WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 3, 1661-1670. Research Article ISSN 2277– 7105

# STUDIES ON SIMILLARITIES IN CHEMICAL STRUCTURE OF CHLOROPHYLL AND HÆME

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Article Received on
17 Jan. 2017,

Revised on 07 Feb. 2017,
Accepted on 27 Feb. 2017

DOI: 10.20959/wjpr20173-8081

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## ABSTRACT

Spectrophotometry is the oldest physical method for quantitative analysis and structural determination. Chlorophyll and Hæme are most important molecules in the plants and human life respectively and plays major role in carrying $CO_2$ and Oxygen which is vital for their survival. Chlorophylls a, b, c and d are the principal pigments in photosynthesis, it absorbs the light energy from sun and convert in to the chemical energy. Hemoglobin is the most important molecule in human body which carriers Oxygen from the lungs to the other tissues and cells of the body. Hemoglobin produces from the Hæme containing Fe (Iron) as a central atom and Chlorophyll containing Mg (Magnesium) as a central atom, the remaining structure is identical. Present work shows the study of both Chlorophyll and Hæme Spectrophotometrically. Therefore, it is advantageous to study the similarities between chlorophyll and Heme Spectrophotometrically.

**KEYWORDS:** Chlorophyll, Hæme, Spectrophotometer, Hemoglobin, photosynthesis.

## INTRODUCTION

The structures of Hæme and Chlorophyll are very similar. The most common group of molecule in Chlorophylls and Hemoglobin is porphyrin ring. The most apparent difference between them is that in hemoglobin the iron (Fe) is combining with four (04) pyrrole rings, while porphyrin ring and by combining four (04) pyrrole around magnesium (Mg). The Spectral analysis of chlorophyll, Hæme and Pyrrole shows the possibilities of changing chlorophyll to Hæme and further to Hemoglobin in the human body by enzymic reaction is very much possible. In 1936, Dr. Arthur Patek found that when Chlorophyll and iron (Fe)

given together, the number of blood cell and level of hemoglobin increased faster than with iron (Fe) alone. Chlorophylls are the substances which makes plant green while Hæme makes the red blood cell. Chlorophylls molecule has the unique property to convert the Sun energy in to chemical energy through photosynthesis which the plant use to make carbohydrates from carbon dioxide and water. Hemoglobin has the property to carry the Oxygen for lungs and other part of the human body for their life. Forty-six (46) elements reported from blood.[1] Many of the essential and trace inorganic elements in blood are also found in the food and herbal product containing high percentage of chlorophyll[2]. The spectral studies of chlorophyll and Hæme are not limited to appearance and function but suggestive of possible interchange through enzymatic reactions.

**Uses of Chlorophyll**

Chlorophylls are used as a color in color soaps, Oils, Fats, Waxes, confectionary, preservers, Liquors, Cosmetics, Perfumes. Source of phytol. For dyeing leather. As sensitizer for color films, has been used as antiknock agent in gasoline; as accelerator in the vulcanizing of rubber; in deodorizer.

**THERAP CAT**: Deodorant.

**THERAP CAT (VET):** has been used orally to reduce odor, and topically to promote healing of skin lesions.

## MATERIAL AND METHODS

**Chemicals**

1] Acetone (Analytical Grade)

2] Distilled water

3] Pyrrole (Spectrochem Pvt. Ltd. Mumbai, Minimum purity(GC) 99%, BP- 128-134, Density-$d_4^{29}$- 0.965-0.975) (PY)

4] Hydrochloric Acid AR Grade, Loba**.**

**Materials**

1] Human Blood (BLD)

2] Fresh Green leaf (GF)

2] Green leaf powder (GP)

**Experimental Design**

**Method for Spectrophotometry**

**Sample GF**

Two- Three fresh leaf of Almond tree collected from the Garden and washed with water after 2/ 3 washing with water they are crushed in mortar and pestle and extract was diluted with acetone. It is represented by code GF.

**Sample GP**

Two- three fresh leaf of Almond tree was collected and it was dried for Ninety-six hour in sunlight, then it was crushed in mixer and grinder to prepared the powder it was sieving from the clean and white cloth and packed in zip pouch till the sample preparation. This powder was used for the preparation of sample in 80% acetone it was denoted by GP.

**Figure 01- Almond Tree leaf**

**Instrumental Configuration**

Spectrophotometer UV-1800, Shimadzu model was set up for the analysis spectra is observed at 200 to 1000 nm.

