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INFRARED SPECTRUM ANALYSIS OF SOME FLAVONOIDS WITH HEMOGLOBIN

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Abstract:
Infrared spectra of some flavonoids Rutin & Hesperidin were recorded. Infrared spectra of hemoglobin and hemoglobin with Rutin & with Hesperidin were also recorded. The spectral data of the complexes (Hemoglobin-Rutin and Hemoglobin-Hesperidin) were interpreted as indicating the near position valency band of the carbonyl group in relation to its position in Rutin and Hesperidin.

Keywords: Flavonoids, Hemoglobin, Infrared spectra.

1. Introduction:

Flavonoids have emerged as potential therapeutic drugs and are effective against several diseases. They are natural, biologically active compounds. They are hyrodxy, metoxyl and glycoside derivatives of flavone. The best known and examined ones include Rutin and Hesperidin. Some flavonoids compounds are contained in pharmaceuticals and applied in therapy. Flavonoids from complexes with metal ions and the compounds with the strongest complex formative properties exhibit the greatest physiological strength. Some flavonoids possess significant anti-hepatotoxic(1),anti-HIV (2,3), antitumor (6,7,8). The antioxidant (5) and anti-inflammatory activities (6, 7, 8). The antioxidant properties of flavonoids are often claimed to be responsible for the protective effects of these compounds against cardiovascular disease, certain forms of cancer, photosensitivity diseases and inflammations (9-12).

2. Experimental:

Hemoglobin, Rutin and Hesperidin were purchased from Sigma-Aldrich Company Bangalore, and were used without further purification. FTIR spectra were recorded on a JASCO FTIR spectrometer (Japan, Tokyo), equipped with a liquid-nitrogen-cooled HgCdTe (MCT) detector and a KBr beam splitter.

3. Results and Discussion:

FTIR spectra of hemoglobin, Rutin and Hesperidin have been shown in Figs 1, 2 & 3 respectively. FTIR spectra of the complexes, Hemoglobin-Rutin and Hemoglobin-Hespiridin have been shown in Figs 4 & 5 respectively.

