zinc Oxide Nanoparticles against Soil Microbes: Nitrobacteraceae

Abstract

Objectives/Goals

The objective of this experiment was to discover whether or not an increased concentration of zinc oxide nanoparticles leads to decreased levels of viable soil bacteria, specifically nitrosomonas and nitrobacter.

Methods/Materials

Tested the antibacterial activity of ZnO nanoparticles against nitrosomonas and nitrobacter by creating a growth media that catered to the growth and isolation of nitrosomonas and nitrobacter. Next, allowed bacteria collected from the soil to grow on the plates while isolation streaking and testing to make sure only Gram Negative bacteria growths occured. Once I isolated the nitrosomonas and nitrobacter, I subcultured them onto agar plates with ZnO aqueous solutions applied to the plates at 20%, 15%, 10% and 0% concentration. I measured the cell viability of the bacteria during their log phase with a Trypan blue solution.

Results

I discovered that in the presence of zinc oxide nanoparticles, the levels of viable nitrosomonas and nitrobacter decreased dramatically. Most notably, the data an inverse relationship between the percentage of viable bacteria and nano-zinc oxide concentrations as the r value was -.98 and the r^2 value stood at .96, or 96% correlation. This showed a a strong, negative relationship between an increased nanoparticle concentration and decreased bacterial viability.

Conclusions/Discussion

My research reasserted the antibacterial properties of the nanoparticle, zinc oxide. However, it shed new light on the subject. Before, it was assumed that nanoparticles could not penetrate the walls of Gram Negative nitrifying bacteria. I discovered the contrary. While nanoparticles have the capacity to make huge advancements in technology and medicine, they also have the capacity to derail our ecosystems by diminishing populations of nitrifying bacteria.

Summary Statement

As measured through cell viability, I demonstrated that ZnO nanoparticles have the capacity to harm our ecosystems by damaging populations of nitrifying bacteria, specifically, nitrosomonas and nitrobacter.

Help Received

I accessed my high school's lab facilities and equiptment to perform the lab. I adapted a recipe for an enrichment media from the paper "Isolation of Nitrosomonas in Pure Culture," by Lewis and Pramer, 1958. This text was available online.