CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38073

Project Title

The Efficacy of a Silver-Zinc Oxide Nanocomposite under Varying Light Wavelengths in Photocatalytic Degradation

Abstract

Objectives/Goals

This project is based on the preparation of a silver-zinc oxide nanocomposite and the determination of its efficiency of photocatalytically degrading various contaminants under various wavelengths of light. By using a urea-based precipitation method, the nanocomposite was prepared and was allowed to break down to sample contaminants, methyl violet and trichloromethane, under red, blue, and green light. My hypothesis was that light with smaller wavelengths will result in higher percentages and rates of degradation, due to the inverse relationship between energy and wavelength.

Methods/Materials

Zinc acetate and silver nitrate were the chemicals used as sources of zinc oxide and silver, the precipitation method catalyzed by urea and sodium hydroxide. The compounds were dissolved in water and heated for 15-30 minutes. Any leftover insoluble material was filtered and the filtrate was prepared for photocatalytic degradation. This, in itself, shows the success of a relatively simple, and readily accessible preparation of nanoparticles, and more broadly, nanotechnology. The preparation was followed with trials in which to determine its photocatalytic abilities. Fixed amounts of methyl violet and trichloromethane were added to a fixed volume of nanocomposite suspension under a particular wavelength of light and allowed to react for 1 hour.

Results

The methyl violet trials had an average degradation percentage of 80%, 70%, and 70% for red, blue and green light, respectively, while the trichloromethane had an average degradation percentage of 21%, 21%, and 22%. The graphs also exhibit no change of efficiency when varying wavelengths of light are used, as the graphed lines shown had little to no deviation from each other. This signifies a broad range of wavelengths that the nanocomposite is effective with.

Conclusions/Discussion

This project contributed to two main benefits: first, the success of a simple method in the preparation of silver-zinc oxide nanocomposites as well as the determination that the ability of the nanocomposite to degrade various contaminants is relatively efficient as well as robust. Instead of one wavelength of light being significantly more effective than the others, the nanocomposite was able to utilize each wavelength of light equally in the degradation.

Summary Statement

The nanocomposite synthesized in this project was able to utilize a wide range of visible light in order to degrade aqueous chemical contaminants.

Help Received

I performed all the synthesis and experimentation by myself. My adviser did give me permission to work in the school fume hood to ensure absolute safety.

Preliminary