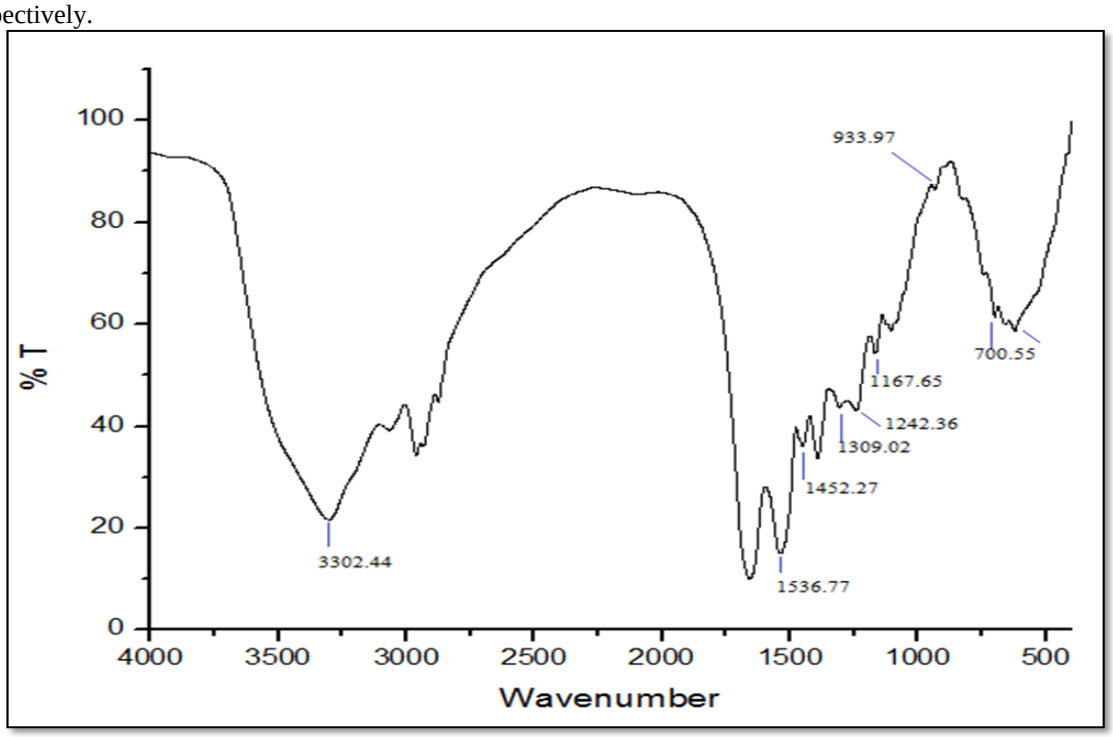

Figure 1: FTIR Spectra of Hemoglobin

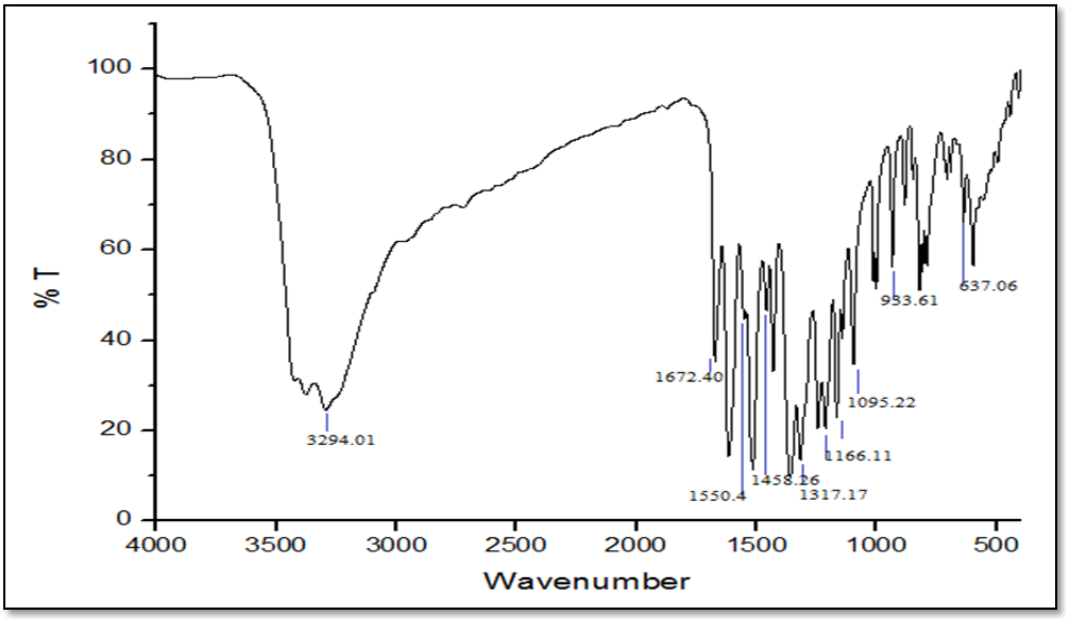

Figure 2: FTIR Spectra of Rutin

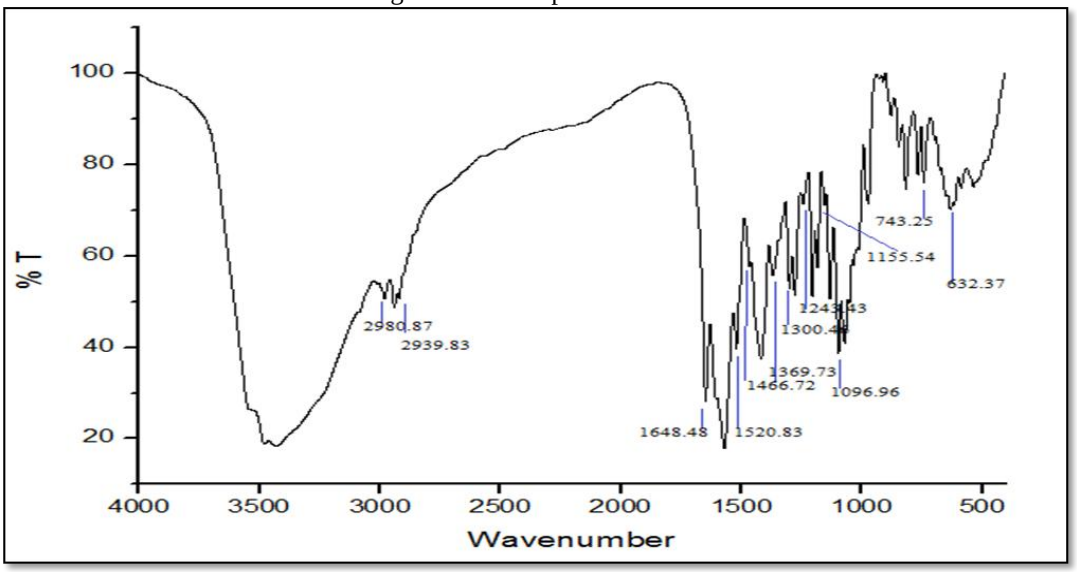

Figure 3: FTIR Spectra of Hesperidin

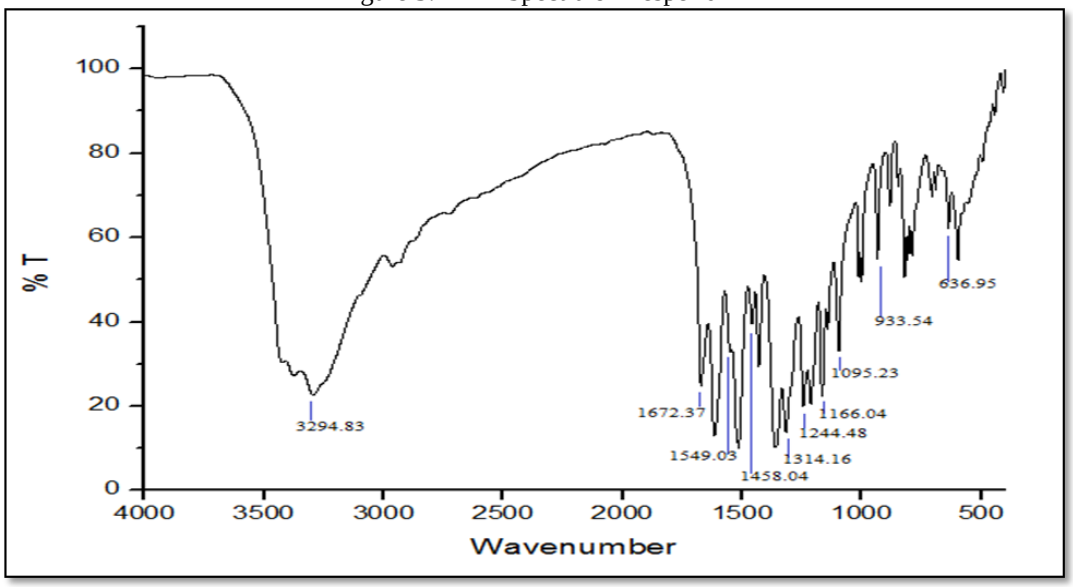

Figure 4: FTIR Spectra of Hemoglobin + Rutin

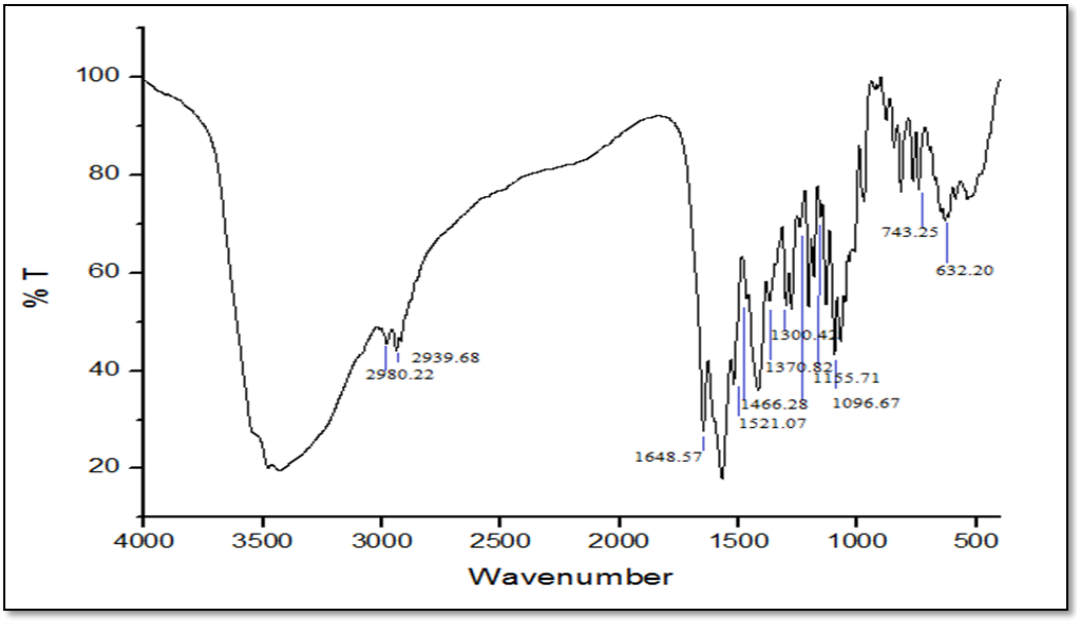

Figure 5: FTIR Spectra of Hemoglobin + Hesperidin

On analyzing the data concerning IR spectra of the complexes examined are presented in Tables 1 & 2 for Hemoglobin-Rutin and Hemoglobin-Hespiridin complexes respectively. It must be emphasized that there are no distinct and simple differences among other characteristic bands of the compounds. The analysis for the vibration of Hemoglobin-Rutin complex has been given here. N-H stretching of proteins was observed at 3294±20cm^{-1}. Asymmetry stretching has been seen at 1672±25cm^{-1}. Aromatic C=C stretching has been observed at 1166cm^{-1}. Symmetric stretching was observed at 933±10cm^{-1}.

Table 3: Difference in FTIR absorption peak intensities of Hemoglobin before and after complex formation with Rutin

