CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34463

Project Title

See the Light! An Inexpensive Cellphone Spectrophotometer for the Classroom

Abstract

Objectives/Goals

We wanted to build a simple and inexpensive cellphone spectrophotometer that would allow us to measure the absorption of visible light through different colored solutions and that would be comparable enough to a commercial instrument to possibly be usable in a school science lab.

Methods/Materials

We use a single LED bulb flashlight as source of visible light. We used food coloring, blue, yellow, red and green at different concentrations in water to create the colored solutions. These were placed in a cuvette directly in front of the LED light. A light spectrum was created by directing the light beam through a grating slide and the resulting image was captured by a cell phone camera in a dark room. The pictures were uploaded onto an image analysis software to calculate the absorbance and transmittance of each solution, using water as reference. We also measure the absorbance of milk, grape, apple and spinach juices. We also passed the same samples through a commercial spectrophotometer.

Results

We found that a solution of a specific color will absorb most of all the other colors of the spectrum but will transmit its own color. The measured wavelength of peaks of absorption for each commercial dye solution showed only a 2 to 5% difference with the values given by the manufacturer. In addition, more concentrated solutions absorbed more of the other colors. The absorbance peaks of these dye solutions as well as the natural solutions measured by the commercial spectrophotometer were in the same wavelength range, with a difference of 30 nm at most.

Conclusions/Discussion

Our spectrometer can help estimate the absorbance of commercial dyes and of colored natural solutions such as plant pigments, or juices, with results comparable to a more expensive commercial instrument. It can also be used to compare concentrations. It is portable, doesn#t require any expensive materials, and could be used in a science classroom to teach student about light and some of its properties such as absorbance and transmittance.

Summary Statement

Estimate the absorbance of colored solutions with a simple, inexpensive spectrophotometer.

Help Received

Mom gave access to lab spectrophotometer at Sanford Burnham Medical Research Institute