SABI2020

22 CONGRESO DE BIOINGENIERÍA
II JORNADA DE INGENIERÍA CLÍNICA

4 al 6 de marzo de 2020
Argentino Hotel
Rambla de los Argentinos
20.200 Piriápolis, URUGUAY
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# “Design and construction of Polarimeter Prototype for the determination of the concentration of optically active substances in solution”

Friedli Florencia*, Mercado Eugenia P.*,
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***Abstract*—This work consists in the design and development of a low cost automatic polarimeter for laboratory use, able to determinate the optical rotation produced by a translucent solution of sucrose at different concentrations.**

## I. INTRODUCTION

Optical activity is a characteristic of some substances that are able to generate rotation in the plane of polarized light. The study of the light rotation produced by these compounds is called polarimetry. The Polarimeter is the instrumental method used to study this physical property. The polarimeter can determinate the rotation of the polarized axis of light when it passes through optically active substances.

All polarimeters include the following components: a monochromatic light source, a light polarizer, a sample tube and a light analyser.

## II. METHODS

The equipment design was diagrammed in modular blocks, to allow futures improvements. The prototype has the following electronical phases: light sourcing, measurement, signal conditioning, safety block to protect the user from laser exposure, user interface and a temperature measurement stage. All these components are commanded by an ATmega 328P microcontroller.

The cabinet was designed taking in consideration the functional requirements of the equipment. The design had to be compatible with extrusion manufacturing. The cabinet works as housing and supporting for all the internal components and warrants the alignment of the measuring axis. It also allows the user safety system implementation and satisfies the optical and hermetic requirements.

*Figure 1: Polarimeter prototype.*

A 532nm green laser, pulsed at 490Hz is used as the polarized light source. The light passes through the sample and is sensed by a LDR photocell, associated to an analogue signal conditioning system. At this stage the signal is amplified, filtrated by a band-pass filter centred in 490Hz, rectified and finally modulated by a peak detector. The result is a noise reduced continuous signal abled to be read and processed by the microcontroller.

The prototype software controls the entire measurement process and analyses the data obtained from the analyte. The results of the angle rotation, concentration and temperature of the substance is the final information presented to the user.

The software design is based on a synchronous sequential system, being the system an electronic circuit of bistable type, where the outputs of the system depend on the current inputs as well as the whole previous sequence. To obtain the angular rotation produced by the analyte (α) the software controls the angular movement of the mechanical parts and measures degree by degree the intensity of light passing through the sample, thus determining the maximum intensity of light by the results obtained. The maximum intensity in association to the angular position of the servomotor is saved as the α angle. The following formula was used to calculate the concentration:

$$[\square]^{\beta}_{T} = \frac{\alpha}{S.c} \quad (1)$$

## III. RESULTS

This is the exhibit of the results obtained at present work and the contrast with the analytical method. A stock solution of sucrose [0.25 g/ml] and calculated dilutions of increasing concentrations were prepared for this purpose. They were used to calculate the theoretical values corresponding to degrees of rotation and concentrations that should be obtained with the prototype, obtaining the following results (Fig. 2).


*Figure 2: Contrast of average sensed values with analytical calculated values.*

## IV. DISCUSION AND CONCLUSSIONS

Considering the results obtained, the following concussions can be made. The use of an alternative coloured 532nm light source was found to be valid for the polarimetry technique. The equipment is able to distinguish variations in the concentration of the analyte in solution, this can be seen in the changes of the angles obtained for each solution. At the same time, there is a greater linearity in the results obtained for solutions over 0.125 g/ml. The operating range for this prototype is between 0.125g/ml and 0.25 g/ml. Above these values the equipment is off range due to the degree of rotation of these concentrations is higher than 360°.

## V. REFERENCES

[1] Determinación de la Rotación Óptica,» [On line]. Available: http://www.loa.org.ar/leg/DE-202-2003-PEN_archivos/170.htm. [Last access: February 2018]

[2] CdFFdFyB, UBA, Apuntes de Polarimetría. Módulo 4. Versión0.0,» [On line]. Available:http://virtual.ffyb.uba.ar/mod/resource/view.php?id=4128.[ Last access: February 2018].

[3] X. U. o. Luisiana, «Sugar Identification using Polarimetry». [On line]. Available:http://www.xula.edu/chemistry/documents/orgleclab/StereoPolar.pdf.[ Last access: February 2018]

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