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STUDY OF METAL OXIDES USED AS STANDARD IN AYURVEDIC MEDICINES BY FOURIER TRANSFORM INFRARED SPECTROPHOTOMETER (FTIR).

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ABSTRACT

Fourier transform infrared spectroscopy (FTIR) is a simple and fast analytical method. it is a powerful tool for the pharmaceutical industry. The technique is used for the phytochemicals analysis of herbal medicines. The present work focused on the qualitative and quantitative analysis of herbal medicine using FTIR with metal oxides used as a standard. Ayurvedic medicine is one of the most popular medicinal system in the world**.** Electrolytes, Trace elements, Toxic, Essential, Minerals, Alkaloids, Steroids and organic compounds, besides that enzymes, proteins and other Inorganic elements are naturally present in Ayurvedic medicines**.** Popularity of Ayurvedic medicines is growing worldwide because of their minimal side effects. Ayurvedic medicines required standardization, with implementation and constant review of technical standards of production and effective quality control methods. It is necessary to promote this study in the view of the importance of results of both individual and social field. Hence in present study Sarpagandha, Arthowin Vati and BPC Capsule are studied by using Calcium Oxide, Zinc Oxide, Magnesium Oxide and Copper Oxide as standard**,** are studied by FTIR ***(****Fourier Transform Infrared* Spectrophotometer**)** for the analysis of metals from Ayurvedic medicines**.**

KEYWORD: Standardization, Ayurvedic medicine, FTIR**,** Calcium Oxide, Zinc Oxides, Magnesium Oxide and Copper Oxide**.**

INTRODUCTION

World Health Organization (WHO) states that around 85-95% of the world population uses traditional Ayurvedic medicines.[1] Most of the people use Ayurvedic medicines for less toxicity and minimum side effects. Contamination or adulteration of Ayurvedic medicines with toxic metals, essential elements, trace elements and insect debris are of major concern.[2] The poor-quality control of these medicines may cause health hazards like anemia due to destruction of red blood cells. World health Organization gives some guidelines.[1] for the preparation of herbal medicines and listed some methods for the standardization of herbal medicines.[3] and give maximum permissible limit of heavy metals.[1] and quality controlled norms. It is important to follow the quality control norms to standardize the herbal medicines. Various instrumental methods like HPLC -high –performance chromatographic techniques.[1] GC-gas chromatography XRPD.[4] electrophoresis and TLC -thin layer chromatography. Are reported for the standardization of herbal medicines. The quality of well-defined constituents is required for reliable beneficial therapeutic effects. Therefore, FTIR methods, are developed which has high degree of sensitivity, specificity and less time consuming.

MATERIAL AND METHODS

Instrument – *"Fourier Transform infrared spectra, PerkinElmer, Model-Spectrum 100"*

Table – 1. Product name and manufacturer.

Sr. No	Brand and Company Name	Product Name	Plants as per label
1	Baidynath	Sarpagandha	Sarpagandha powder
2	Safe life	Arthowin vati	Rasna mool, Sunthi, Gokshur, Erand mool, Ashwagandha, Guggul, Guduchi
3	Peekay pharma	BPC capsule	Sarpgandha, Lahasun, Arjun chhal Ex, Guggul AshwagJatamansi, Naandha, Isabgol, Brahmi, Jatamansi, Nagarmotha, Shankpushi, Kapoor kachri, Badi ilaichi

Figure-1. Sarpagandha, Arthowin vati and BPC Capsule

Table-2. Metal Oxides (standards)

Sr. No	Code Number	Metal Oxide
1	OX1	Calcium Oxide
2	OX2	Zinc Oxide
3	OX3	Magnesium Oxide
4	OX4	Copper Oxide

Sampling*:* In the present study, the above metal oxides and herbal medicines are selected for the analysis.

