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Phytochemical and Fourier Transform Infrared Spectroscopy Analysis of Faidherbia Albida (Del)As A Preservative Agent

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***Abstract*— This study determined the preservative potential of methanolic leaf and stem bark extracts of Faidherbiaalbida. The bioactive compounds of F. albidaextractswere extracted using methanol and functional compounds were determined using Fourier transform infrared spectroscope(FT-IR). Phytochemical studies revealed the presence of tannins, steroids, terpenes, alkaloids in the leaf while tannins, saponin, alkaloids, steroids, terpenes and cardiac glycoside in the stem bark. FT-IR analysis of methanolic leaf and stem bark extracts confirm the presence of primary amine, alcohol, alkyl halide, alkene, alkane and aldehyde. The FT-IR signals at 1165, 1450, 1750, 2850, 2920 cm-1 were considered as an indicator of the presence of formaldehyde which is a major constituent of a preservative agent. F. albida extracts can serve as alternative preservative agent which support the traditional use of the plant for the preservation of corpse.**

***Index Terms*— preservative, phytochemical, spectroscopy, alcohol, methanol extracts.**

I. INTRODUCTION

Plants continue to serve as possible sources for new drugs and chemicals derived from various parts of plants. These can be extremely useful as lead structure for synthetic modification and optimization of bioactivity[22].

Faidherbiaalbida otherwise known as *Acacia albida* (Del) is of the family Mimosoideae. It is native to Southwest Africa, through West, North Africa to Egypt and East Africa. Common names include winter thorn and apple-ring acacia. The Hausa people of Northern Nigeria called it 'Gawo' while in Fulfuldes it is called 'Chayski'. Phytochemical studies reveal that plants in this family contain tannins, which account for their use in making of dyes [22].The plant can attain up to 30 m height and a diameter of 1.5 meters. More usually it reaches 15-25 meters height and a breast height diameter of up to 1 meter [17] [27]. The leaves are compound and bippinate with leaflets borne along the pinnae as is typical of *Mimosoidae*. Flowers are borne in dense axillary panicles and are successively white, cream and then yellow and are strongly scented (perfumed). The Roots can reach aquifers up to 80 m below the surface [2].

In folkloric medicine, it is used in fevers by the Masai people of Kenya as well as for diarrhoea in Tanganyika. A liniment, made by steeping the bark, is used for bathing and massage in pneumonia. The bark infusion is used to assist in child birth, and is used as a febrifuge for cough [22].A decoction of the bark is used in cleansing fresh wounds, in a manner similar to that of potassium permanganate [7] and for colds, haemorrhage, leprosy and ophthalmic in West Africa. In northern Nigeria, especially among the cattle rearing nomads, a decoction of the stem bark is taken orally for the management of the sleeping sickness and malaria. The stem Infusion is used to treat spirit related illness while the fruits are used as charm to drive away evil spirits [6].*F. albida*extracts are pharmacologically active. They are used as astringents to treat gastrointestinal disorders, particularly diarrhea [12]. Previous studies has demonstrated that the plant possess anti-pyretic, anti-inflammatory, anti-diarrhoea [21]and anti-trypanosomiasis [22] effects in experimental rats. Anti-malarial activity of ethanolic stem bark extract of *F. albida*was also reported [18]. It was also shown to be relatively safe acute [18] [11]. The stem bark extracts of *F. albida*was also reported to have Antimicrobial Activity [26] [10][8].In vivo anti-diarrhoeal effect [12] and in vivo antitrypanosomal activity against T. evansi infection [24]. Furthermore,[5] have shown that seed aqueous extract possessed mild hypoglycemic and hypolipidemic effects in type 2 diabetic patients. Similarly anti-hyperglycemic and anti-hyperlipidemic effects of aqueous stem bark extracts was also reported [25].

