open-spectrophotometer

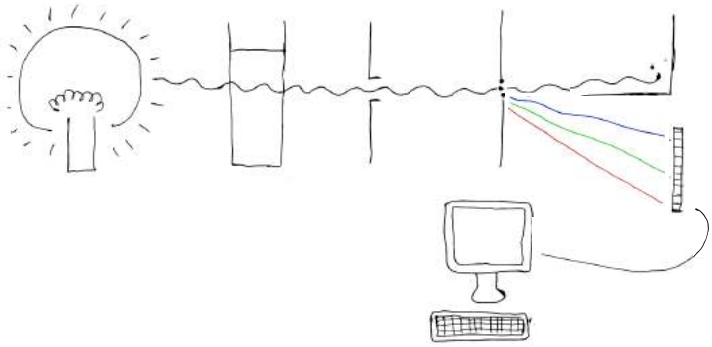
Florian, Océane and Luc Patiny, Michaël Zasso

HOW ?

Open hardware, open software

https://github.com/open-spectro

Principle



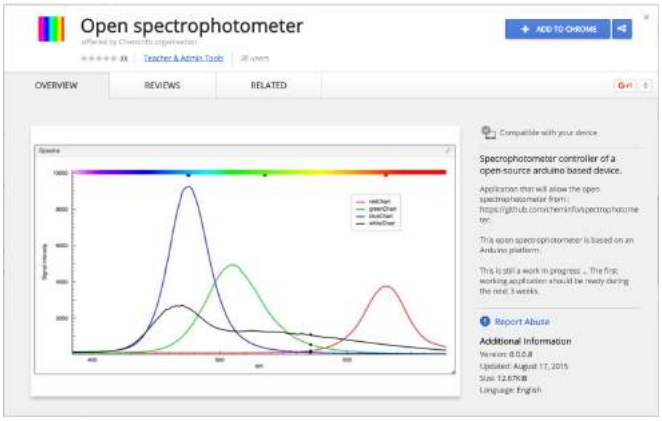
The light produced by white LEDs goes through a sample, is selected by 2 slits and diffracted by a grating film. The diffracted light is analysed by a photodiode array that is connected to the computer.

Hardware

Compact PCB are designed to use the same micro controller as the Arduino™ Leonardo and is fully compatible with the Arduino™ IDE. This makes it very easy to program.
Communication with the spectrophotometer is done using USB virtual serial port allowing simple control from any program.

3D printed box with a precision of 0.1 mm allows precise installation of the electronic and grating film.

Software



A chrome application allows to control directly the spectrophotometer from the computer in order to calibrate, acquire and process the data.

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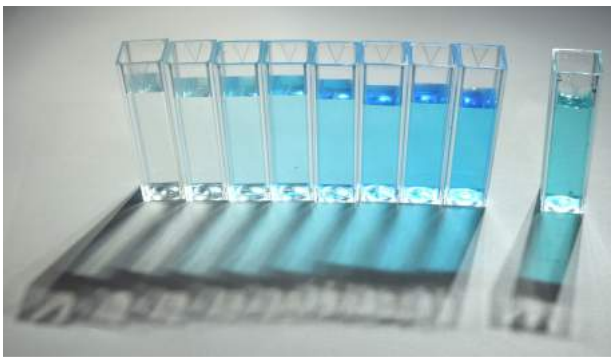
WHAT FOR ?

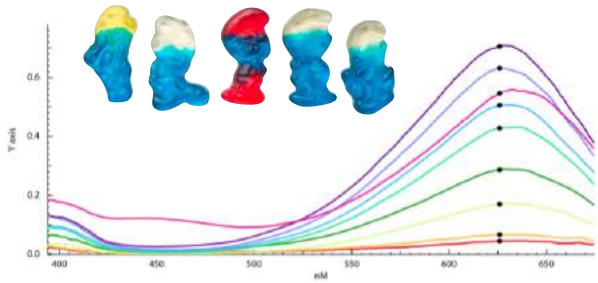
Simple design to understand how a spectrophotometer works, but precise enough to make real experiments. Very cheap and accessible to everyone.

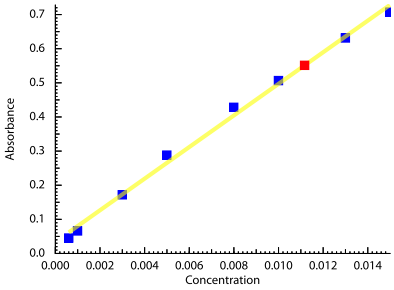
Determination of pigments concentration

Blue patent V is the pigment that is present in Haribo smurfs sweets. Using a calibration curve with the pure pigment it is possible to determine the amount of colorant present in the sweets.



Left: reference solutions. Right: Haribo





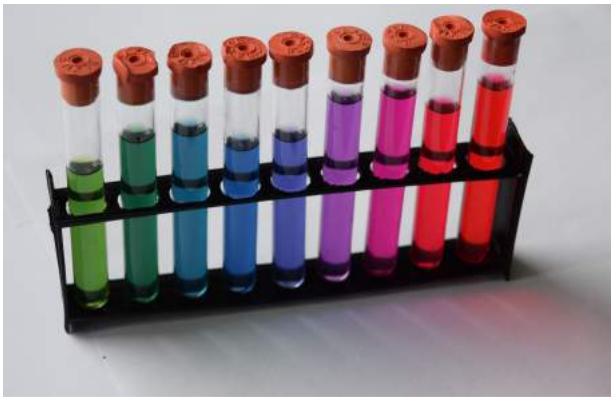
Linear regression

Slope: 46.12
Intercept: 0.03
R: 0.9973
R^2: 0.9946

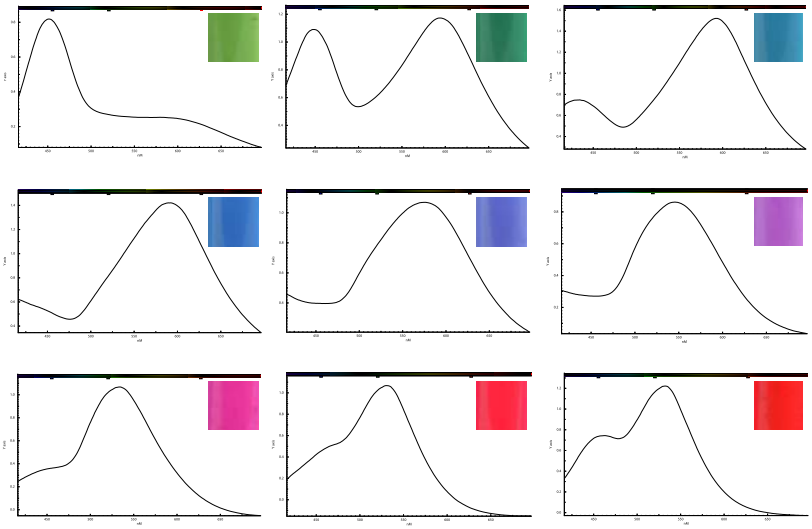
Calibration curve. In red the unknown.

Determination of pH using red cabbage

Chopped red cabbage was cooked in boiling water for 10 minutes to yield after filtration to a dark purple liquid.
The liquid was diluted by a factor 3 with water and either tartaric acid or sodium carbonate where added in various quantities to obtain a large color palette.



Red: acid, green: basic



Absorbance spectra of the 9 solutions