Experimental design

OX1, OX2, OX3, and OX4 code numbers are assigned for the metal oxides and A, E and F code for the herbal samples**.** Each sample ground to fine powder by using mortar and pestle at room temperature and packed in butter paper**.** Sample prepared in KBr, small amount of metal oxide standard / small amount of sample individually mixed with KBr**.** Sample was then placed in the sample holder and positioned in the sample beam of instrument, all spectra were obtained under the identical instrument operating conditions**.** FTIR spectra is recorded in the range of mid-IR region 4000cm^{-1} – 400 cm^{-1} comparing with standards. The FT-IR spectrum is used as fingerprint to identify the functional group of the active compounds based on the peak value on the region of infrared radiation. Rapid quality verification method using FTIR spectrophotometer measures the vibration of bonds with chemical functional group and generates a spectrum that can be regarded as a biochemical or metabolic "fingerprint" of the sample.

RESULT AND DISCUSSION

Table -03. Metal Oxide and Herbal Sample with Observed frequency

Sample	Code	Frequency cm^{-1}		
Metal Oxides as a standard	Ox1	3643.43, 3314.84	1453.52, 1126.67	875.68, 712.94, 475.81, 466.90, 437.99
	Ox2		1615.13, 1415.29, 1133.64,	834.83, 503.69, 504.22, 460.41
	Ox3	3696.41,	1478.29, 112.43,	828.58, 569.34, 522.36, 501.75, 488.61, 476.16, 453.75, 432.89
	Ox4		1631.24, 1399.72, 1115.03	849.98, 606.87, 537.91, 499.66, 465, 430.04, 419.97
Herbal Sample	A		1632.75, 1111.45,	471.81, 454.09
	E		1631.84, 1402.35, 1110.92,	831.77, 518.69, 554.29, 424.67,
	F		1631.45, 1398.96, 1111.99,	811.99, 534.13, 471.44, 446.13

Table -04. Herbal Sample with Observed frequency cm^{-1}

Sr. No	Frequency cm^{-1}		
	A	E	F
1	1632.75	1631.84	1631.45
2	------	1402.35	1398.96
3	1111.45	1110.92	1111.99
4	--------	831.77	811.99
5	------	--------	------
6	471.81	424..67	471.44

Figure-02 A. Herbal Samples, Sarpagandha(A), Arthowin Vati (E) and BPC Capsule (F).

Figure-02B. Metal Oxides as standard OX1, OX2, OX3 and OX4

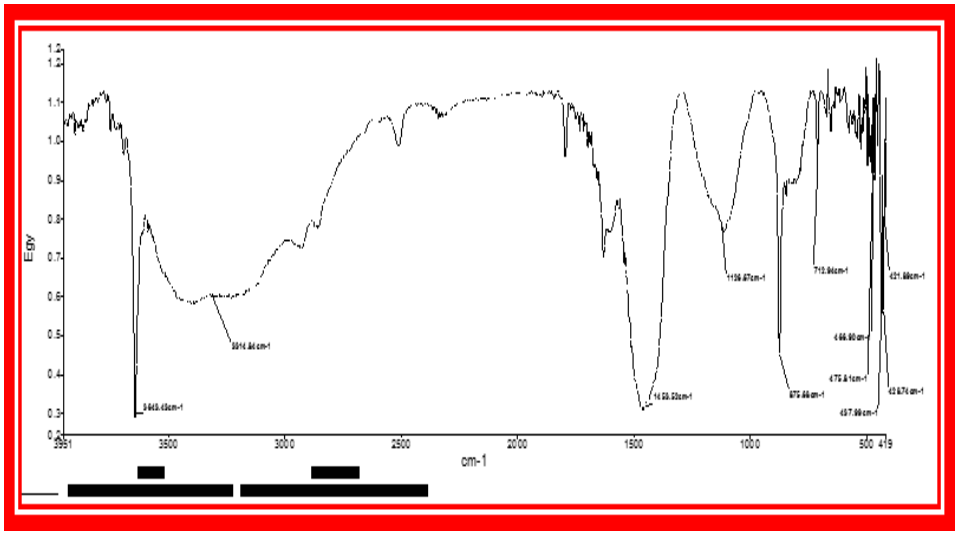

Figure-3. Graphical representation of Calcium oxide (OX1)

