CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J2099

Project Title
Physical Block vs. Chemical Screen: Which Type Is More Effective?

Abstract

Objectives/Goals

Ultraviolet (UV) light from the sun causes damage to human skin cells that may destroy the ability of the skin cells to control cell division, leading to types of skin cancer. Thus, people are encouraged to protect their skin from the potentially harmful effects of UV light by using protective creams. Chemical screens and physical blocks have different ingredients that work in different ways. The screens only protect us from some of the harmful rays (UVB), while the blocks protect us from almost all of the harmful rays (UVA and UVB).

With enough sun exposure, UV light is lethal to bacteria. In this experiment, I compare different kinds of ingredients to evaluate their effectiveness to protect bacteria from the effects of UV light. I use bacteria as a substitute for the human skin in this experiment. I will test the ability of the creams to protect the bacteria from sunlight, and then use that information to consider the effect of the same cream on human skin.

Methods/Materials

This is a two-week experiment. Week 1: I inoculated Petri dishes with bacteria that I swabbed from my mouth. I waited 1 week to let them grow. After this first week, I performed a colony count. Then, I measured 1.0ml of each cream for the Petri dishes and then covered them with this covering of sun protection. I exposed the dishes to UV light (the Sun) with them all having the same exposure time. I then again waited a week and let the UV light kill some of the bacteria. After the second week, I again performed a colony count of those bacteria that survived exposure to the UV light.

The experiment required a total of 16 Petri dishes: 6 unprotected controls (2 no bacteria, 2 no UV exposure, 2 with UV exposure), 6 for chemical screens, and 4 for physical blocks.

Results

Creams with zinc oxide and titanium dioxide protected bacteria from the sun. Dishes protected with Zinc Oxide had the most bacteria survive UV rays. Titanium Dioxide (the other physical block) also protected the bacteria well. The chemical screens were all less effective in protecting the bacteria from UV rays.

Conclusions/Discussion

Physical blocks deflect UV rays while chemical sunscreens absorb and convert UV rays thus your skin is less damaged by the UV rays compared to no protective cream. Physical blocks such as Zinc oxide and Titanium dioxide protect best from the sun's UV rays. While it is good to wear a sunscreen, it is best to wear a sunblock.

Summary Statement

This research tested the different efficacy of sun protectant ingredients to block the ultraviolet light killing of bacteria used as a proxy for human skin protection of cancer-causing sun damage.

Help Received

This project was my concept, but my parents helped with the typing and photography. My father helped me confirm the bacterial colony counting. My neighbor helped with the board pasting.