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Functional Group Detection of *Dregea Volubilis* and *Derris Trifoliata* Using FTIR

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A B S T R A C T

FTIR spectroscopy is an analytical tool used to develop a rapid and effective analysis method for studying integrally the main constituents in Dregea volubilis & Derris trifoliata. The plant material was collected, washed, oven dried and stored in air tight container. Pressed pellet technique was used for the analysis of the plant sample. IR spectrum in mid region of 4000cm-1 to 400 cm-1 was used for identifying the various functional groups and chemical constituents present in the whole plant sample of Dregea volubilis & Derris trifoliata. The spectra confirmed the presence of functional groups such as carbohydrate amino group, antioxidant enzymes carboxylic acid, aromatic compounds, nitro compounds, phenols, aromatic amine and halo compounds.

Keywords: FTIR, functional groups, chemical constituents, Dregea volubilis, Derris trifoliata

1. Introduction

Plants are inevitable sources of chemical compounds and plant physiologists in collaboration with chemists and biochemists have been able to isolate and characterize a myriad of chemical compounds from plants [1]. Therefore, research on natural substances has remained essential both in the developed and developing countries [2]. In fact, about 60% of medicine sold in pharmacies came directly from natural sources. [3]. Phytochemicals with biological activity have had great utility as pharmaceuticals and pest management agents [4]. Through the 19th century and into the first half of the 20th century, the primary strategy for discovery of plant compounds with these uses was determining the active ingredients of plants with reported medicinal or pesticidal properties [5]. A wide range of our recently used medicines had their roots directly or indirectly from plants. Some of these medicines are no longer synthesized in large quantities by competitors because they have shown toxicity to humans and other animals. This has made it possible for more investigations to be carried out on plants so as to enable us to know the therapeutic status of newly discovered drugs of plant origin. In this respect, plant-based research has made promising results in the fields of anticancer and antimalarial therapies [6]. FTIR is one of the most widely used methods to identify the chemical constituents and elucidate the compound structures. These vibrational spectroscopic techniques are relatively simple, reproducible, non-destructive to the tissue, and only a small amount of material (micrograms to nanograms) with a minimum sample preparation are required. In addition, these techniques also provide molecular-level information allowing investigation of functional groups, bonding types, and molecular conformations. Spectral bands in vibrational spectra are molecule specific and provide direct information about the biochemical composition. These bands are relatively narrow, easy to resolve, and sensitive to molecular structure, conformation and environment. It is strongly believed that in studies related to spectroscopic techniques both the reliable experimental procedure and characterization of spectral peak position and their assignment along with accurate peak detection and definition are of crucial importance [7]. Therefore, we starve for a quick and effective analysis method to entirely monitor and reflect the whole constituents of the selected medicinal plants.

2. Experimental

2.1 Sample preparation

The powdered sample were grounded in an agate mortar and pestle in order to obtain fine powder. Powdered leaf material was mixed with KBr in a ratio of 1/100 completely, and subsequently the mixture of each plant was subjected to FTIR spectroscopic analysis.

2.2 Test chemicals

The AR grade Chloroform and KBr were used throughout the experiment.

2.3 Spectroscopic analysis

FTIR spectra were recorded with a Jasco FTIR 4100 cm–1. The powdered leaf sample of Derris trifoliate were scanned at room temperature (25±2 ºC) with a spectral range of 4000–400 cm–1. Background spectra collected under identical conditions were subtracted from the sample spectra. Therefore, in the present study it is possible to directly relate the intensities of the absorption bands to the concentration of the corresponding functional groups.