**RESULT AND DISCUSSION**

Hemoglobin is the red blood pigment found in erythrocytes. Normal level of hemoglobin in Male is 14 to16 g/dl in female is 13 to 15 g/dl. Hemoglobin is a conjugated protein containing Globin- the apoprotein part and Hæme - the non- protein part (prosthetic group). Spectrophotometric studies of chlorophyll carried out and compared with the pyrrole standard. Spectrophotometric study shows that pyrrole from herbal medicines may be

contributing to formation of Hæme ⟶ Haematine ⟶ Haemoglobin. Personal observations shows that the hemoglobin level of the patient on long term Herbal therapy is getting improved by its measurement of hemoglobin level.

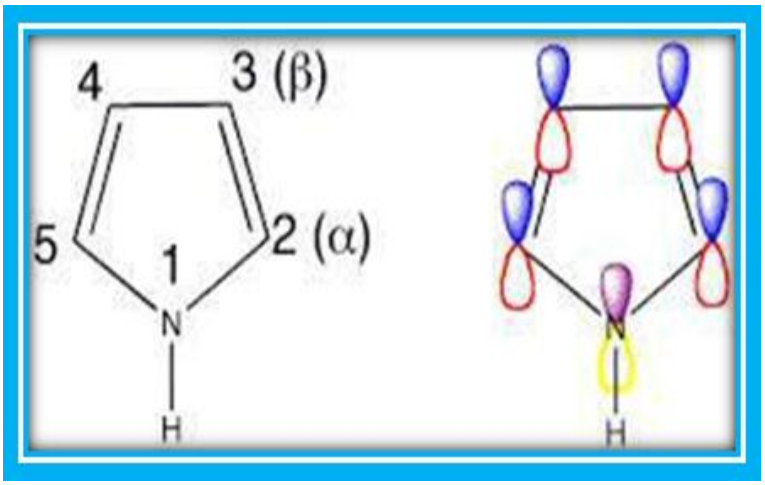