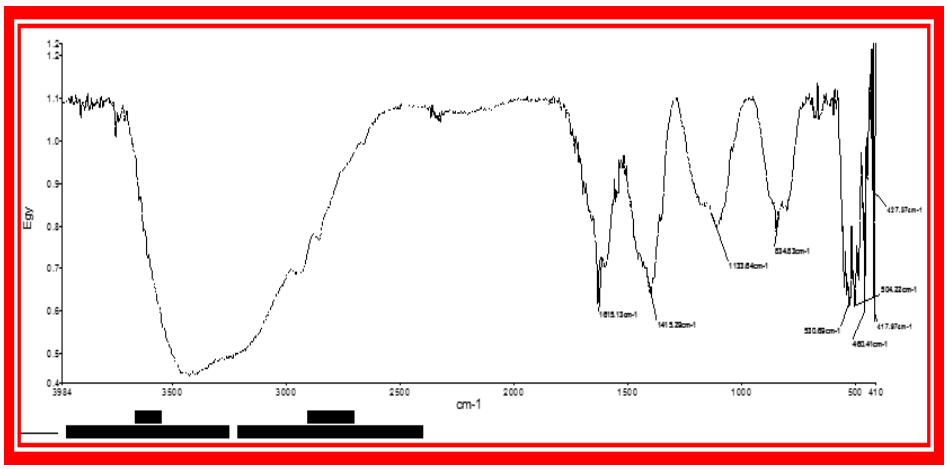

Figure-4. Graphical representation of Zinc oxide (OX2)

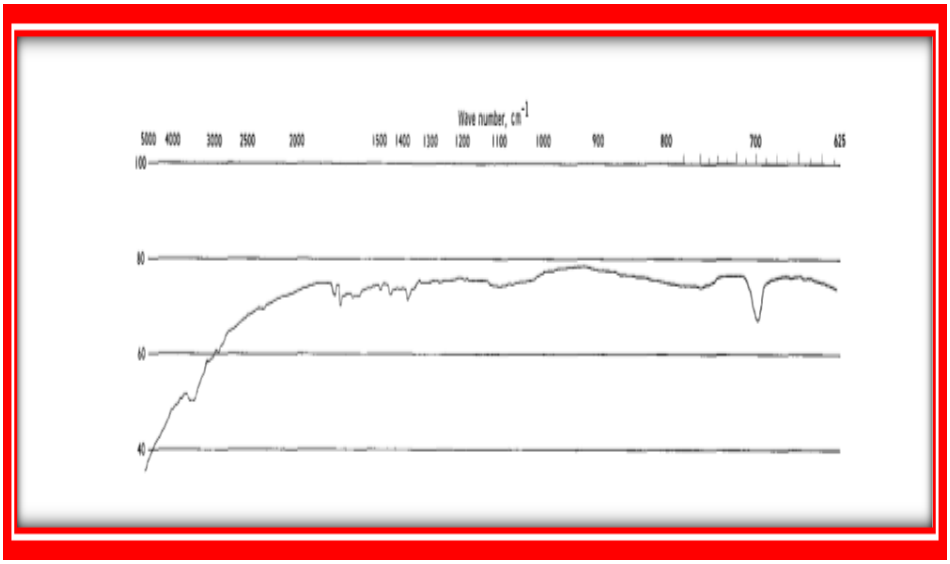

Figure-5. Graphical representation of Zinc oxide (OX2)

Graph from NASA Book Zinc oxide[5]

