CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
35497

Project Title
Coral Bleaching by Sunscreens: Effect of Sunscreen Chemicals on the Survival of Coral Symbiont Zooxanthellae Algae

Abstract

Objectives/Goals
Corals have a symbiotic relationship with the algae zooxanthellae, which carry out photosynthesis on the coral, providing the reef with essential sugars, lipids, and oxygen. Coral bleaching occurs when the zooxanthellae die, causing the reef to become white. The project was done to test if sunscreen chemicals have an effect on the viability of zooxanthellae, and if there is a difference in toxicity of active ingredients in mineral-based sunscreen and chemical-based sunscreen. I hypothesized that oxybenzone, an active ingredient in chemical-based sunscreens, is more toxic to zooxanthellae than zinc oxide, an active ingredient in mineral-based solutions. Higher concentrations of the solutions will lead to a higher mortality rate of the zooxanthellae.

Methods/Materials
Varying concentrations of sunscreen active ingredients were prepared in a 22 g/L saltwater stock solution. 1 mL of each sunscreen solution was combined with 1 mL of zooxanthellae in solution, and added to a well in a welled plate. After this dilution, the solution concentrations were: 10 mg/L, 25 mg/L, 50 mg/L oxybenzone; 50 mg/L, 125 mg/L, 250 mg/L zinc oxide. The experiments were done in triplicate. The welled plates were kept in a 25˚C room under a 12-hour/day timed lamp, for 0 to 3 days. A hemacytometer was used to count alive and dead algae at each time point.

Results
Normalized results showed that oxybenzone and zinc oxide had similar impacts on zooxanthellae mortality. Standard deviation in each concentration of both ingredients overlapped with or were very close to the other concentrations, indicating that higher concentration had no significant effect. Longer exposure to all sunscreen solutions showed increases in algae mortality. The sunscreen ingredients, regardless of type and concentration, activated dormant viruses in zooxanthellae by inducing the lytic viral cycle, killing the algal cells.

Conclusions/Discussion
My hypothesis was not supported, as both ingredients had similar toxicity, and higher concentrations had similar effects as lower concentrations. Although mineral-based sunscreens may be less harmful to humans, they are still harmful to zooxanthellae, and in turn, corals.

Summary Statement
I tested the effects of two sunscreen chemicals on the survival of zooxanthellae, an algal species symbiotic with coral, to see how sunscreen that leaches into the ocean affects coral bleaching.

Help Received
Teacher supervised; Presentation High School paid for materials; father helped with experimental setup