CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J1725

Project Title

The Study of Optical Properties of Artificial Colors

Abstract

Objectives

The objective of this experiment is to find a technique to measure concentration of food coloring in the solution using optical methods.

Methods

I built a compact home-built spectrophotometer that uses a three-colored LED and a photoresistor.I wrote the code for the Arduino board that controls the spectrophotometer. Using this instrument I investigated the light transmission through solutions containing one of the three food colors; Red 40,Blue 1, Carrageenan (green). The light transmission was measured at three wavelengths; red, blue, and green. For each light color, I measured the transmission versus the concentration. From these measurements I found the absorption coefficient for each light color and food coloring.

Results

I found for the given food colors, the absorbent coefficient strongly depends on the wavelength. For example, for the solution that consisted of red food coloring the absorption coefficients for the three lights was 0 for the red light and 353 for the blue and green light. In addition, the absorption coefficient of each light depends on the food color it passed through. For example, the absorption coefficient for the red light was 0 and it increases to 128 and 563 when it passed through the solutions that consisted of green food coloring and blue food coloring respectively.

Conclusions

In conclusion the absorbent coefficients of each food color depends on the wavelength.The absorption depends on the concentration. Therefore concentration can be found by measuring transmission of the light through the solution. This can be used in the real life world by looking at the transmission since each chemical absorbs a set of specific wavelengths and from there you can detect the presence of a certain chemical.

Summary Statement

A home-built spectrophotometer can be used to study the optical properties of artificial colors.

Help Received

I built the spectrophotometer, wrote the code, and preformed the experiment myself. My scientific adviser explained to me concepts of optical absorption and helped me with troubleshooting the code and electrical wiring.