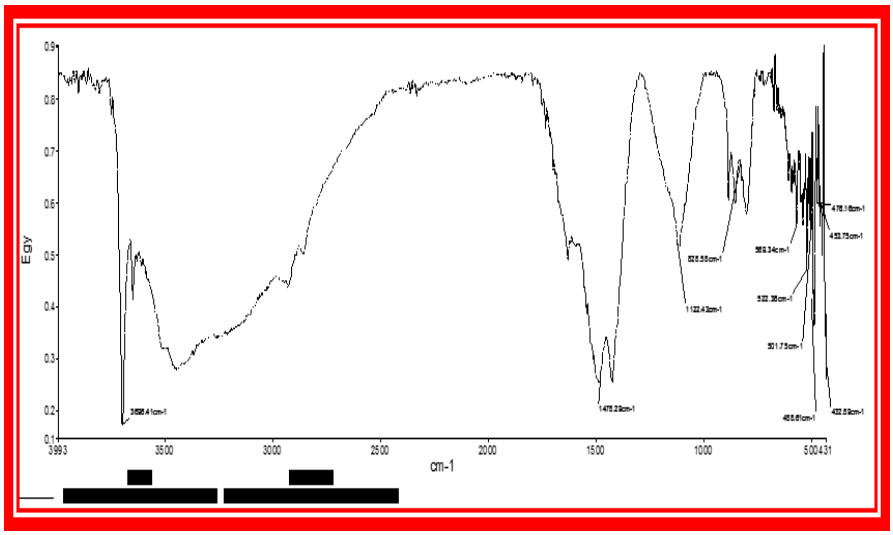

Figure-6. Graphical representation of Magnesium oxide (OX3)

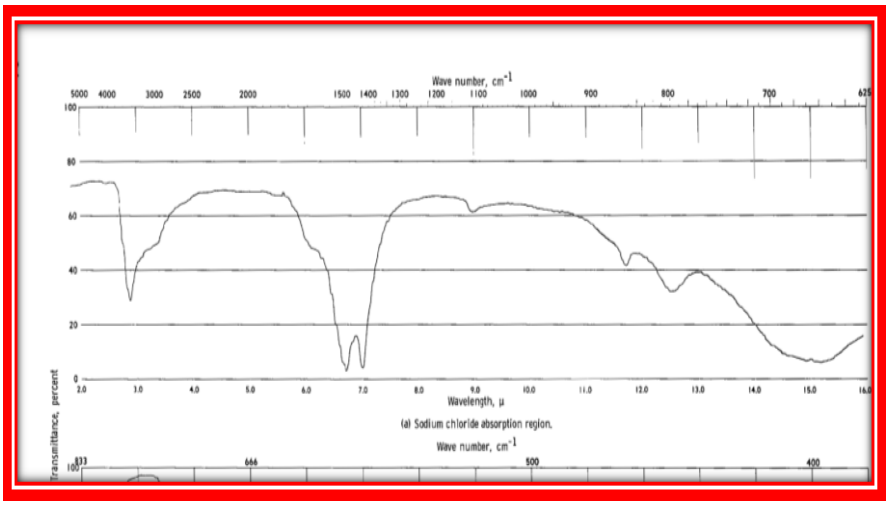

Figure-7. Graphical representation of Magnesium oxide (OX3)[5]

Graph from NASA Book MgO

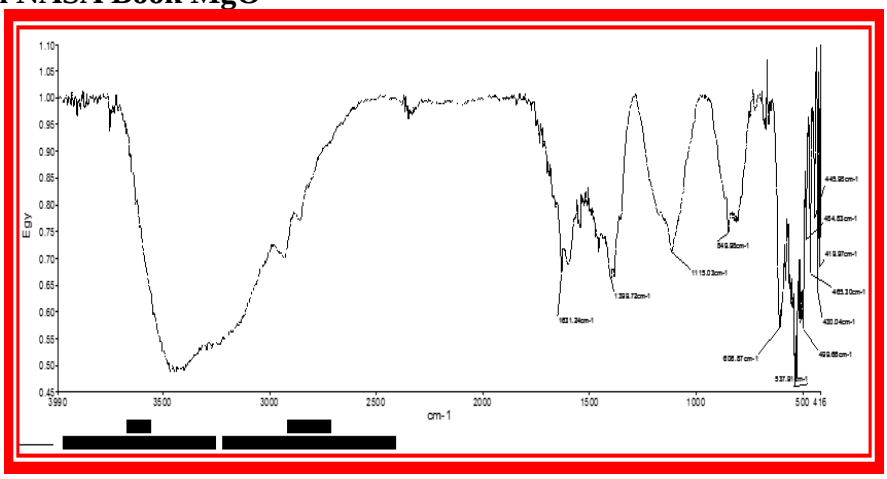

Figure-8. Graphical representation of Copper oxide (OX4)

