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## Absorbance Measurement by Colorimeter

Ms Zaveri Juhi Mukesh, Mrs.A.A.Shinde

Dept of Electronics  
B.V.D.U.C.O.E Pune, India

*Abstract-Within the past few years a number of different designs of photoelectric calorimeters have been described in the literature. This paper addresses the absorbance measurement of visible light through different sample solutions at different range of wavelengths by using different colour filter and finally the results have been compared with the absorbance values obtained by a digital colorimeter.*

**Keywords:** LED, LDR, colorimeter, absorbance, filter, wavelength.

### I. INTRODUCTION

Colorimeter is also known as filter photometer. In scientific fields the word generally refers to the device that measures the absorbance of particular wavelengths of light by a specific solution. Changeable color filters are used in the colorimeter to select the wavelength of light which the solute absorbs the most, in order to maximize accuracy. The usual wavelength range is from 400 to 700 nanometers (nm). If it is necessary to operate in the ultraviolet range (below 400 nm) then some modifications to the colorimeter are needed. In modern colorimeters the filament lamp and filters may be replaced by several light-emitting diodes of different colors.

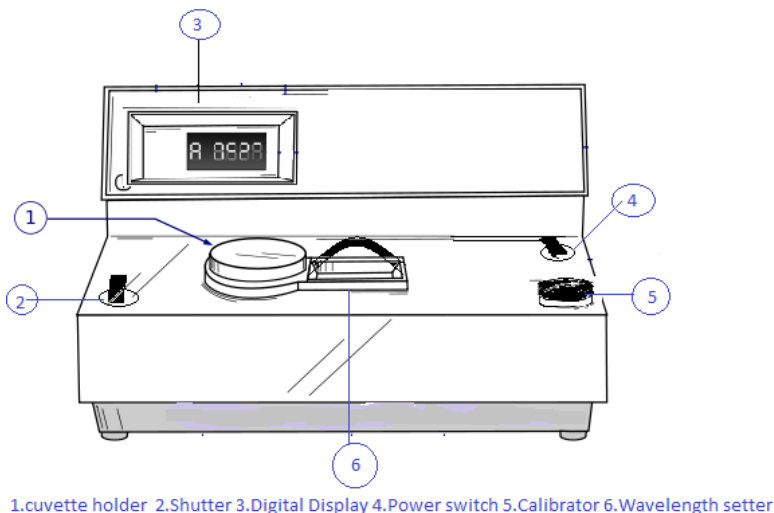


Fig1.Schematic of a digital colorimeter

### II. ABSORPTION MEASUREMENT BY COLORIMETER

In the present work the absorption of Visible light passing through different Sample solutions is measured by using a Bright LED as the transmitter and an LDR at the receiver end. LDR is an acronym for light dependent resistor whose resistance is dependent on light. Different dilute solutions such as Hydrochloric Acid, Sodium Hydroxide, Calcium Chloride, Sodium Nitrate, Ferric Chloride and Sulphuric Acid are mixed with 2% of universal indicator and tested. A small tube of square cross section, sealed at one end, made of quartz called a cuvette has been designed to hold samples for experiments.

The experimental setup comprises of Bright LED at transmitter end, an LDR at receiver and a quartz cuvette for the sample solutions and color filters. In a manual colorimeter the cuvettes are inserted and removed by hand.

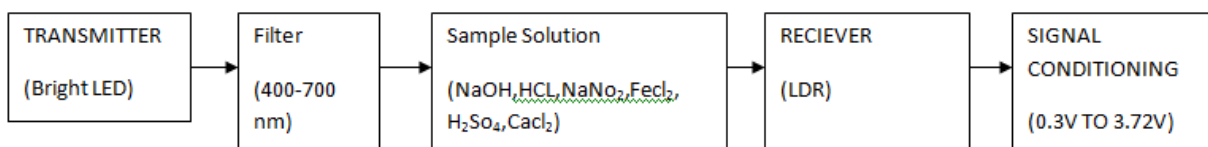


Fig2.Block Diagram of Experimental setup

First, the intensity of light( $I_0$ ) passing through a blank is measured. Blank is a solution that does not contain the solute that absorbs light, here Distilled Water has been used as blank solution. Second, the intensity of light ( $I$ ) passing through sample solution is measured at different wavelengths. Here colour filters has been considered i.e. Blue(492-455),Green(492-577),Yellow(577-597) and Red(622-700) for measuring intensity of light at four different range of wavelengths. Finally the experimental data is used to calculate the Absorbance (A).

$$A = -\log(I/I_0)$$

This calculated absorbance has then been compared with the absorbance value obtained through Digital Colorimeter Model no 12.