F. albida has been found to preserved corpse by some local communities in northern Nigeria. Furthermore, the need for the preservation of corpse is now given much attention for scientific, traditional and religion purposes. Preservation is considered appropriate when the cadaver is kept safe from harm, destruction or decomposition. This is achieved by treating the cadaver with special chemicals, i.e. embalming.One of the most important chemicals used for this purpose is formaldehyde. Formaldehyde is bactericidal, fungicidal and insecticidal[4]. Modern preservative formulations have been unable to solve the problem of preserving corpse. The use of herbs is therefore preferred because they are relatively cheap, of medicinal importance, has no known side effects, and is abundantly available in attempt to kill resistant strains of microorganisms. Corpses preserved with these natural products are more acceptable and perceived as safe. The aim of this study was to determine the preservative potential of *F. albida*in an attempted to identify the possible chemical component responsible for preservationused in northern Nigeria to preservative corpse.

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II. MATERIALS AND METHODS

Plant material:

The leaf and stem bark of *F.albida* was collected between the months of December and January, 2015-2016 from within and around Bwaranji, Jimeta, Adamawa State, Nigeria. The plant was identified and authenticated by a botanist in the Department of Plant science, ModibboAdama University of Technology Yola, Adamawa State, Nigeria were voucher number was deposited.

Preparation of Plant material

The plant parts (leaf and stem bark) were chopped into pieces and dried at room temperature to constant weight for 5 days. The dried parts were coarsely pounded using pestle and mortar and further reduced to powder using an electric blender and stored in a tightly covered glass jars for further studies.

Extraction of plant material

Cold extractions with methanol (99%) as described by [9], was carried out. One hundred (100) g of each sample was weighed into1000ml of the solvent methanol). the samples and solvent were stirred every 30 min for 3 h and allowed to stand for 24 h with the resultant solution filtered using Whatman filter paper No 1 under room temperature (25 ^{0}C) to obtain the methanol extracts. The extracts obtained above were concentrated to one third of its original volume on a water bath. The concentrates were transferred into reagent bottles and stored in a refrigerator for phytochemical screening, FT-IR analysis.

Phytochemical Analysis

Chemical tests were conducted on the methanolicleaf and stem bark extracts as described by [23] [19].

1) Test for Tannins:

About 0.5g of the extract was boiled in 10ml of water in a test tube and then filtered. A few drops of 0.1% Ferric chloride was added and observed for brownish green or a blue black colouration.

2) Test for Saponins:

One gram of the extract was boiled in 10 ml of distilled water in a water bath and filtered. About 5 ml of the filtrate was mixed with 5 ml of distilled water and shaken vigorously for a stable persistent froth. The frothing was mixed with 3 drops of olive oil and shaken vigorously after which the formation of emulsion was observed.

3) Test for Flavonoids:

Five milliliters of dilute ammonia solution was added to a portion of the extract followed by addition of Conc. H_2SO_4. Observation of yellow coloration in the extract indicates the presence of flavonoids.

4) Test for Steroids:

Two milliliters of acetic anhydride was added to 0.5 ml of the extract and then followed with 2 ml H_2SO_4. The change of colour from violet to blue or green indicates the presence of steroids.

5) Test for Alkaloids:

About 0.5g of the extract was stirred with 5 ml of 1% HCl on the steam bath. The solution was filtered and 1ml of the filtrate was treated with 2 drops of picric acid. The turbidity of the filtrate on addition of picric acid indicates the presence of alkaloids.

6) Test for Terpenoids:

Five milliliters of methanolic extract was mixed with 2 ml of chloroform, 3ml of conc. H_2SO_4 was carefully added to form a layer. Observation of reddish brown coloration of the interface that was formed indicates the presence of terpenoids.

7) Test for Cardiac Glycosides:

Five milliliters of methanolic extract was treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution. About 1ml of conc. H_2SO_4 was added to the mixture. A brown ring of the interface indicates a deoxysugar characteristic of cardenolides.

III. FOURIER TRANSFORM INFRARED SPECTROPHOTOMETER (FT-IR)

Fourier Transform Infrared Spectrophotometer (FT-IR) is perhaps the most powerful tool for identifying the types of chemical bonds/functional groups present in the phytochemicals. The wavelength of light absorbed is salient feature of the chemical bond as can be seen in the annotated spectrum. By interpreting the infrared absorption spectrum, the chemical bonds in a compound can be determined.

