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Research Article

FT-IR STUDIES ON THE LEAVES OF *ALBIZIA LEBBECK* BENTH

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ABSTRACT

Objective: In the present study an attempt has been made to establish FT-IR profile and identify the functional components of *Albizia lebbeck* Benth.

Methods: FTIR method was performed on a Thermo Scientific Spectrophotometer system which was used to detect the characteristic peak values and their functional groups.

Results: The results of *A. lebbeck* leaves FTIR analysis confirmed the presence of amide, alkynes, alkanes, carboxylic acids, alkenes, aromatics, aliphatic amines and alkyl halides compounds which shows major peaks at 3654.12, 3307.55, 2918.44, 2849.92, 1643.73, 1454.46, 1054.13 and 510.34 respectively. The dry ethanolic extracts of *A. lebbeck* leaves FTIR analysis results proved the presence of alcohols, phenols, alkanes, carboxylic acids, aromatics, ketones and alkyl halides compounds which shows major peaks at 3370.19, 2955.65, 2925.68, 2853.40, 1739.72, 1463.02 and 506.57 respectively.

Conclusion: The results of the present study produced the FTIR spectrum profile for the medicinally important plant *A. lebbeck*.

Keywords: *Albizia lebbeck,* FTIR, Spectroscopy, Functional groups.

INTRODUCTION

Fourier transform infrared spectrometry is a physico-chemical analytical technique that does not resolve the concentrations of individual metabolites but provides a snapshot of the metabolic composition of a tissue at a given time (Griffiths and de Haseth 1986). FTIR can be employed to determine the structure of unknown composition and the intensity of the absorption spectra associated with molecular composition or content of the chemical group [1, 2]. The FT-IR method measures the vibrations of bonds within chemical functional groups and generates a spectrum that can be regarded as a biochemical or metabolic "fingerprint" of the sample. By attaining IR spectra from plant samples, it might possible to detect the minor changes of primary and secondary metabolites [2, 3]. At present, particularly in phytochemistry, FTIR has been exercised to identify the concrete structure of certain plant secondary metabolites [4-6]. But, on pharmacognosy FTIR is still a new tool to characterize and identify the commercial components from the adulterant. FT-IR method has been successfully utilized in the characterization of bacterial, fungal and plant species [7-19]. FT-IR is one of the most widely used methods to identify the chemical constituents and elucidate the compounds structures, and has been used as a requisite method to identify medicines in Pharmacopoeia of many countries [12].

Albizia lebbeck Benth is widely distributed in India and is also found in South Africa and Australia. Traditionally, the barks are used in toothache and diseases of the gum. Decoction of the leaves and barks are protective against bronchial asthma and other allergic disorders. Barks and seeds are astringent and are given in piles and diarrhea. Ethanolic and methanolic extracts of pods possesses anti-protozoal, anti-fertility activity, hypoglycemic and anticancer properties [20-23]. The plant extract is reported to have antiseptic, anti- dysenteric, anti-ovulatory, nootropic, anti-inflammatory, antimicrobial activity and anti-tubercular activities [24-27]. The plant also contains saponins, macrocyclic alkaloids, anthraquinone glycosides, tannins, and flavonols [26]. The saponin constituents of Albizia so far described are echinocystic acid glycosides [28, 29]. The albiziasaponins A, B, and C were isolated from the barks of A. lebbeck [30]. Phytochemical investigations of Albizzia lebbeck pod showed that they contain 3', 5 Dihydroxy 4', 7 dimethoxy flavone, and N- Benzoyl L phenyl alaninol [31]. The beans of the plant contain albigenic acid-a new triterpenoid sapogenin [32]. The tri-O-glycoside flavonols kaempferol and quercetin were identified from the leaves of A. lebbeck [33]. Albizziahexoside a new hexaglycosylated saponin was isolated from leaves of A. lebbeck[34]. Misra et al [35] isolated N-demethyl budmunchiamines from A. lebbeck seeds and Maa et al [36] confirmed the tannin presence in A. lebbeck. With this background the present study was aimed to report the main functional components of present in the leaves of A. lebbeck by using FT-IR. In addition, we tried to develop a rapid, accurate and feasible analysis method to integrally reflect the inherent qualities of A. lebbeck.

MATERIALS AND METHODS

Collection and processing of plant material

Albizia lebbeck Benth was collected from the natural habitats of Rasipuram, Namakkal district, Tamil Nadu, India authenticated by Dr. E.G. Wesely and the voucher specimens were deposited in the St. Xavier's College Herbarium (XCH 00000) for further reference. The whole plant samples were washed thoroughly in running tap water to remove soil particles and adhered debris followed by sterile distilled water. The washed plants were blotted on the blotting paper and spread out at room temperature in shade. Shade dried samples were grounded to fine powder using tissue blender. The powdered samples were then stored in a refrigerator for further use.

