CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
S0613

Project Title
The Effect of Temperature on the Equilibrium in the Production of Biodiesel

Abstract

Objectives/Goals
For my project, I wanted to determine at which temperature of production of biodiesel would result in the greatest yield of the reactants (catalyzed methanol and soybean oil) into the products (biodiesel and crude glycerol). The temperatures I tested were 30, 45, 60 75, and 90 degrees celsius. Using Le Chatelier's Principle, I hypothesized that the biodiesel produced at 30 degrees celsius would have the highest conversion rate of soybean oil to biodiesel, thus resulting in the greatest yield of biodiesel.

Methods/Materials
First, I made a catalyzed methanol mixture with the potassium hydroxide. I completed a trial for each temperature. For stage one of the trial, I heated soybean oil to the specific temperature and added catalyzed methanol. I let it react at the specified temperature for sixty minutes and then placed the solution in a separatory funnel to separate into an upper biodiesel phase and a lower crude glycerol phase for twenty minutes. I took out the crude glycerol phase and weighed it for my future calculations. For stage two of the trial, I repeated the process exactly. This was the end of my trial. To complete my calculations, I first found the moles of soybean oil used and the theoretical glycerol yield. I then found the actual glycerol molar yield and overall soybean oil conversion for stage one and stage two.

Results
My biodiesel produced at 30C had a 98% conversion rate, at 45C had a 66% conversion rate, at 60C had a 93% conversion rate, at 75C had a 59% conversion rate, and at 90C had a 0% conversion rate.

Conclusions/Discussion
My hypothesis was supported because the biodiesel produced at 30C had the highest conversion of products to reactants. There was an overall trend of higher temperature having lower conversion rates with the exception of 60C. In both my 60C trial and my 90C trial my biodiesel phase and glycerol phase would not separate and instead turned into soap. The weight of the crude glycerol was higher than it was supposed to be because the crude glycerol phase also had soap in it. For the 90C trial, so much soap was created so a value for the crude glycerol was impossible to obtain, thus resulting in the 0% conversion. It is useful for the biodiesel production industry to know that lower temperatures lead to a higher yield of biodiesel.

Summary Statement
My project investigates which temperature of production produces the highest yield of biodiesel in accordance to the equilibrium rules of Le Chatelier's Principle.

Help Received
My chemistry teacher Dr. Rano Sidhu helped me understand the characteristics and importance of chemical equilibrium.