**Fig-02. Pyrrole Structure**

Pyrrole + Fe ⟶ Hæme ⟶ Haematine ⟶ Haemoglobin

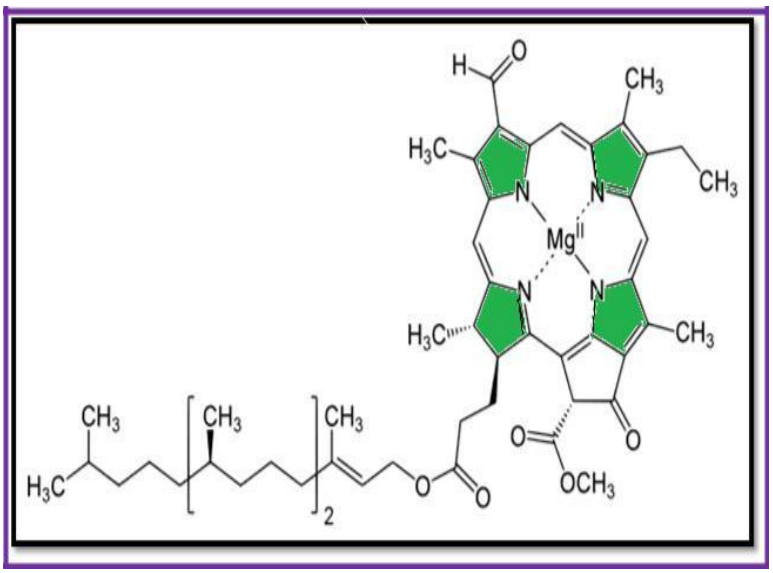


***Figure 03- Chlorophyll Structure***

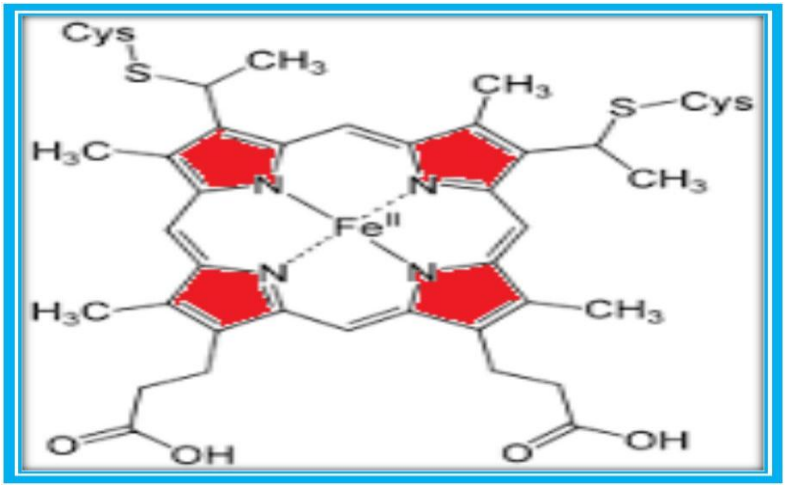


***Figure 04*- Hæme *Structure***

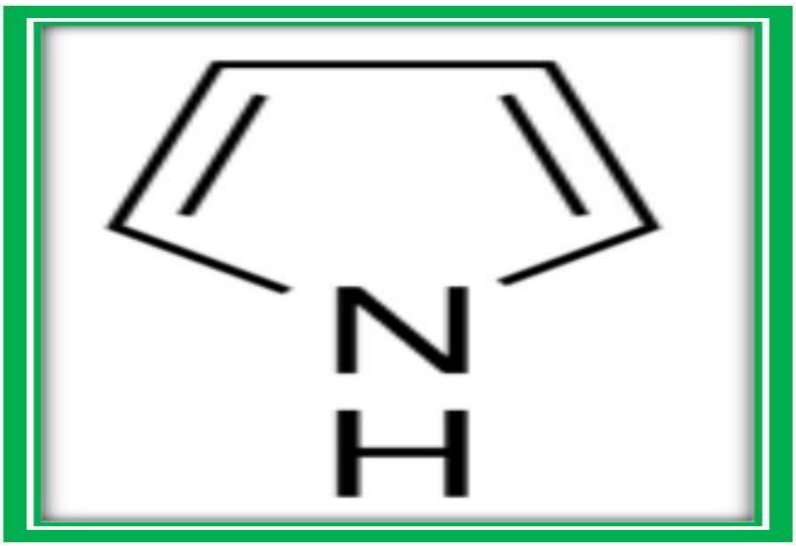


**Fig 05- Pyrrole Structure**

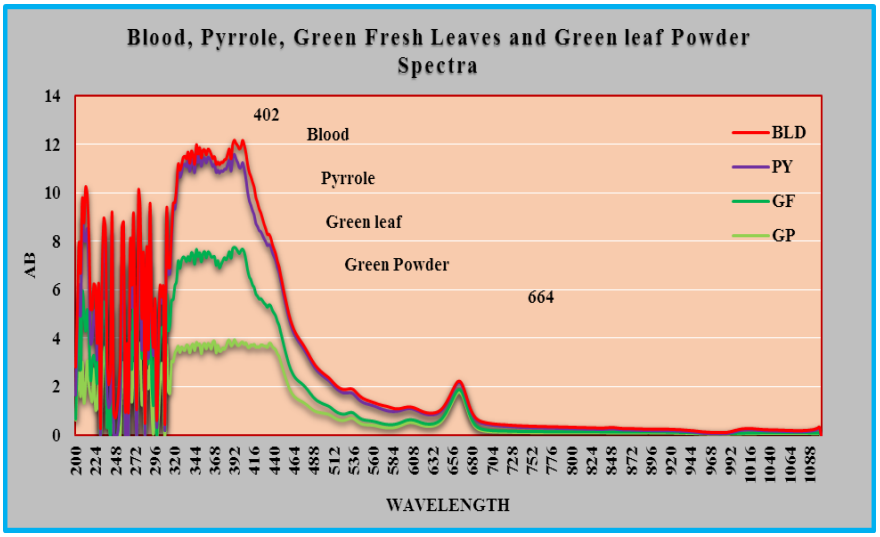


**Figure 06- Spectra diagram for Samples.**

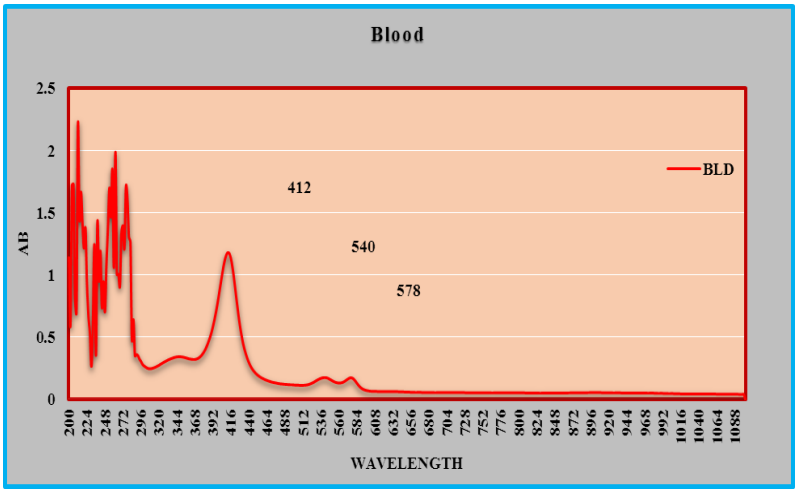


**Figure – 07. Spectra for Blood.**

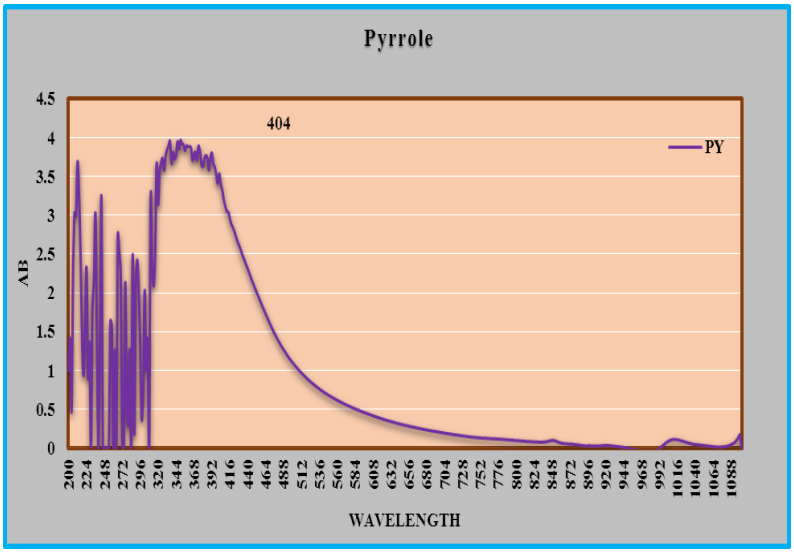


**Figure -08. Spectra for Pyrrole.**

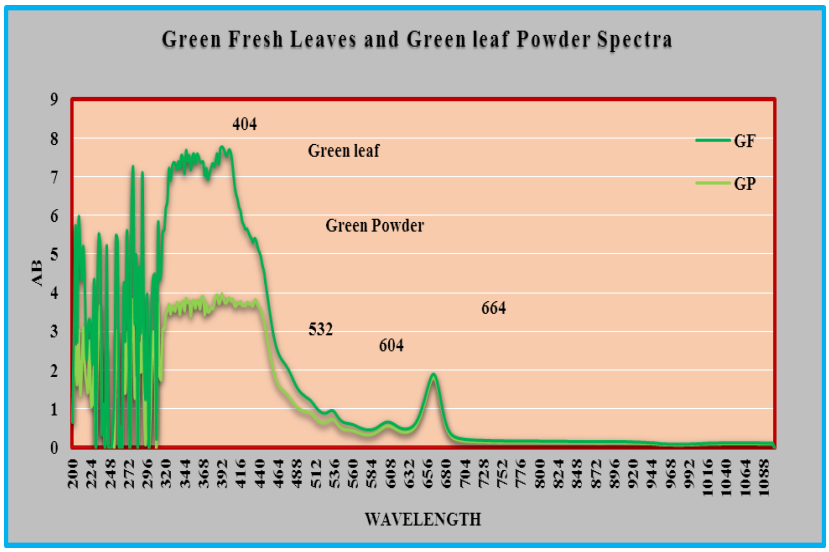


**Figure -09 Spectra for Green leaf and Green leaf powder.**

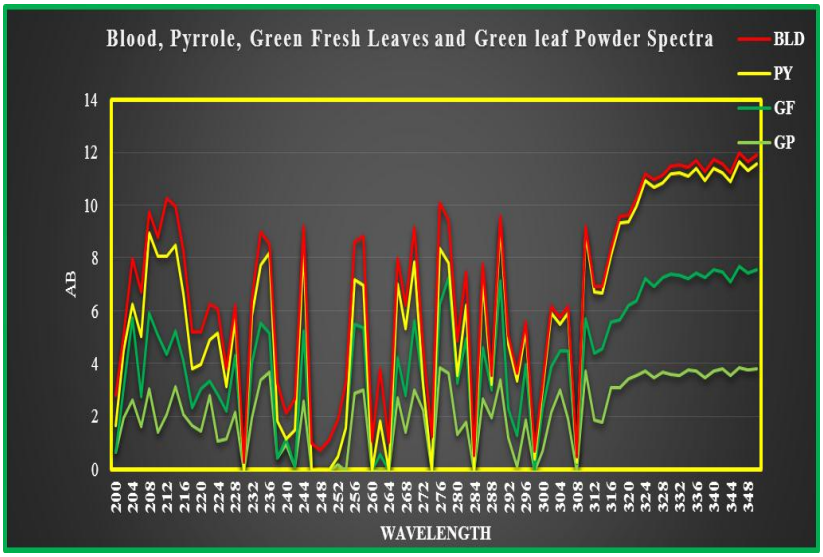