Extraction of plant material

The powdered leaves of *Albizia lebbeck* were extracted using ethanol with gentle stirring for 72 h separately at room temperature. The extracts were then filtered through Whatmann No. 1 filter paper and concentrated using vacuum distillation.

FTIR Spectroscopic Analysis

All spectra were obtained with the aid of an OMNI-sampler attenuated total reflectance (ATR) accessory on a Nicolet FTIR spectrophotometer (Thermoscientific Nicolet is10, USA) followed by previous methods with some modifications [12, 37, 38]. A small amount of powdered leaves was respectively placed directly on the germanium piece of the infrared spectrometer with constant pressure applied and data of infrared absorbance, collected over the wave number ranged from 4000 cm^{-1} to 675 cm^{-1} and computerized for analyses by using the Omnic software (version 5.2). The reference spectra were acquired from the cleaned blank crystal prior to the presentation of each sample replicate. All spectra were collected with a resolution of 4-1 cm and to improve the signal-to-noise ratio, 256 scans were co-added and averaged. Samples were run in triplicate and all of them were undertaken within a day period.

RESULTS AND DISCUSSION

The FTIR spectrum was used to identify the functional group of the active components based on the peak value in the region of infrared radiation. The leaves powder and ethanolic extracts evaporated powder of *A. lebbeck* was passed into the FTIR and the functional groups of the components were separated based on its peak ratio. The results of *A. lebbeck* leaves FTIR analysis confirmed the presence of amide, alkynes, alkanes, carboxylic acids, alkenes, aromatics, aliphatic amines and alkyl halides compounds which shows major peaks at 3654.12, 3307.55, 2918.44, 2849.92, 1643.73, 1454.46, 1054.13 and 510.34 respectively (Fig. 1A and B; Table-1).

The dry ethanolic extracts of *A. lebbeck* leaves FTIR analysis results proved the presence of alcohols, phenols, alkanes, carboxylic acids, aromatics, ketones and alkyl halides compounds which shows major peaks at 3370.19, 2955.65, 2925.68, 2853.40, 1739.72, 1463.02 and 506.57 respectively (Fig.1C and D; Table-2).

