CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
J1517

Project Title
Rainbow Makers

Abstract

Objectives/Goals
My objective was to determine how the refractive index value of a medium affects its angular dispersion.

Methods/Materials
In the first part of my experiment, I used Snell's Law tocalculate the refractive indices of the materials that I used. To measure the angular dispersion, I began by preparing an easel paper by drawing the shape of the hemispherical dish that I used. Then I drew the three angles of incidence (30, 45, and 60 degrees) and the normal from the exact center of the dish. Then, I poured 1/2 a cup of liquid into the dish and directed a beam of light from a slit lamp through the medium, placing the beam on the desired angle of incidence. I then followed the angle of refraction until the place on the paper where the spectrum was clearest and marked the beginning and end of the spectrum. After connecting the two lines back to the origin, I connected their ends with a small line which I named L, while the spectrum line was called R. I used the formula Theta = 360(L/2 x pi x R), in which theta was the angle of difference between the red and blue ends of the spectrum. I then used Theta/Delta Lambda(change in wavelength) to calculate the angular dispersion.

Results
The media with the highest refractive index values produced the highest angular dispersion values. The mineral oil, which had the highest refractive index value, produced the highest angular dispersion. The water/gel, which had the lowest index values, produced the smallest angular dispersion values. The isopropyl alcohol, whose index value was in between the water/gel and the mineral oil, produced an angular dispersion value that was also between them.

Conclusions/Discussion
My conclusion is that my results supported most of my hypothesis. The mineral oil, isopropyl alcohol, and water produced angular dispersion values in the descending order that I had predicted. The part of my hypothesis that was not correct concerned the aloe vera gel. Although its refractive index value tested as almost equal to water, it was so viscous that I predicted that it would not even be able to refract light. However, it produced an angular dispersion equal to that of water.

Summary Statement
My project was about the effects of a medium's refractive index value on its angular dispersion.

Help Received
Professor John Kenney at Concordia University helped with the experimental design ; Mr. Ramiah Bapu helped with the mathematical formulae; Mother helped spot beam of light to minimize error