Development and Evaluation of a Portable Spectrophotometer.

Cândido, J.P.; Macedo, A.P.P ; Galembeck. E.

Depto.de Bioquímica e Biologia Tecidual, IB-UNICAMP, SP, Brasil.

INTRODUCTION: Colorimetric methods, such as proteins and glucose quantification, and enzymatic assays are widely performed in biochemical laboratories employing spectrophotometer equipment. Even being present in most of the labs that serve undergraduate students, low cost and portable spectrophotometers can be a valuable tool in high schools and for field studies. **OBJECTIVES:** We have assembled and evaluated a portable spectrophotometer, inspired in some open projects freely available on the Internet. **MATERIALS AND METHODS:** The system was built using an RGB LED as a light source and a light detector (TSL2561). These components were placed into the ends of a cuvette holder, which was designed in FREECAD software and fabricated in a 3D printer. The data collection system was developed using an Arduino UNO microcontroller, an LCD to show the absorbance, a micro SD card to store the results, and a push button to select the LED emitted light wavelength. All components were powered by battery bank of 2000mAh. The software was written in C++, and we used Arduino IDE 1.8.6. For the equipment evaluation, we ran protein (Bradford) and glucose (Somogyi-Nelson) essays comparing the results obtained from the developed equipment with the one used in our didactic lab (Biospectro SP-22). **DISCUSSION AND RESULTS:** The results obtained comparing both pieces of equipment shows a correlation coefficient of 0.99 for the both methods (Bradford and Somogyi-Nelson) in test-retest. The commercial equipment demonstrated the coefficient of variation higher than 10%, while developed spectrophotometer showed values lower than 5%. The power bank was able to supply energy to the equipment up to 12 hours. **CONCLUSION:** These results demonstrated high reliability for the data collected from the developed spectrophotometer. Besides the low cost, compact design and high battery autonomy. The developed equipment has presented as a valuable alternative for field experiments and in-class practices of biochemistry.

Keywords: Spectrophotometer, Arduino, colorimetric analysis.

Supported by: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001, and FAPESP proc. # 2014/50906-9.