Dried powder of the plant extracts of *Faidherbiaalbida* was used for FT-IR analysis. 10 mg of the dried extract powder was encapsulated in 100 mg of KBr pellet, in order to prepare translucent sample discs. The powdered sample of each extracts was loaded in FT-IR spectroscope (Shimadzu, Japan), with a Scan range from 400 to 4000 cm^{-1} with a resolution of 4 cm^{-1}.

IV. RESULTS

The results of phytochemical analysis of *F. albida* leave extracts revealed the presence of alkaloids, tannins, steroids and terpenes, while that of the stem bark showed the presence of alkaloids, tannins, saponins, steroids, terpenes and cardiac glycoside as shown in Table 1.

Table 1. Phytochemical analysis of leave and stem bark extracts of *F. albida*

Bioactive components	Leaf extracts	Stem bark extracts
Alkaloids	+	+
Saponins	+	+
Tannins	-	+
Flavonoids	-	-
Steroids	+	+
Terpenes	+	+
Cardiac glycosides	-	+

Keywords: + = present - = absent

Absorption Frequencies of FT-IR Result Obtained from Stem bark Extracts

FTIR analysis of the stem bark extracts of F. Albida has absorption bands and the wave numbers (cm-1) of the prominent peaks obtained were described in Table 3. The peak at a frequency of 2850 cm-1, 2920 cm-1 and 1750 cm-1 were strong while the others vary from medium to weak.

Table 2. FT-IR analysis data interpretation of the stem bark methanolic extracts of *F. albida*

Type	Absorption Frequency (cm^{-1})	Intensity	Remark an assignment
Methylene group (CH_2)	2850.00	S,N	Symmetry stretching
Methylene group (CH_2)	2920.00	S,N	Asymmetry stretching
NH group (amine)	3400.00	B,M	Primary amine stretching
OH group (alcohol)	3640.00	N,M	OH free stretching
Carbonyl C=O	1750.00	S,N	C=O stretching
Alkenyl (alkene)	1620.00	M,N	Conjugated alkenes stretching
Methylene group (CH_2)	1450.00	S,W	CH_2 Scissoring
Methylene group (CH_2)	1165.00	S,W	CH_2 Wagging
Halo compound	650.00	W,N	C-Br stretching

Key word: S=Strong N=Narrow B=Broad M=Medium W=Weak

Absorption Frequencies of FT-IR Result Obtained from Stem Bark Extracts

FT-IR analysis of the leaf extracts of *F. albida* has absorption bands and the wave numbers (cm^{-1}) of the prominent peaks obtained were described in Table 3. The peak at a frequency of 3310 cm^{-1} and 2926.57 cm^{-1} were strong while the others vary from medium to weak.

Table 3. FT-IR analysis data interpretation of the methanolic leaf extracts *F. albida*

Type	Absorption frequency (cm^{-1})	Intensity	Remark an assignment
OH group (alcohol)	3310.00	B,S	OH-stretching, H-bonded
Methylene group (CH_2)	2926.57	W,N	Asymmetry stretching
Methylene group (CH_2)	2855.97	W,N	Symmetry stretching
Carbonyl group	1740.40	N,W	C=O stretching aldehyde
Aromatic C=C group with phenyl nucleus	1609.42	W	C=C skeletal stretching
Methylene group	1451.00	W	C-H bending
C-N amine	1045.59	W	C-N stretching

Key word: S=Strong N=Narrow B=Broad M=Medium W=Weak

V. DISCUSSION

The phytochemical analysis of methanolic extracts of the leaf of *F. albida*in this study revealed the presence of alkaloids, tannins, terpenes and steroids while that of the methanolicstem bark extractsrevealed the presence of tannins,saponins, alkaloids among others (Table 1). The result from stem bark is in agreement with the work of [21] [12] [16]but in contrast with that of [10] who stated that only volatile oil out of these bioactive components was present in the stem bark. According to [12] the observed differences could be due to environmental changes where the plants were collected or seasonal changes that could have altered the plant components. It could also have been as a result of changes during extraction and / or storage. It also depend entirely on which drying method have been adopted.