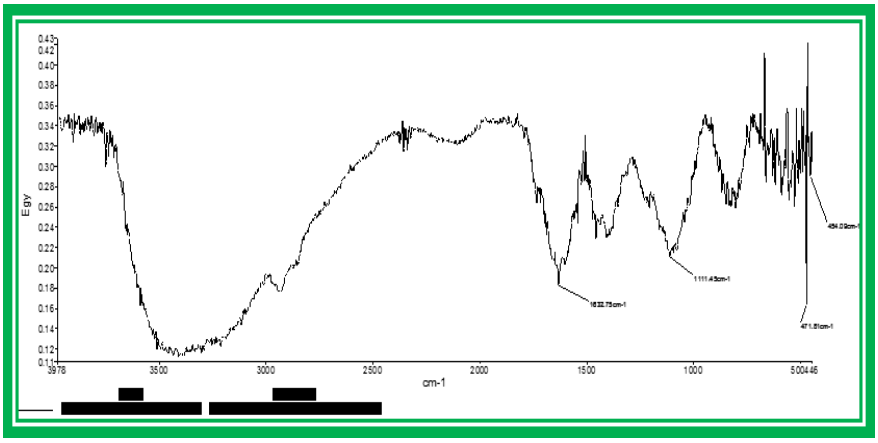

Figure-9. Sample A (Sarpagandha)

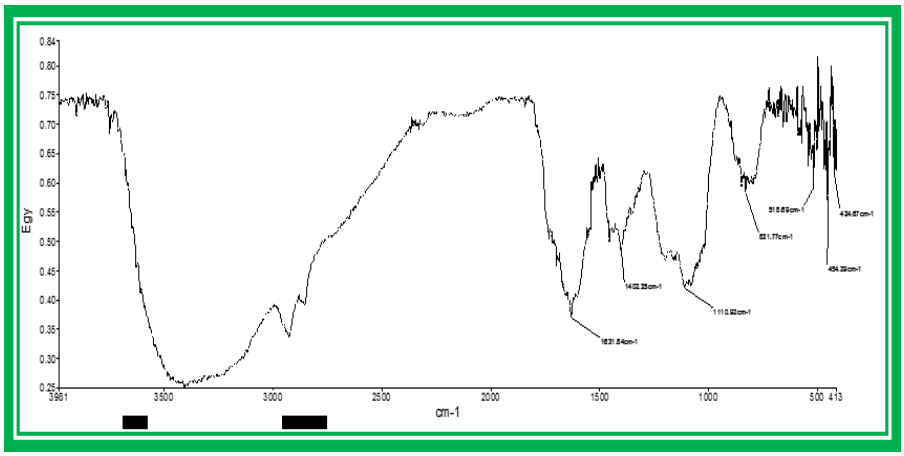

Figure-10. Sample E (Arthowin Vati)

