CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J0603

Project Title

Kinetics of the Inversion of Sucrose

Abstract

Objectives/Goals

Our goal was to use polarimetry to measure the activation energy of the inversion of sucrose in the presence of a catalyst. Sucrose inversion occurs when it is dissolved in water in the presence of a catalyst such as an acid or an enzyme. Sucrose is broken into glucose and fructose, two other sugars. Because sucrose, glucose, and fructose are optically active, they rotate the plane of linearly polarized light. Each has a different specific rotation, so the rate of inversion can be measured using polarimetry.

Methods/Materials

We built a homemade polarimeter for our experiment. We used a white laptop screen as a polarized light source. The sugar solution was placed on top of the screen and viewed through a polarizing filter. The polarizing filter was rotated until light from the laptop could no longer be seen. We found the difference between the angle of polarization of the solution and that of the laptop to determine the effect of the solution.

Results

The angle of rotation of the solution changed as the sucrose converted to glucose and fructose. By measuring the angle over a period of time with our polarimeter, we were able to determine the reaction rate. We observed that the reaction proceeded much faster at higher temperature and calculated the rate constant by fitting the specific rotation with an exponential function. With these rate constants, we used the Arrhenius equation to calculate the activation energy of the reaction.

Conclusions/Discussion

We succeeded in building a homemade polarimeter and using it to measure the rate of an important chemical reaction in biochemistry and the food industry. We showed that, by measuring the rate at multiple temperatures, we could calculate the activation energy of the reaction.

Summary Statement

A homemade polarimeter was built and used to determine the activation energy of an important chemical reaction in biochemistry and the food industry.

Help Received

Paul Carter helped us understand concepts in chemistry and math needed for the project