**Figure- 10. Spectra for all sample UV range enlarged**

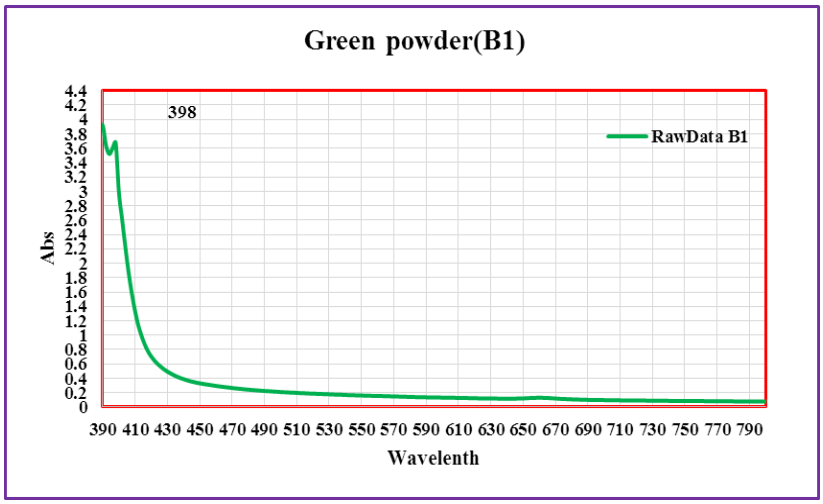


**Figure -11. Spectra for Green powder**

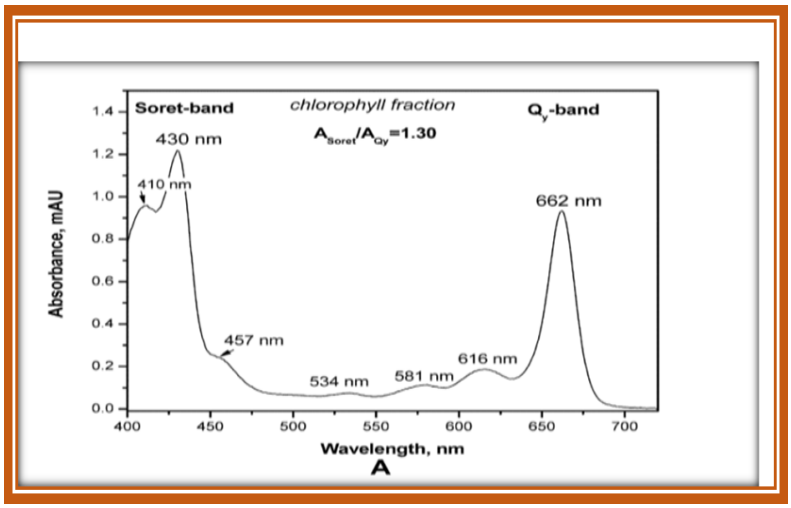


**Figure 12- Chlorophyll spectra[3]**

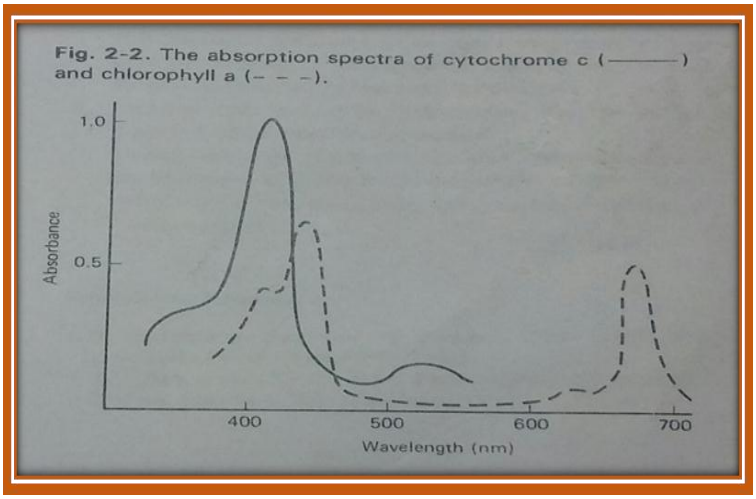


**Figure 13- The absorption spectra for Chlorophyll a (dotted line)[4]**

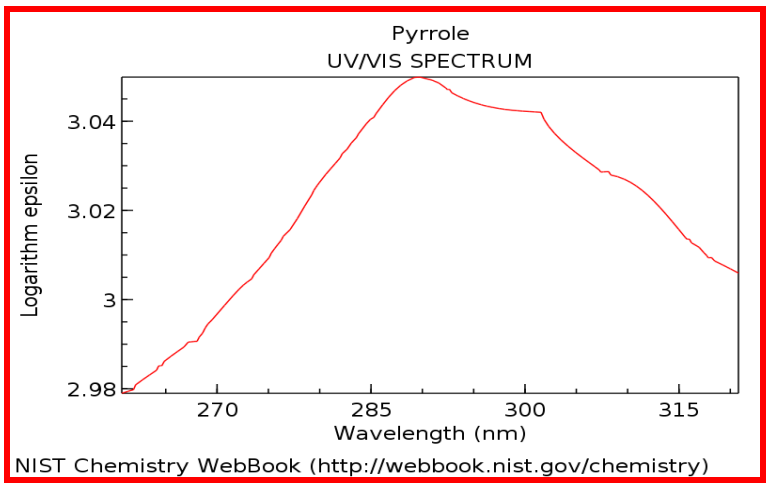


**Figure 14- Pyrrole spectra[5]**

**Table No-01. Wavelength of sample Observed**

| Sr. No | Wavelength | | |
|---|---|---|---|
| | Blood (BLD) | Chlorophyll (GF &GP) | Pyrrole (PY) |
| 1 | 414 | 404 | 404 |
| 2 | 548 | 534 | |
| 3 | 578 | 604 | |
| 4 | | 664 | |

**Table 02-Wavelength reported for Chlorophylls[6]**

| Sr. No | Chlorophylls Wavelength (Merck Index) | | | | Hæme |