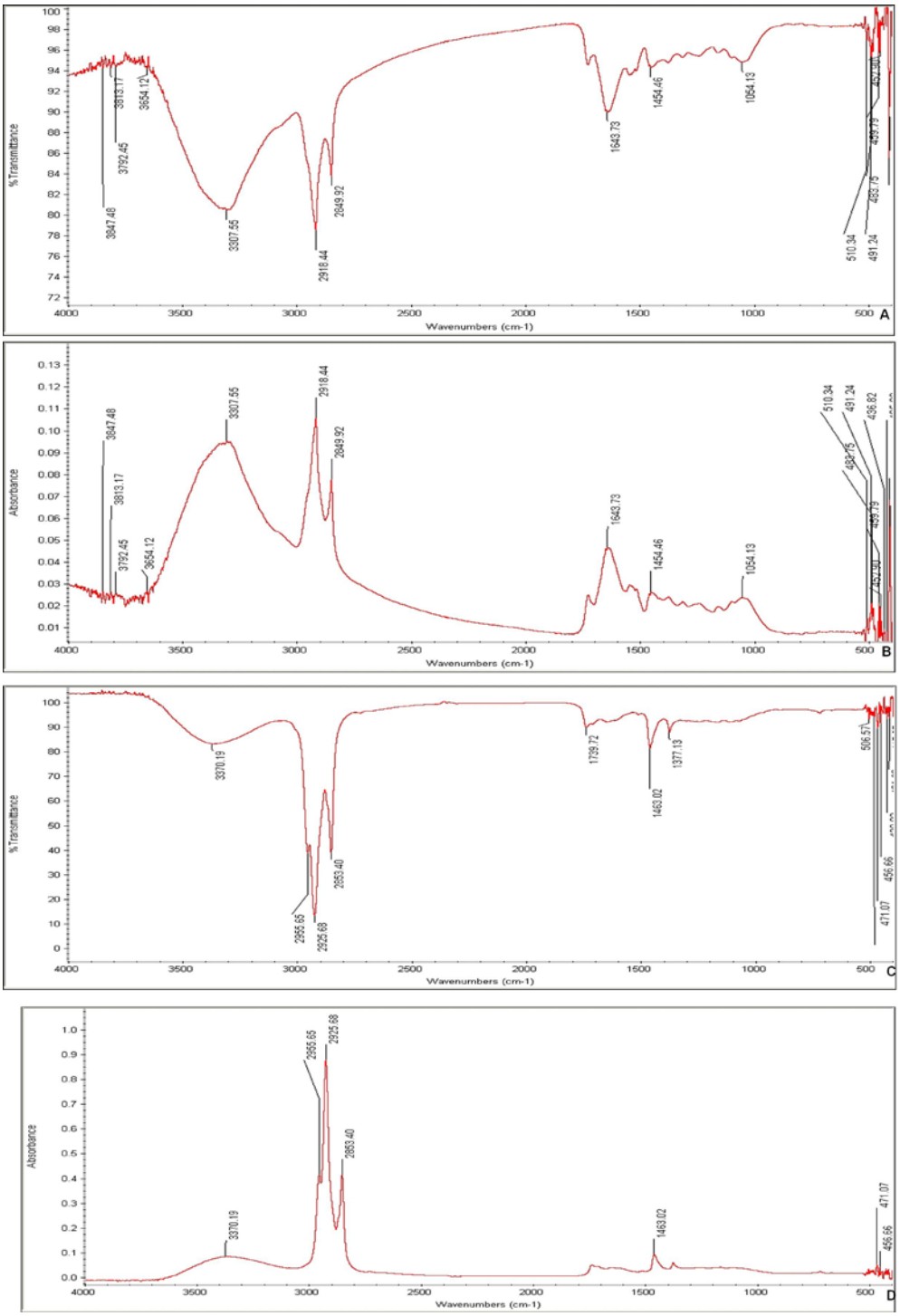

Fig. 1: FTIR Spectrum of *Albizia lebbeck* Benth – Leaves

A. FTIR Tr- Spectrum of *A. lebbeck* Benth – Leaves
B. FTIR Ab- Spectrum of *A. lebbeck* Benth – Leaves
C. FTIR Tr- Spectrum of Ethanolic extracts of *A. lebbeck* Benth – Leaves
D. FTIR Ab- Spectrum of Ethanolic extracts of *A. lebbeck* Benth – Leaves

Table 1: FT-IR Peak Values and Functional groups of *Albizia lebbeck* Leaves powder

Leaf Powder TR with value		Leaf Powder AB with value	
Peak values	**Functional group**	**Peak values**	**Functional group**
3847.48	Unknown	3847.48	Unknown
3792.45	Unknown	3813.17	Unknown
3813.17	Unknown	3792.45	Unknown
3654.12	Amide	3654.12	Amide
3307.55	Alkynes	3307.55	Alkynes
2918.44	Alkanes	2918.44	Alkanes
2849.92	Carboxylic acids	2849.92	Carboxylic acids
1643.73	Alkenes	1643.73	Alkenes
1454.46	Aromatics	1454.46	Aromatics
1054.13	Aliphatic amines	1054.13	Aliphatic amines
510.34	Alkyl halides	510.34	Alkyl halides
491.24	Alkyl halides	491.24	Alkyl halides
483.75	Unknown	483.75	Unknown
459.79	Unknown	459.79	Unknown
452.90	Unknown	452.90	Unknown
		436.82	Unknown

Table 2: FT-IR Peak Values and Functional groups of Ethanolic extracts of *Albizia lebbeck* Leaves powder

Solvent EX AB with value		Solvent EX TR with value	
Peak values	**Functional group**	**Peak values**	**Functional group**
3370.19	Alcohols, phenols	3370.19	Alcohols, phenols
2955.65	Alkanes	2955.65	Alkanes
2925.68	Alkanes	2925.68	Alkanes
2853.40	Carboxylic acids	2853.40	Carboxylic acids
1463.02	Aromatics	1739.72	Ketones
471.07	Unknown	1463.02	Aromatics
456.66	Unknown	1377.13	Unknown
		506.57	Alkyl halides
		471.07	Unknown
		456.66	Unknown

Spectral differences are the objective detection of componential differences. By using FT-IR spectrum, we can confirm the functional constituent's presence in the given parts and extract, identify the medicinal materials from the adulterate and even evaluate the qualities of medicinal materials [12]. The results of the present study spectrum also revealed the functional constituents present in the crude powder and ethanolic extracts of *A. lebbeck*. Many researchers applied the FTIR spectrum as a tool for distinguishing closely associated plants and other organisms [1-19, 37-42]. The results of the present study coincided with the previous observations observed by various plant biologist and taxonomist. The results of the present study developed novel phytochemical marker to identify the medicinally important plant. Further advanced spectroscopic studies are required for the structural elucidation and identification of active principles present in the leaves of *A. lebbeck*.

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