CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J0501

Project Title
Measuring Concentration of Solutions (Liquids) using Light

Abstract

Objectives/Goals
The purpose of my experiment was to measure concentration of very small volumes of solutions (such as dye colored water or juices) using light when it flows through small glass capillary tubing. My experimental setting was based on Light Absorbance Detection.

Methods/Materials
In my experimental setting I used micro-glass capillary tubes for the collection of very small volumes (micro-liters) of different concentrations of solutions and optically measured the amount of light passing through the small tube. I used a small vacuum pump to transfer the measuring solution inside the micro-glass capillary tubing and monitored the concentrations by measuring the amount of visible light being absorbed through the test solution.

Results
I learned that my micro-capillary measuring setup performed close to what I was expecting. As I changed the waters dye color concentration the light absorbance also changed proportionally, which resulted in the light intensity changes measured by the digital voltmeter.
My data supported the hypothesis that the light absorbance increased as the solution concentration also increased. Therefore the differences in light output measurement represents the liquid concentration (colored water concentration).

Conclusions/Discussion
During my experiment I learned that as I changed the water#s dye color concentration (dependent variable) the light absorbance also changed proportionally, which resulted in the light intensity changes measured by the digital voltmeter. For example as I diluted the dye concentration by a factor of 2, the light output intensity also measured 2 times less. This is supported by my data and the findings agree with the descriptions given about the physics of light absorbance provided in science books and other micro-fluidic types of publications. I learned that it was important to center the light output from the optical fiber directly through the center of the micro-capillary tube where the concentrated liquid was flowing which helped to reduce the amount of the background or scattered light in the detector. This resulted in improvements in detection sensitivity.
This study should be repeated using other types of solutions such as soft drinks or orange juice or micro liters of blood (oxygenated) to measure their concentration, which would be useful in standardization and quality control processes in food industry and health clinics.

Summary Statement
I measured small volumes of different concentrattions of samples (dye colored water) using Light Emitting Diode.

Help Received
I recieved help on my science fair project, from my father.