|---|---|---|---|---|---|
| | a | B | c | d | |
| 1 | 660 | 642 | 628 | 686 | 550 |
| 2 | 613 | 593 | 580 | 445 | 557 |
| 3 | 577 | 565 | 442 | | |
| 4 | 531 | 545 | | | |
| 5 | 498 | 453 | | | |

| | | | | | |
|---|---|---|---|---|---|
| **6** | **429** | **427** | | | |
| **7** | **409** | | | | |

From above graphical representation it shows that the Blood (BLD) sample spectra was observed at 414 nm, 548 nm and 578 nm, for Chlorophyll the green powder (GF & GP) spectra was observed at 404 nm, 534 nm, 604 nm and 664 nm and for Pyrrole (PY) spectra observed at 404nm. These observed values are compared with the standard values reported in Merck index and by using Pyrrole as a standard.

## CONCLUSION

The observed spectra from Blood (BLD), Chlorophyll (GF & GP) and Pyrrole (PY) Samples from experimental data and the reported wavelength values of Chlorophylls a, b, c and d and the reported wavelength for Chlorophylls, Hæme, Pyrrole indicates that the Chlorophylls may be involving in the formation of Hæme $\longrightarrow$ Haematine $\longrightarrow$ Haemoglobin. It also shows that the Hemoglobin level may change by taking the green vegetable which contain the chlorophylls**.**

## ACKNOWLEDGEMENTS

Authors sincerely acknowledge the valuable support provided by the Principal Elphinstone College, Fort Mumbai-32, India. Principal G. N. Khalsa, College Matunga, Mumbai-19, India.

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