CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
J1726

Project Title
Testing the Chirality of Glucose Using a Homemade Polarimeter

Abstract

Objectives/Goals
My objective is to come up with a way to test the Chirality of Glucose. Knowing the Chirality of a molecule is important when developing substances that will go into the body since the body is a chiral environment. Can a homemade polarimeter be used as a first step in measuring the chirality of Glucose, a known Chiral molecule? Also, will the angle of rotation of plane polarized light increase with a greater concentration of Glucose or a longer path length through the solution?

Methods/Materials
Polarizer, Analyzer, Light Corn Syrup (Glucose) in four concentrations (0%,25%, 50%, 100%), Water, Four PVC tubes glued to a pane of glass to put the solutions in, iPad as a light source, camera, Analyzer stand, Lazy Susan, 16'x16' butcher block paper, Ruler, Protractor. In this experiment I use an iPad for a constant light source, two polarizers, one to polarize the light before entering the sugar solutions, and the other to analyze the outgoing light. The polarizer is rotated relative to the analyzer in order to get the minimum light through the system. This is where the polarizer and analyzer are at 90deg to each other. This technique was used for each solution concentration to see the angle differences where the minimum light occurred. This will give us the degree of polarization rotation. The 0% solution is our reference point, because water is non-chiral.
The second experiment is done using a 25% concentration solution in all four cylinders with just changing the path length, or depth, of the solution. The four path lengths are 1cm, 2.4cm, 3.6cm, and 5.1cm. The angle of rotation is found using the same procedure as the previous experiment.

Results
When increasing the ratio of the Glucose solution to water we measured a greater angle of rotation. For the three concentrations of 25%, 50% and 100% we measured angles (in degrees) of 9.5, 17.5 and 31, respectively.
When increasing the path length of the Glucose solution we also measured an increase in angle of rotation. For the path lengths of 1cm, 2.4cm, 3.6cm and 5.1cm, we measured angles (in degrees) of 10, 16, 21 and 27, respectively.

Conclusions/Discussion
A homemade polarimeter can measure the degree of polarization rotation of a Chiral molecule. The polarimeter showed that having a greater concentration of the sugar solution and a longer path length through the solution causes greater rotation of the polarization.

Summary Statement
I made a homemade polarimeter to measure the difference in angle of rotation of plane polarized light for four different concentrations of the Chiral molecule Glucose

Help Received
I had assistance from my mom to design and understand my Polarimeter and the subject of polarization.