The presence of secondary metabolites in plants, produce some biological activity in man and animals and it is

responsible for their use as herbs [14] and therefore explains its traditional use as health remedy. Secondary metabolites in plants confers them protection against bacterial, fungal and pesticidal attacks and thus are responsible for the exertion of antimicrobial activity against some microorganisms [15]. Tannins have been reported to hasten the healing of wound, inflamed mucus membrane and to arrest bleeding [26]. The tannin-containing plant extracts were used as astringents, against diarrhoea, as diuretics, against stomach and duodenal tumours and as anti-inflammatory, antiseptic, antioxidant and haemostatic pharmaceuticals [13].

From the result in Fig. 1, the methanolic leaf extracts has absorption bands, the wave number (cm^{-1}) of the prominent peaks obtained were described in Table 3. The IR spectrum of different extracts reveals structural information about major and minor constituents. The peak at 3419 cm^{-1} assigned to the O-H stretching vibration. In addition, the peak at 1740 cm^{-1} assigned to the C=O stretching vibration means that some carbonyl compounds existed in the leaf extracts. So, depending on the fingerprint characters of the peaks positions, shapes and intensities, the fundamental components may be identified [1]. The peaks at 2926 cm^{-1} narrow strong belong to CH_2 (methylene) asymmetry alkane and likewise peak at 2855 cm^{-1} which is narrow weak assigned to CH_2 (methylene) symmetry alkane; meanwhile the peak intensity at 1609 cm^{-1} is weak and was assigned to C=C skeletal stretching of alkene. The remaining peaks at 1451cm^{-1} which is also weak was assigned to methylene CH_2 bending alkane and 1045 cm^{-1} medium belong to C-N stretching amine. Presence of C=O, C-H, C=C and C-O, C-C and C-O bonding structures are responsible for the formation of alkyl groups, methyl groups, alcohols, ethers, esters, carboxylic acid, anhydrides and deoxyribose[3] [20].

From the result in Fig. 2, the methanolic stem bark extracts of *F. albida* contained absorption bands as were describe in Table 4. The characteristic strong and narrow band at 2850 cm^{-1} assigned to methylene (CH_2) group symmetry stretching. Meanwhile, the peak at 2920 cm^{-1} also narrow and strong assigned to methylene (CH_2) group asymmetry stretching. The presence of peak at 3400 cm^{-1} medium belongs to an amine group (NH) stretching. Another characteristics peak is at 3640 cm^{-1} medium and narrow was assigned to free OH stretching. The strong peak at 1750 cm^{-1} is characteristic of C=O stretching with accompanied strong but narrow peaks at 1450 $cm^{-1}$and 1165 cm^{-1} were assigned to methylene group of alkane scissoring and wagging respectively. The medium absorption band at 1620 cm^{-1} belong to C=C conjugated alkene stretching. The only weak peak observed in the stem bark was found at a frequency of 650 cm^{-1} and was assigned to C-Br stretching.

The leaf methanolic extracts suggests the presence of alcohol, aromatic benzene, amine and aldehyde. On the other hand, the stem bark methanol extracts also suggest the presence of alcohol, alkyl bromide, primary amine, conjugated alkene, alkane, and aldehyde (formaldehyde) which is indicative of methylene group both symmetry and asymmetry, scissoring and wagging with accompanying carbonyl group. Many workers revealed the FT-IR spectrum as an effective tool for differentiating, classifying and discriminating closely related plants and other organisms.