### III. EXPERIMENTAL RESULTS

#### A. TABLES

Sodium Hydroxide(NaOH)		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.49	0.40
Green	0.54	0.45
Yellow	0.32	0.22
Red	0.12	0.33

Table I . Absorbance value for sodium hydroxide

Hydrochloric acid(HCL)		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.13	0.22
Green	0.18	0.18
Yellow	0.03	0.06
Red	-0.01	0.15

Table II . Absorbance value for Hydrochloric acid

Sodium Nitrate(NaNO <sub>2</sub> )		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.22	0.28
Green	0.23	0.27
Yellow	0.18	0.17
Red	0.07	0.33

Table III . Absorbance value for Sodium Nitrate

Ferric Chloride(FeCl <sub>2</sub> )		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.25	0.32
Green	0.27	0.28
Yellow	0.15	0.12
Red	0.05	0.24

Table IV . Absorbance value for Ferric Chloride

Sulphuric Acid(H <sub>2</sub> SO <sub>4</sub> )		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.09	0.25
Green	0.14	0.19
Yellow	0.05	0.09
Red	0.00	0.18

Table V. Absorbance value for Sulphuric Acid

Calcium Chloride (CaCl <sub>2</sub> )		
Filter	Absorbance value of Colorimeter	Calculated Absorbance[A=-log(I/I <sub>0</sub> )]
Blue	0.14	0.23
Green	0.13	0.20
Yellow	0.11	0.12
Red	0.05	0.245