3. Results

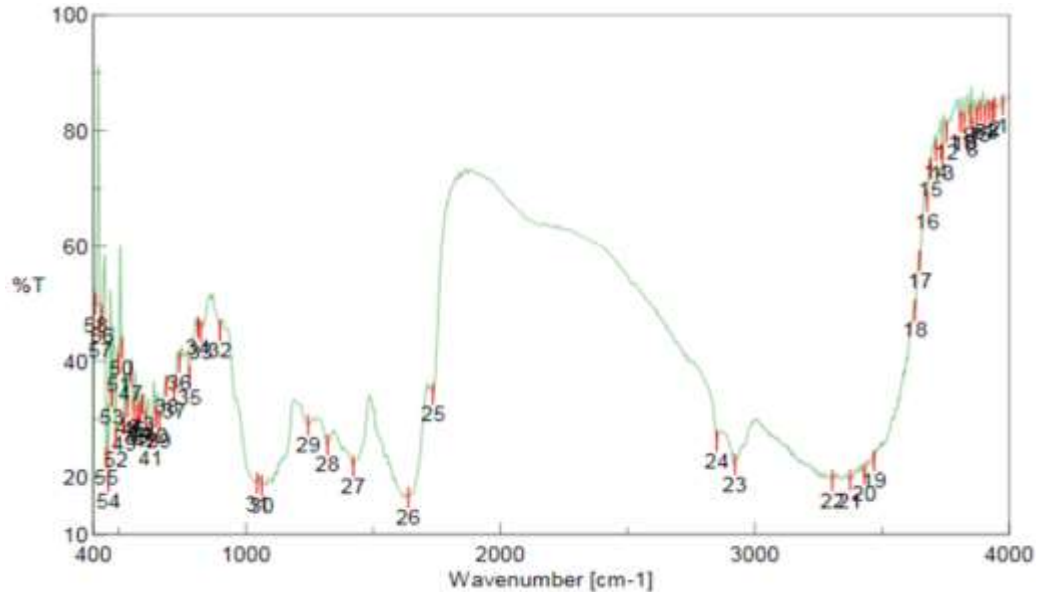

Fig 1:- FTIR spectra of *Dregea Volubilis*

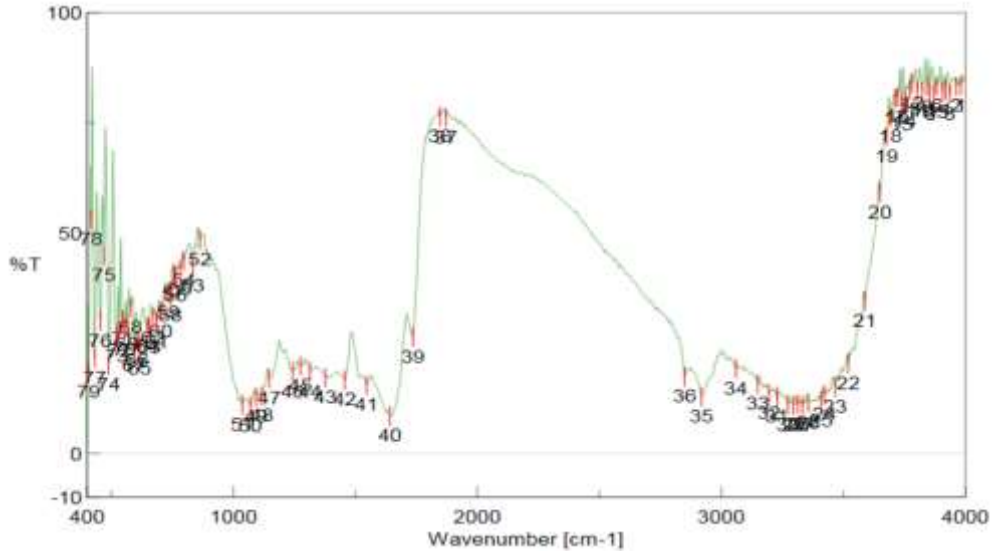

Fig 2:- FTIR spectra of *Derris trifoliate*

Wavenumber in cm^{-1}		**Vibrational Assignment**
Peak no	**Dregea volubilis**	
1	3630, 3649, 3677, 3691	O-H stretching vibration
2	3304, 3373, 3430, 3468	O-H stretching vibration, presence of carbohydrate amino group
3	2851, 2921	O-H stretching vibration of carboxylic group
4	Absence	N=C=O stretching of Isocyanate 2274
5	1735	C-H bending vibration of aromatic compound
6	1323	O-H bending vibration of phenol
7	1328	C-N stretching vibration of aromatic amine
8	1421	CH2 bending vibration of lipids
9	645	C-Br stretching bromo compound
10	624	C-I stretching iodo compounds