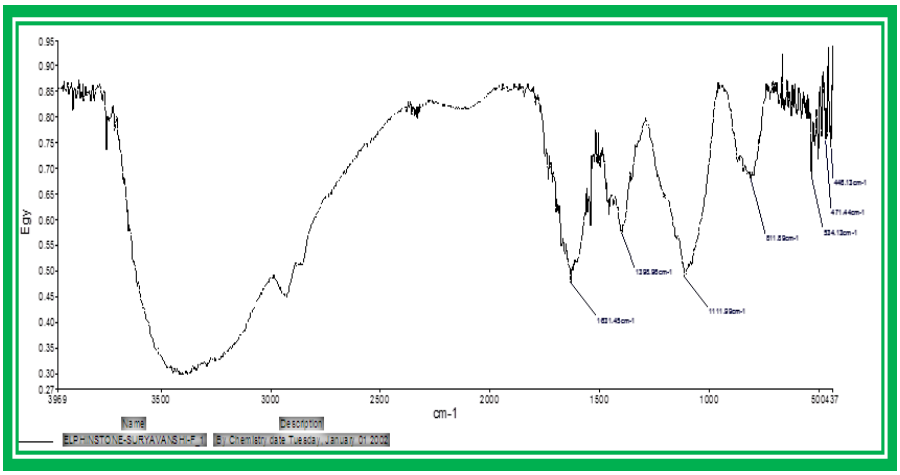

Figure-11. Sample F (BPC Capsule)

Molecular vibration due to the infrared radiation will be an interesting factor to study in herbal medicines which will have definite physiological effect on human body. The presence of inorganic metals in herbal medicines eventually effects on the stretching or bending on the

spectral band and the spectra may be shifted. The spectral data shows that the metal present in most of the herbal medicines were in the form of metal oxide or in the form of sulphide**.**

Validation of the result

Five product manufactured by different company containing Sarpagandha validated the FTIR patter are given below.

Table-05. Product name and manufacturer

Sr. No	Brand and Company Name	Product Name	Plants as per label
1	Baidynath(S1)	Sarpagandha	Sarpagandha powder
2	Unjha (S2)	Sarpagandha Ghanvati	Sarpagandha, Pimpri mul, Khurasi Ajmo, Jatamasi.
3	Zandu (S3)	Sarpagandha	Sarpagandha
4	Local powder (S4)	Sarpagandha	Sarpagandha powder
5	Local powder (S5)	Sarpagandha	Sarpagandha powder

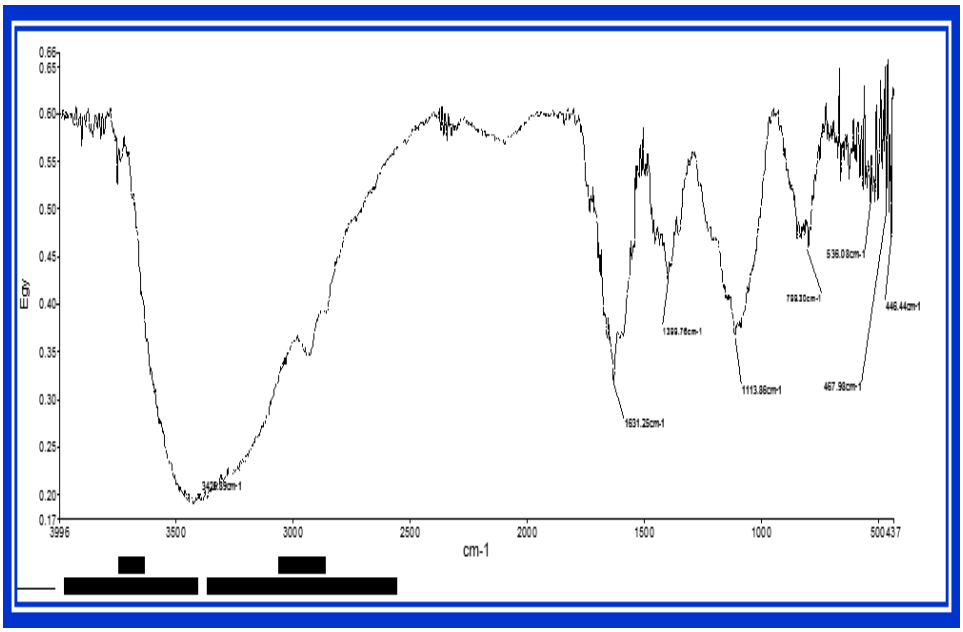

Figure -12. Sarpagandha (S1)