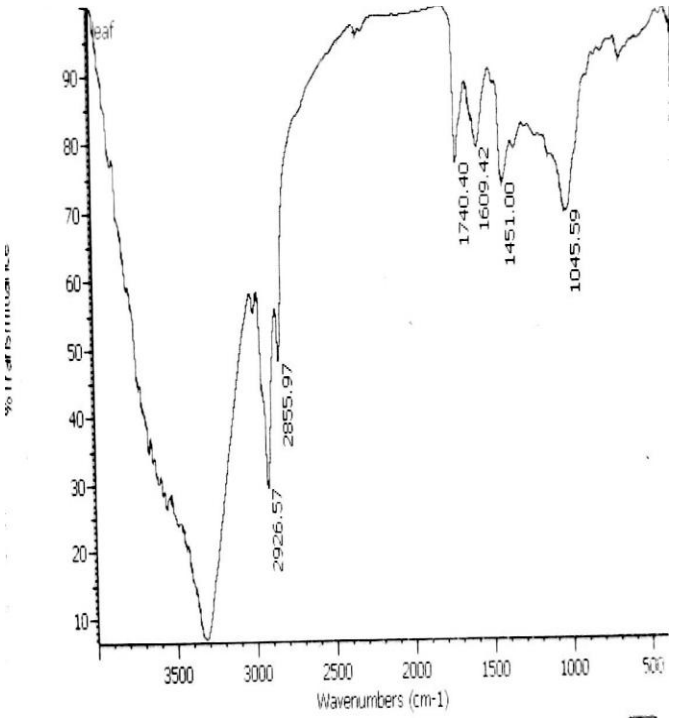
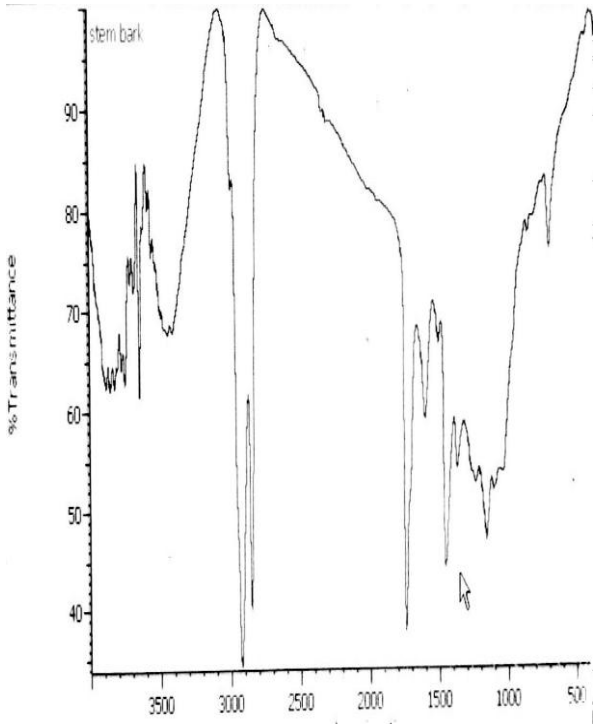


Figure 1: FTIR spectra of methanolic leaf Extract.



Wave number (cm^{-1})

Figure 2: FTIR spectra of methanolic stem bark extract.

CONCLUSION

F. albida has been used for treatment of diseases such as inflammation, hemorrhage, diarrhea and ophthalmia. From the present study, the leaf and stem bark plantmethanolic extracts showed an abundant production of phytochemicals as secondary metabolite which can serve as a source of preservative agent. Base on the FT-IR analysis, the stem barks extracts contained 9 peaks, while leaf the least-7 peaks. The presence of several compound specifically alcohol and formaldehyde were responsible for the preservative activity of the plants. This support the traditional used of the plant as preservative agent. Other spectroscopic analysis such as NMR, Ultra-violent and mass spectroscopy can further be done to confirm the presence of formaldehyde and alcohol.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

[1] G.Chen, R. J., Xu, G. Y., Wang, H. Y., Xu H. Z. and Liu, Y. M. (2001). Study on Isolation and Structure of Polysaccharide XC-1 from Angelica sinesis (oliv) diels. Chemistry Bulletin/HuaxueTongbao, 64(6): 372-374.

[2] 2.C2CTFT (Centre technique forestier tropical), (1989). Faidherbiaalbida(Del.) A. Nogent-sur-Marne, France: CTFTand Wageningen, Netherlands: Centre technique de cooperationagricoleetrurale.pp.72 .

[3] 3.Dukor, R. K. (2002). Vibrational Spectroscopy in the Detection of Cancer, in Handbook of Vibrational Spectroscopy, John Wiley and Sons, Chichester, pp. 3335-3360.

[4] 4.Eri4.Erich Brenner (2014). Human Body Preservation – Old and New Techniques.J. Anat., 224: 316-344. Doi: 10.1111/joa.12160.