Table V I .Absorbance value for Calcium Chloride

B. GRAPHS

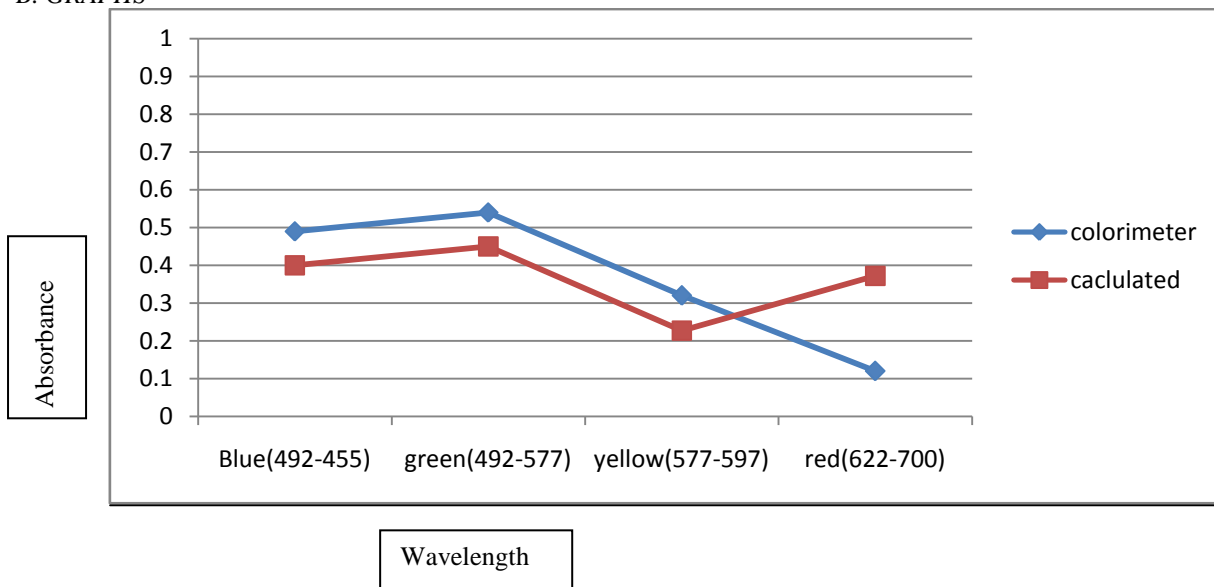


Fig 3. Compared absorbance value for sodium Hydroxide

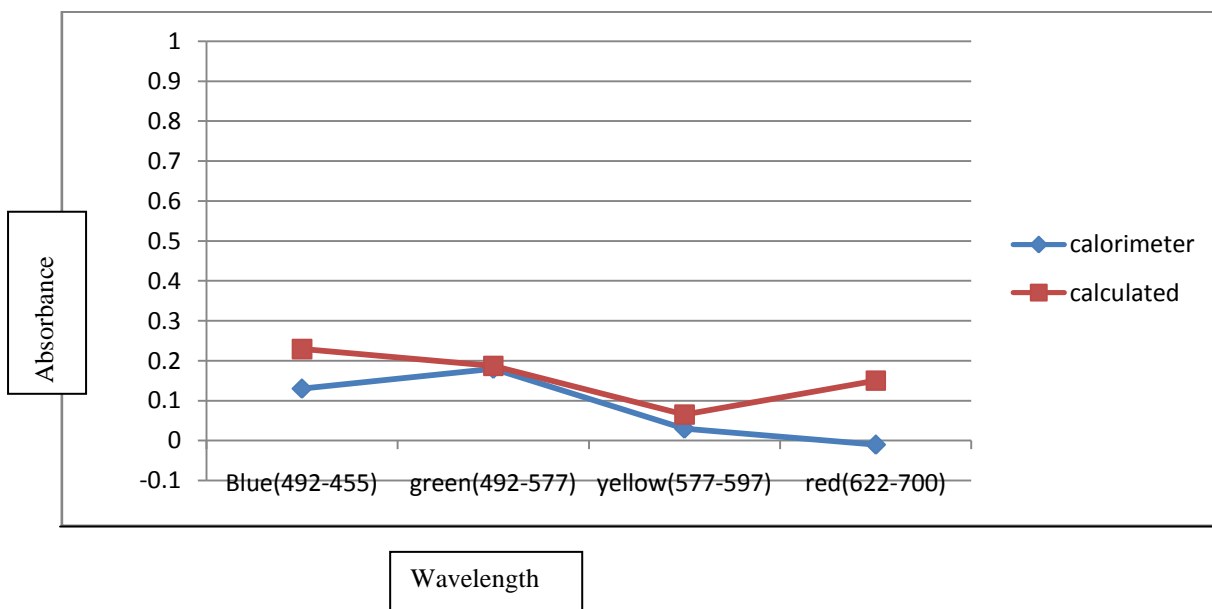


Fig 4. Compared absorbance value for Hydrochloric Acid

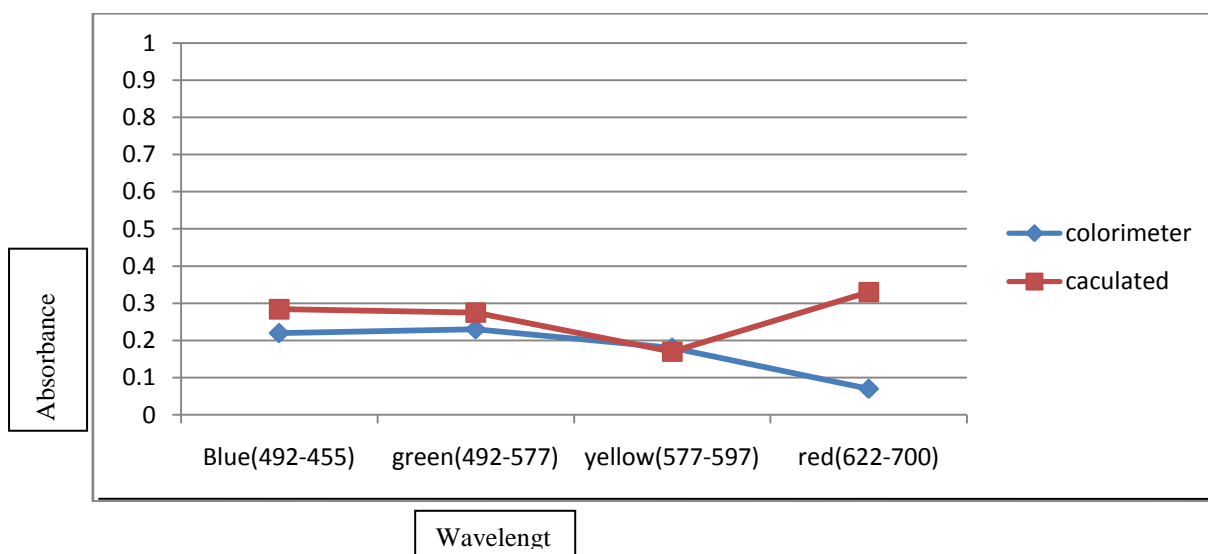


Fig 5. Compared absorbance value for sodium Nitrate

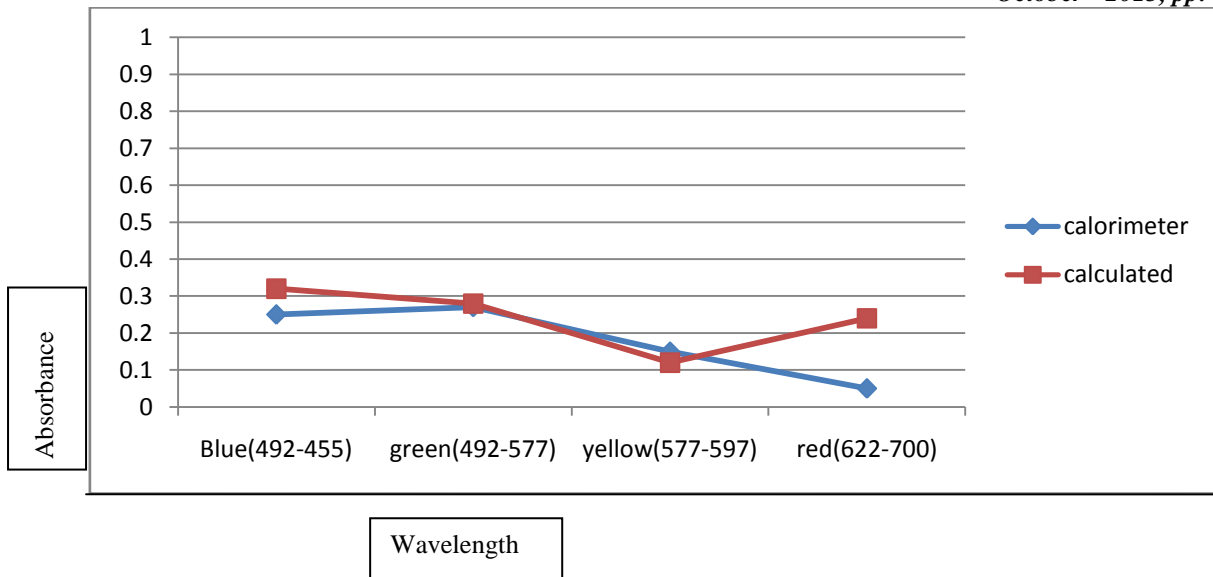


Fig 6 .Compared absorbance value for Ferric Chloride

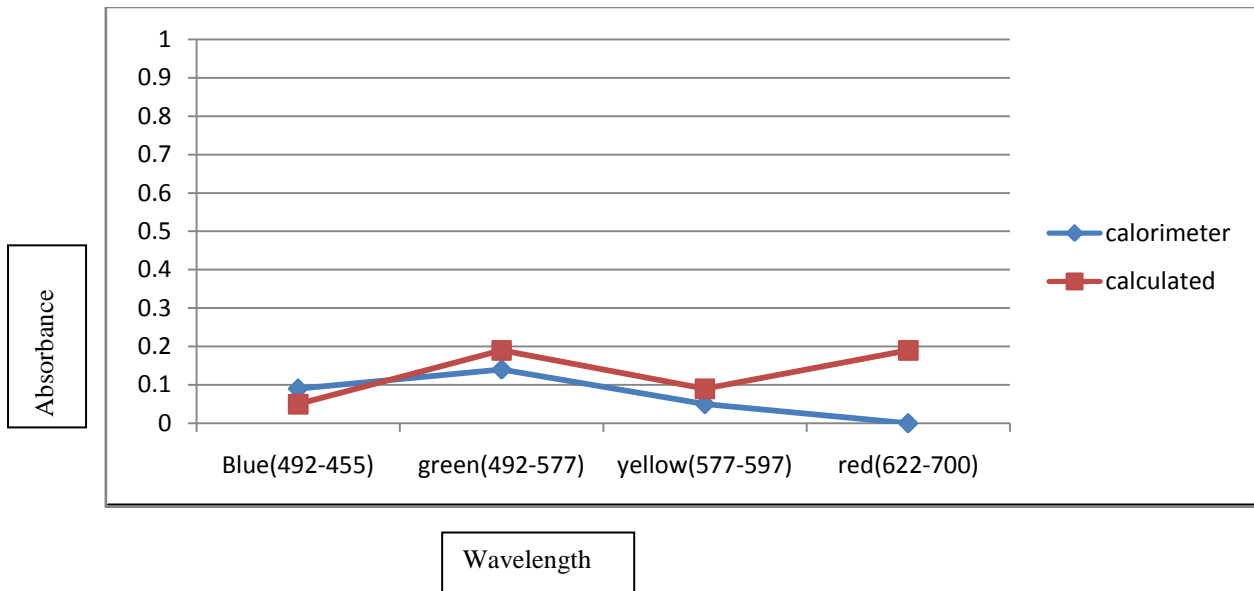


Fig 7. Compared absorbance value for Sulphuric acid