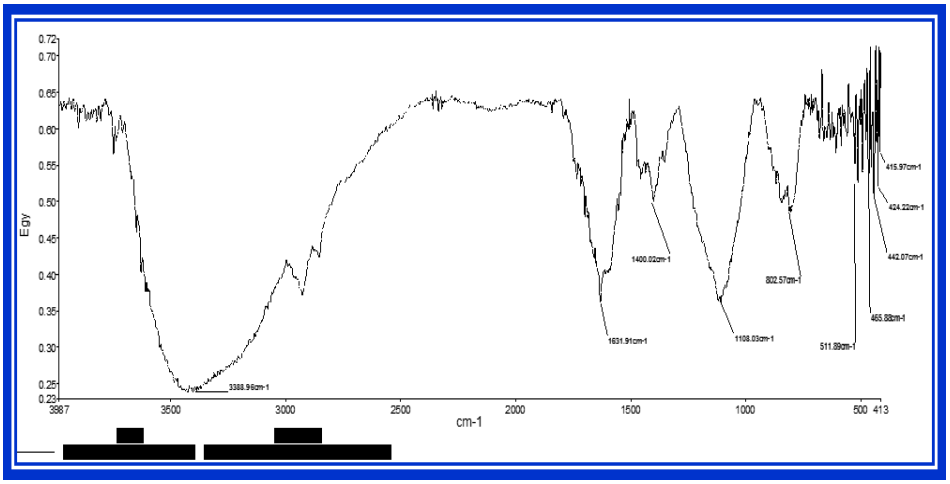

Figure -13. Sarpagandha (S2)

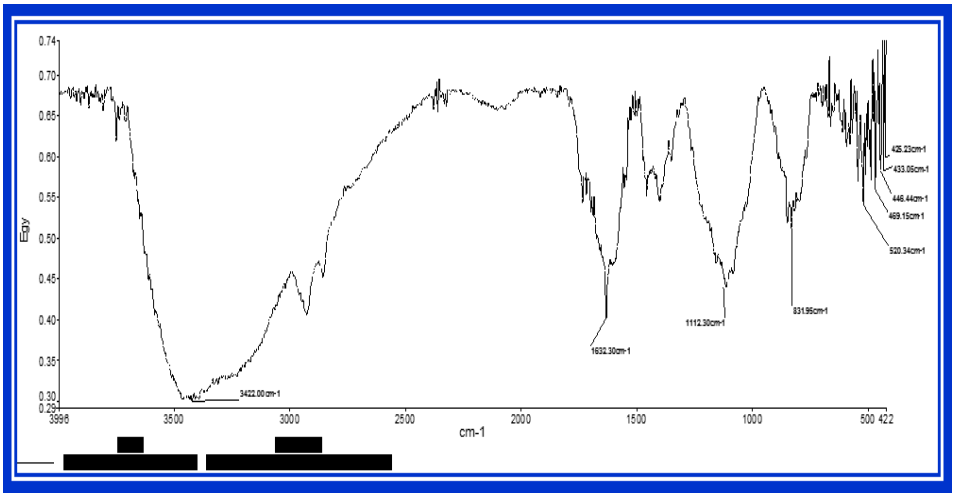

Figure -14. Sarpagandha (S3)