[5]

[6] 5.Gaber, K. E., Singhal, U. and Daowad, O. (2013). Hypolipidaemic Effects of Some Common Plants Extracts in Type 2 Diabetic Patients at Eldabba Area (North Sudan). IOSR.J. Pharmacy Biol. Sci., 8: 38-43.

[7] 6.Ibr6.Ibrahim, J. A., Muazzam, I., Jegede, I. A. andKunle O. F. (2010).Medicinal Plants and Animals Sold by the "Yan-Shimfidas" of Sabo Wuse in Niger State, Nigeria. African Journal of Pharmacy and Pharmacology, 4(6): 386-394

[8] 8.Ismail, M. A., Eman, A. M., Marwa, R. M., Fatma, F. A., Ibrahim, B. A. and Magdi, A. E. (2014). Preliminary Phytochemical Screening, Plant Growth Inhibition and Antimicrobial Activity Studies of Faidherbiaalbida Legume Extracts. Journal of the Saudi Society of Agricultural Sciences,http://dx.doi.org/10.1016/j.jssas.2014.06.002

[9] 9. Ju9.Junaid, S. A., Olabode, A. O., Onwuliri, F. C., Okworiu, A. E. and Agina, S. E. (2006). The Antimicrobial Properties of Ocimumgratissimum Extracts on some Selected Bacterial Gastrointestinal Isolates. Afr. J. Biotechnol., 5(22): 2315-2321.

[10] 10. Kubmarawa, D., Ajoku, G. A., Enwerem, N. M. and Okorie, D. A. (2007). Preliminary Phytochemical and Antimicrobial Screening of 50 Medicinal Plants from Nigeria.Afr. J. Biotechnol., 6(14): 1690–1696.

[11] 11. 10.Lawal, A. R., Agunu, A., Ibrahim, H. and Ibrahim, K. (2012). Acute Toxicity and Pharmacognostic Studies of Root bark of Acacia albidaDel. (Fabaceae) Niger. J. Pharm. Sci., 11: 31-38.

[12] 12. Mahmoud, S. J., Zailani, H. A. and Wurochekke, A. U. (2013). In vivo Anti-diarrhoeal Effect of Methanolic Stem bark Extracts of Faidherbiaalbida.Sky Journal of Biochemistry Research, 2(2): 5 – 8.

[13] 13. 13.MamtaSaxena, JyotiSaxena, Rajeev Nema, Dharmendra Singh and AbhishekGupta.Phytochemistry of Medicinal Plants.Journal of Pharmacognosy and Phytochemistry2013; 1(6):168-182.

[14] 14. Mann, A., Yahaya, Y., Banso, A. and John, F. (2008). Phytochemical and Antimicrobial Activity of TerminaliaavicennioidesExtracts Against some Bacteria Pathogens Associated with Patients Suffering from Complicated Respiratory Tract Diseases. J. Med. Plants Res., 2(5): 94-97.

[15] 15. Marjorie, M.C. (1999). Plant Products as Antimicrobial Agents.ClinMicrobiol., 12(4): 564-582.

[16] 16. Osuntokun, O. T. and Olajubu, F. A. (2014). Comparative Study of Phytochemical and Proximate Analysis of Seven Nigerian Medicinal Plants.Applied science research journal, 2(1): 10 – 26.

[17] 17. Saka, A. R., Bunderson, W. T., Mbekeani, Y. and Itimu, O.A. (1990). Planning and Implementing Agroforestry for Small-holder Farmers in Malawi. In: Budd, W.D., (ed.). Planning for Agroforestry, Elsevier Science Publishers. Amsterdam, Netherlands, pp. 247-266.

[18] 18. Salawu, O. A., Tijani, A. Y., James, A. A. and Oga, E. F. (2010). Acute and Sub acute toxicity study of Ethanolic Extracts of Stem bark of Faibherbiaalbidain rats. Afr. Journal of Biotech., 9(8):12–1224.

[19] 19. Sofowora, A. (1993). Medicinal Plants and Traditional Medicine in Africa, 2nd Edition, Spectrum Books Ltd. Nigeria, pp.289.