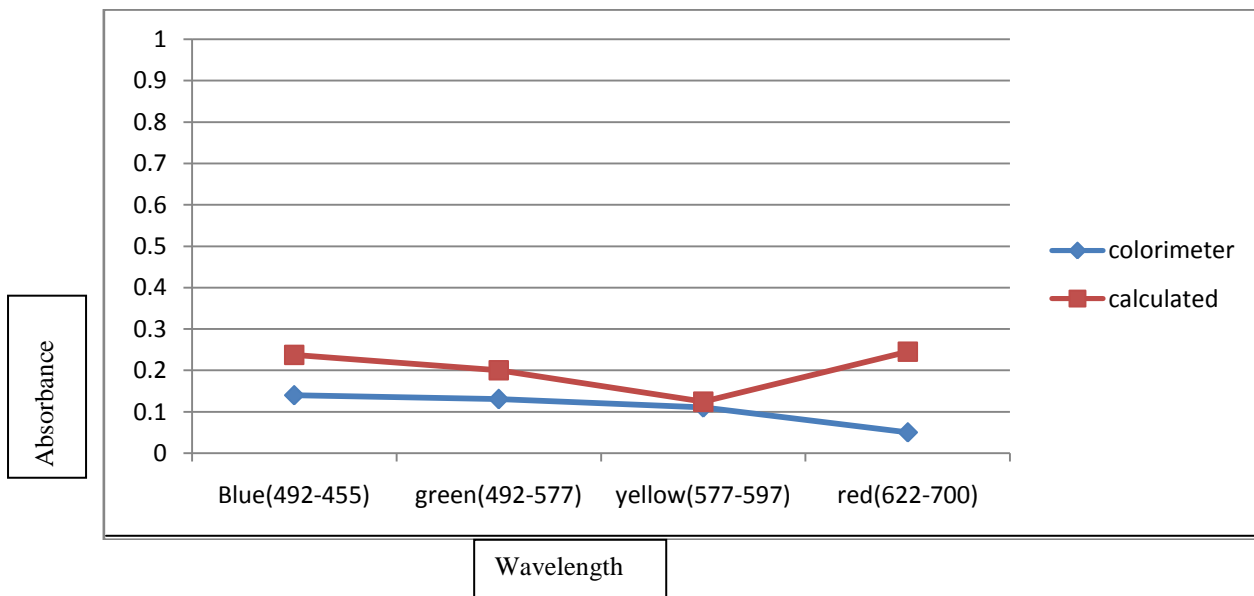


Fig 8. Compared absorbance value for Calcium Chloride

#### **IV. CONCLUSION**

The goal of the project was to measure the absorbance of different sample solutions at different wavelengths. The details of a simplified colorimeter has been presented. Here the absorbance values for different dilute solution mixed with 2% of indicator has been taken on digital colorimeter Model No 12 and experimental setup has been compared and found to be similar.

#### **REFERENCES**

- [1] G.MACKINNEY "Absorption of light by Chlorophyll Solutions", University of California ,Berkley, March 13 , 2006
- [2] "Colour." Encyclopædia Britannica. Encyclopedia Britannica Online. Encyclopædia Britannica Inc., 2011. Web . 17 Nov. 2011.
- [3] Mandeep Singh "Introduction to Biomedical Instrumentation" Volume III
- [4] "Colorimetry" Encyclopædia Britannica. Encyclopedia Britannica Online. Encyclopædia Britannica Inc., 2011. Web . 17 Nov. 2011.
- [5] Istvan T.Rada, Marta Deri "The Colorimeter".