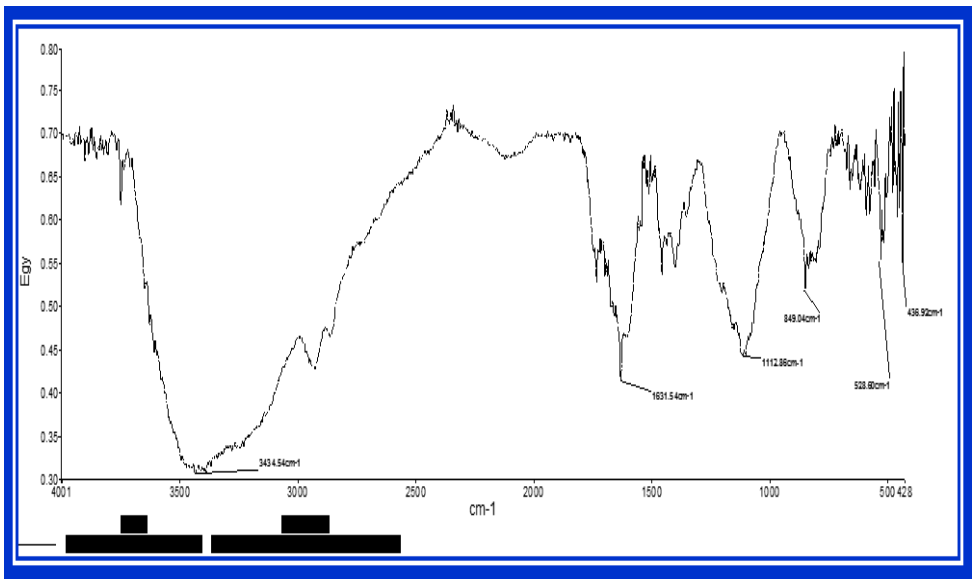

Figure -15. Sarpagandha (S4)

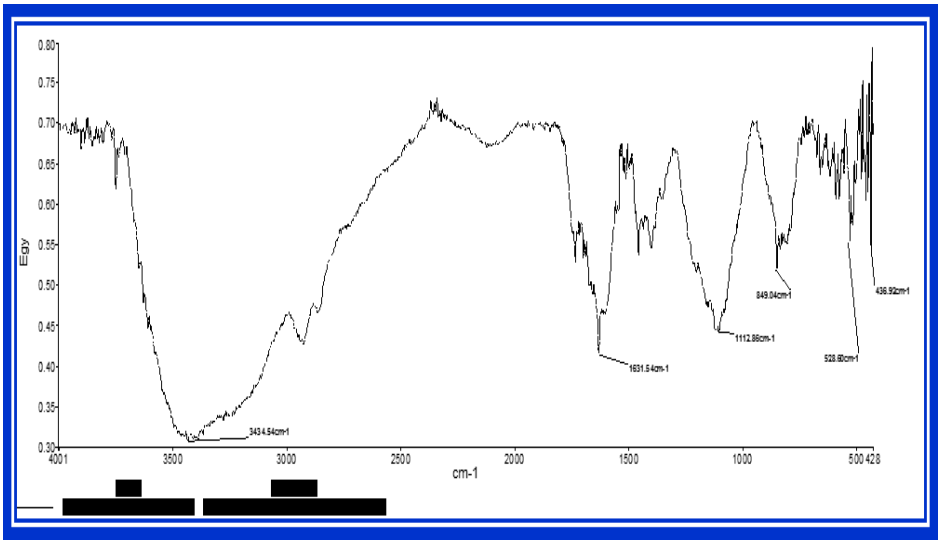

Figure -16. Sarpagandha (S5)

Table -06. Sarpagandha Sample S1, S2, S3, S4 and S4 with Observed frequency cm^{-1}

Sr. No	Sample frequency				
	S1	S2	S3	S4	S5
1	3426.89	3338.96	3422.0	3434.54	3434.54
2	1631.25	1631.91	1632.30	1631.54	1631.54
3	1399.76	1400.02	1112.30	1112.86	1112.86
4	1113.86	1108.03			
5	799.30	802.57	831.95	849.04	849.04
6	536.08	511.89	520.34	528.60	528.60
7	467.98	465.88	469.15		
8	446.44	442.07	446.44	436.92	436.92

CONCLUSION

Results obtained from FTIR spectra can identify the elements from different herbal plants and identify the inorganic elements responsible for the shifting of spectral bands from its original position. FTIR are used in the present study can be made mandatory for the quality control of Herbal medicines that can avoid the laborious and time consuming work. The FTIR spectra obtained for zinc oxide and magnesium oxide in the present work appears to be more elaborating than graphical representative given in NASA book (5).

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