CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
S0519

Project Title
Photopolymerization: Advanced Technology, Environmentally Friendly, Energy Efficient

Abstract

Objectives/Goals
My objective is to find the affect of monomers, oligomers, and photoinitiators on the characteristics of the polymer during photopolymerization. Also, I want to determine the affect of UV intensity on the rate of polymerization (solidification).

Methods/Materials
Make Gel A by using 25% monomer, 70% oligomer, and 5% photoinitiator. Make Gel B exactly the same, except use another type of monomer. Make Gel C exactly like Gel A except use a different oligomer, and make Gel D exactly like Gel A except use a different photoinitiator. Expose 0.5 g of each gel under the same intensity of UV light. Record all the properties exhibited by the final products of each of the gels.
Also, obtain three UV lamps of different intensities. Using the same gel, expose equal amounts of it into each of the UV lamps and record the highest exotherm reached and the time it took to reach it.

Results
The most prominent difference between Gel A and Gel B was the shininess of the polymers. The most prominent difference between Gel A and Gel C was durability, and between Gel A and Gel D was the rate of polymerization. Also, the gel exposed to the lamp with the highest intensity reached the highest exotherm and in the shortest amount of time. The gel exposed to the lamp with the lowest intensity reached the lowest exotherm and it took the longest amount of time to reach it.

Conclusions/Discussion
Monomers, oligomers, and photinitiators all seem to have an affect on a range of properties; however, there is one main characteristic that each contributes to the polymer. Monomers affect the shininess of a polymer, while oligomers affect the durability of the product, and photoinitiators affect the rate of polymerization (how fast the gel becomes a solid polymer). Also, the higher the UV intensity applied to the gel, the faster the rate of polymerization, and the higher the amount of exotherm (heat produced).

Summary Statement
My project concerns researching the characteristics of certain chemicals involved in photopolymerization, a reaction that occurs when monomers, oligomers, and photoinitiators are combined and exposed to UV light to form a polymer.

Help Received
All of the raw materials and equipment used in this experiment were provided by Jagdish Cosmochem Products, Inc. However, I received no help in carrying out any experiments. I did all of the work on this project by myself.