CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38304

Project Title

Coatings to Protect Polymers from UV Damage

Abstract

Objectives/Goals

UV resistant polymer formulations pose a threat to the environment. Irreversibly safe from the sun, these plastics may linger for generations. The primary objective of this study is to determine whether removeable coating materials can protect vulnerable polymers(plastics) from UV induced damage. A secondary goal of this study is to observe any differences in the effectiveness of different coatings in protecting more than one type of polymer.

Methods/Materials

This project tested the ability of coatings made from olive oil and Elmer#s Glue (#Elmers#) alone and in combination with titanium dioxide and zinc oxide to protect three different plastics (Polyethylene Terephthalate Glycol, Polyurethane, and Polystyrene) from UV damage. Coated plastic specimens were placed in non-UV protective glass trays and positioned in a tanning bed where they received UV exposure equivalent to 162 days of tropical summer sun. Coatings were then removed.

I built a testing box using corrugated cardboard, duct tape and adhesive. I mounted photovoltaic cells onto the box#s floor. The wire leads passed through the box and connected to a multimeter. Light was shined down through the box, through the sample, onto the cells. Regular calibrating measurements were taken, and the light placement adjusted to maintain consistency. The data gathered was found statistically significant through Chi squared analysis.

Results

The tested coatings protected each of the three plastics from UV light caused damage. Surprisingly, the data showed that each coating#s ability to protect a plastic was not consistent between plastics. This suggests that different mechanisms in each plastic were responsible for their UV light vulnerability. Data indicates that Polystyrene is best protected by glue combined with a protectant against both UV A and B while the other two plastics were best protected by isolation from the surrounding air alone.

Conclusions/Discussion

My primary objective was achieved. Under test conditions coatings can protect plastics against UV induced damage. Using coatings plastics can be made safe from UV during their useful life and restored to UV vulnerability by removal of their coatings or shredding of the plastic. Pursuit of my secondary goal revealed that different coatings may be needed for different plastics and that effectiveness of human sunscreen protectants may not correlate to their effective level in protecting plastics.

Summary Statement

I showed that polymers can be protected from UV exposure by using protective coatings and documented that the effectiveness of a coating is dependent on both the coating and the particular polymer protected.

Help Received

Matt Bessler, my Science Teacher, helped me narrow my review of literature and taught me how to use Google sheets to create graphs. Tamar and Joel Weissler, my parents, each helped me with proof reading and understanding statistical significance analysis. San Diego Plastics and E-Plastics helped me chose

Preliminary