CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
Dave S. Ho

Project Number
S0508

Project Title
The Optimal Temperature for the Decomposition of Biuret to Urea in Solution

Abstract

Objectives/Goals
Fertilizers used for better crop growth mainly depend on urea. However, the impurity biuret(harmful to plants) is also created as a residue. It is possible to convert biuret to urea in a closed container, manipulating the temperature to create the best yield. The main objective of this project was therefore to develop a trend between the temperature and the yield of urea from the biuret and to find an optimal temperature range where this reaction could occur, thereby allieviating the food issue today.

Methods/Materials
METHODS: Biuret can be decomposed at the basic pH of 12.5 in the temperature range of 0-100 centigrade. 0.5 grams of biuret was dissolved in 0.05 M NaOH at temperatures between room temperature and 100 degrees Celsius for the decomposition to urea. Because urea is a powerful protein denaturant, the protein gelatin was added, and the non-denatured gelatin was later stained with the dye ninhydrin. Concentration of the dyed gelatin were later calculated using the Beer-Lambert Law after measuring absorbance using a spectrophotometer.
MATERIALS: Biuret Powder, Fume Hood, Glassware, Goggles, Apron, Stirring Rod, Hot Plate, Thermometer, Stopwatch, Camera, Gelatin Powder, Spectrophotometer, Cuvettes, Water, Ninhydrin Dye Assay, Ethanol, Sodium Hydroxide, Water, Magnetic Stir-bar, Magnet, Labeling Tape, Marker, Paraffin Film, Eye glass

Results
Apparently, the concentration yields in order of temperature created a sinusoidic trend, with the best temperatures around the local maximas of the function $f(x)=-0.182\sin(0.262x-2.98)+.452$ between 0 to 100 degrees centigrade. The results of this experiment were unexpected. Largely contrasting the hypothesis, where decomposition of biuret is not more proficient at a higher temperature.

Conclusions/Discussion
As stated, the data does not follow any conventional pattern explained in any rate law. The concentrations recorded did not have a positive, linear, or even logarithmic trend. Therefore, no verifiable conclusion was reached.
By understanding that urea can be optimally purified at certain temperatures, low-biuret urea can be made more efficiently. This would then slightly lessen the enormous food shortages around the world from the increase of population. From this, the decomposition of biuret to urea in ideal conditions would aid society.

Summary Statement
To address the situation of world famine, an optimal temperature range was attempted to be found where biuret (a plant harmful compound) can be decomposed into urea (a fertilizer).

Help Received
Chemistry teacher (Ms. Bunch) offered her labratory room for this experiment.