CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38558

Project Title

Nanoparticles Improve Duration of Sunblock Protection while Maintaining Efficacy

Abstract

Objectives/Goals

Recent studies have demonstrated that topically applied sunblock may enter both the bloodstream and breast milk with unknown consequences. The purpose of this experiment is to evaluate the effectiveness and duration of action of a novel skin protectant product developed from the mixture of Zinc Oxide, a bioadhesive, and nanoparticles that prevent absorption through the skin. This experiment will employ a simple, inexpensive, edible silver nanoparticle to encapsulate a physical block to create a more durable, effective sun protectant. Common bacteria from the mouth and pig skin serve as proxy for human skin.

Methods/Materials

A series of mixtures of Zinc oxide, the cellulose-based bioadhesive, and silver nanoparticles were formulated at different concentrations to determine the minimum required to block UV-A and UV-B rays. Petri dishes with agar were inoculated with sun sensitive bacteria and allowed to grow for one week in the dark. A colony count was performed and one of the UV protectants was applied. The protected bacteria were then exposed to UV radiation and colony counts of the bacteria were made at three and seven days following UV exposure. The second stage of the experiment assessed the duration of the protection conferred.

Results

In all six treatment groups, bacteria grew as expected prior to colony count I. In the Zinc oxide group with bacteria and sun exposure, the colony count nearly doubled. The Zinc Oxide plus bioadhesive group demonstrated strong protection of the bacteria as the colony count doubled. The further addition of nanoparticles increased this level of protection further. Zinc Oxide was protective for five hours, and then began to lose its shielding effect. The addition of the bioadhesive to zinc oxide maintained the irradiance below the threshold of 30 W/m2) until the nine-hour mark, while the addition of nanoparticles further extended the duration.

Conclusions/Discussion

This project determined that combining the most effective sun protection with a nanoparticle produced a more effective and durable protection. The addition of the nanoparticle allows the product to persist and provide reflectiveness for a drastically increased duration. Extending this experiment to cultured human skin will confirm these findings and potentially reduce skin cancer rates while employing a product that reduces absorption of the chemicals into the body.

Summary Statement

This project assessed the ability of a novel nanoparticle encapsulated sunblock to add durability to the protective effects of sunblock without reducing efficacy.

Help Received

My father helped with confirming some of my colony counts, and my mother helped prepare my board.