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PO-60**design and development of a simple and innovative optical detection sensor for acetic acid (#792)**

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Design and development of a simple and innovative Optical detection sensor for acetic acid

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Keywords: sensor, acetic acid, optical material, detection, coordination compounds.

1. Introduction

Optical materials is an essential science and a key innovation that affects our everyday lives. It is vital to numerous regions of the as healthcare, energy production and environmental monitoring.[1] For example, optical materials are contributing in the Low-Cost sensors developing for the detection of specific pollutants or adulterant materials, which is the case of our studies. In an important part of our work in the design of new optical materials for substances detection, we focus on the developing of a new method for detecting acetic acid using coordination compounds with metals that has many advantages over existing techniques. Acetic acid is a common substance and an atmospheric pollutant, and its accumulation can be a health problem, and may even cause damages on some elements as art works. For this reason, its detection and quantification is very important. The main advantages of the method we are developing, are that; it is simple innovative, low coast and specializes only in acetic acid detection.



2. Figures and tables

The sensor we are developing consist of four different parts:

- 1-An aluminum-heating base.
- 2- Power supply
- 3-TCS34725 RGB sensor.
- 4-Arduino Uno with a Data Logger Shield.
- 5-Interface I2C 16x2 LCD.

1- RGB values of normal papers:

We use normal papers with different colors to test RGB values in those papers. Then we compare it with theoretical RGB values of the same colors[2],[3][4]

color	Paper used	Theoretical RGB values			Sensor measured RGB values		
Red		R:167.53	/G:53	/B:28	R:167.48	G:47.85:	B:44.07
Blue		R:44.63	G:95.62	B:108.37	R:46.59	G:96.03	B:109.80






Orange		R:153.55	G:61.82	B:38.64	R:157.32	G:59.00	B:39.20
Green		R:76	G:120	B: 86	R:78.19	G:98.21	B:69.43
Yellow		R:98.04	G:85.88	B: 43.53	R:97.06	G:99.35	B:49.59
Black		R:93	G:89	B: 81	R:107.72	G:81.34	B:65.95
white		R:83.92	G:94.38	B:74.24	R:81.42	G:88.98	B:76.42

Table01: comparison of theoretical and experimental RGB values of different colored papers

2- RGB values after the material/Acetic Acid reaction

-Preparation of solvent/acid solution, 10% acetic acid and 90% of Dichloromethane

-The dye, which is the material that contain coordination compounds with metal, was placed in the oven for 20 min at 90°.Material cooling for few minutes, and the RGB reference value of the material was measured using the sensor (figure 01).

RGB of the yellow dye: R=117.23 /G=83.39 /B=54.38 .

-To the dye placed on a small plat, two droplets of the solution (10%acid/solvent) was added.

Result: After 6 minutes of the contact, we noticed an obvious color change from Yellow to orange (figure 02). We measured again the RGB value of the material after the reaction.

RGB of the orange dye: R=123.86 /G=75.77 /B=56.83



Figure 01: measurement of reference value

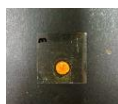


Figure 02: result of the liquid acetic acid / dye reaction

-30 ppm of the acetic acid (98.90%) in a small tube was placed inside a covered glass container during 1h so that the acetic acid evaporated (turned to gas). the dye is dried for 20 minutes in an oven of 90c°,aftercooling we use the spectrophotometre and our device to have reference values of wavelength and RGB value for the dye sample.

Wavelength: 847.68 nm

RGB value: R=115.38 /G=83.08 B= 54.23

We place the dye simple inside the container and we ensure that it is well closed.Figure3 After 2days, we notice a clear change in in the color of the dye sample placed inside glass, from yellow to orange (figure 4). To confirm the variation we use the same first method, both the spectrophotometer and our device to check the variation of the wavelength and the RGB values .



Figure 03: isolated system of the gas Acetic acid /dye experiment

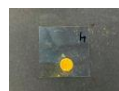


Figure 04 result of the gas/Acetic acid/dye experiment

Wavelength :869.47 nm

RGB value: R=127.73 /G=77.61 B= 54.05

3.Conclusions We noticed that values given by the device we are developing, and those given by spectrophotometer, are compatible. Thing that proves the efficiency of the sensor.

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