Intensities (cm^{-1})			**Difference in intensities prior to and after %**	**Tentative Assignment**
HbA	**R**	**HbA + R**		
3302.44	3294.01	3294.83	0.86	Amide A, N-H stretching of proteins
1657.91	1672.40	1672.37	14.71	Asymmetric stretching
1536.77	1550.41	1549.03	17.75	Aromatic C=C Bending
1452.27	1458.26	1458.04	3.37	C – H bending
1309.02	1317.17	1317.16	30.05	Protein ring structure
1242.36	1244.34	1244.48	23.11	Amide III band components of proteins (C-N)
1167.65	1166.11	1166.04	32.00	C=C Stretching
1105.59	1095.22	1095.23	25.75	HbO_2 exhibits $\nu(O_2)$ band, C-O stretching
933.97	933.61	933.54	31.48	Symmetric stretching
621.87	637.06	636.95	3.60	-CH=CH-(cis)

Table 4: Difference in FTIR absorption peak intensities of Hemoglobin before and after complex formation with Hesperidin

Intensities (cm^{-1})			**Difference in intensities prior to and after %**	**Tentative Assignment**
HbA	**H**	**HbA + H**		
2960.98	2980.87	2980.22	11.18	-C-H asymmetric stretching of –CH3
2934.98	2939.83	2939.68	8.28	-C-H symmetric stretching of $-CH_2$
1657.91	1648.48	1648.57	7.55	Asymmetric stretching
1536.77	1520.83	1521.07	22.24	Aromatic C=C Bending