Table 1: FTIR frequency range and functional group present in leaves of *Dregea volubilis.*

Wavenumber in cm^{-1}		**Vibrational Assignment**
Peak no	**Derris trifoliate**	
1	3588, 3650, 3693	O-H stretching vibration
2	3228,3520,3466,	O-H stretching vibration, presence of carbohydrate amino group
3	2850, 2918,3059, 3228	O-H stretching vibration of carboxylic group
4	Absence	N=C=O stretching of Isocyanate
5	1641, 1735, 1847, 1870	C-H bending vibration of aromatic compound
6	1545	N-O stretching vibration of nitro compound
7	1340	O-H bending vibration of phenol
8	1274	C-N stretching vibration of aromatic amine
9	1421	CH2 bending vibration of lipids
10	1116	C-H stretching vibration of Antioxidant enzymes
11	647	C-Br stretching bromo compound
12	616	C-I stretching iodo compounds

Table 2: FTIR frequency range and functional group present in leaves of *Derris trifoliate.*

4. Discussion

4.1 Dregea volubilis

Results of FTIR spectroscopic studies have revealed the existence of various chemical constituents in leaves of Dregea volubilis. The absorption bands, the wave number (cm–1) of dominant peaks obtained from absorption spectra were defined in Table 1. It should be pointed that we did not find the peak at 1635 cm–1 due to the absence of moisture content in the samples investigated, as shown in Figs.1. The peak at 3630, 3649, 3677, 3691 and 3304, 3373, 3430, 3468 represents the presence O-H stretching. Peak at 2851 and 2921 represents the presence of O-H stretching of carboxylic acid group. No peak between 2250-2275 confirms the absence of isocyanate group. Peaks at 1735 represent C-H bending of aromatic compounds. Peaks at 1323 and 1328 represent O-H bending and C-N stretching of phenol and aromatic amine respectively. FTIR analysis confirms the presence of carbohydrate amino group carboxylic acid, aromatic compounds, phenols, aromatic amine and halo compounds. FTIR analysis also confirmed the absence of isocyanate group that means the plant can be used in further analysis. Hence FTIR can be used in detection of functional group present in the samples.

4.2 Derris trifoliate

Results of FTIR spectroscopic studies have revealed the existence of various chemical constituents in leaves of Derris trifoliate. The absorption bands, the wave number (cm–1) of dominant peaks obtained from absorption spectra were defined in Table 1. No peak was observed at 1635 cm-1 due to the absence of moisture content in the samples investigated, as shown in Figs.1. The peak at 3588, 3650, 3693 cm-1 and 3228, 3520, 3466 cm-1 represents the presence O-H stretching. Peak at 2851 cm-1 and 2921 cm-1 represents the presence of O-H stretching of carboxylic acid group. No peak between 2250-2275 cm-1 confirms the absence of isocyanate group. Peaks at 1641, 1735, 1847, 1870 cm-1 represent C-H bending vibration of aromatic compounds. N-O stretching of nitro compound was confirmed with presence of 1545 peak in spectra. Peaks at 1341 cm-1 and 1421 cm-1 confirmed the presence of phenols and lipid respectively. Peak at 1116 cm-1 represents the presence of antioxidant enzymes. Peaks at 647 and 616 represent bromo compound and iodo compound respectively. FTIR analysis confirms the presence of carbohydrate amino group, antioxidant enzymes carboxylic acid, aromatic compounds, nitro compound, phenols, aromatic amine and halo compounds. FTIR analysis also confirmed the absence of isocyanate group that means the plant can be used in further analysis. Hence FTIR can be used in detection of functional group present in the samples.

5. Conclusion

The FTIR method can be used to determine the different functional groups present in the plant powder. The suggested method is simple, selective, and eco-friendly for detection of functional groups in plant powders.

6. Acknowledgements

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7. Reference

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