1452.27	1466.72	1466.28	18.57	C – H bending
1391.19	1369.73	1370.82	20.88	C=O symmetric stretching
1309.02	1300.46	1300.42	9.47	Protein ring structure
1242.36	1243.43	1243.42	26.31	Amide III band components of proteins (C-N)
1167.65	1155.54	1155.71	17.1	C=C Stretching
1105.59	1096.96	1096.97	5.26	HbO_2 exhibits $\nu(O_2)$ band, C-O stretching
743.23	743.25	743.25	7.15	Fe ion position
621.87	632.37	632.20	11.97	-CH=CH-(cis)

The following is the discussion for the complex of Hemoglobin-Hesperidin. Asymmetry stretching has been observed at 1648±25cm^{-1}. Aromatic C=C bending was observed at 1520±25cm^{-1}. C-H bending has been observed at 1452±20cm^{-1}. Protein ring structure has been observed at 1300±10cm^{-1}. C=C stretching has been observed at 1155±20cm^{-1}.

4. Conclusion:

In the present paper, the flavonoids, Rutin and Hesperidin have been characterized and the complexes of Hemoglobin with Rutin and Hesperidin have also been characterized. This study has contributed with a description of vibrational spectra and geometrical parameters analysis of the complexes with potential antiviral activity.

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