FT-IR Analysis for Functional Groups Determination of Some Organic Compounds from the Seeds of *Ficus racemoas*[*]

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ABSTRACT

One Myanmar indigenous medicinal plant, *Ficus racemosa*, locally known as Yea Thapan, belonging to the family Moraceae was selected for evaluation of preliminary phytochemical screening, elemental composition and isolation of some organic compounds. The preliminary phytochemical screening was performed using a standard procedures. Preliminary phytochemical analysis revealed that alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic compound, reducing sugar and saponin were present in the seeds of *Ficus racemosa*. The elemental composition of sample was investigated by Energy Dispersive X-rays Fluorescence (EDXRF) spectral data. Moreover, some organic compounds were isolated and purified from ethyl acetate by using thin layer and coloum chromatographic techniques. The prominent functional groups in some organic compounds were assigned by Fourier Transform Infrared (FT-IR) spectral data.

Keywords : phytochemical, EDXRF, organic compound, FT-IR

1 INTRODUCTION

The plant is a large deciduous tree distributed all over India from outer Himalayan ranges, Punjab, Khasia mountain, Chota Nagpur, Bihar, Orissa, West Bengal, Rajasthan, Deccan and common is South India [18]. It is the member of the four sacred trees *Nalpamara (Ksirivrkasa)* meant to be planted around the home and temples. It is found throughout the year, grows in evergreen forests, moist localities and bank of streams, deciduous forests, to the elevation of 1800 m above sea level, often cultivated in villages for shade and its edible fruits [5,6,10,11].

Goolar is an attractive fig tree with a crooked trumk and a spreading crown. Unlike the banyan, it has no aerial roots. The most distinctive aspect of this tree is the red, furry figs in short clusters, which grow directly out of the trunk of the tree [2].

Ficus racemosa Linn has been extensively used in traditional medicine for a wide range of ailments. Its bark, fruits, leaves, roots, latex and seeds are medicinally used in different forms, sometimes in combination other herbs [3]. Bark is highly efficacious in threatened abortion and also recommended in urological disorders, diabetes, hiccough, leprosy, dysentery and piles[7,14,16,19]. The leaves are good wash for wounds and ulcers. They are useful in dysentery and diarrhoea. The infusion of bark and leaves is also employed as mouth wash to spongy gums and internally in dysentery, menorrhagia, effective remedy in glandular swelling, abscess, chronic wounds, cervical adenitis and haemoptysis [3, 16, 19]. The fruits are astringent, stomachic, refrigerent, dry cough, loss of voice, disease of kidney and spleen, astringent to bowel, styptic, tonic, useful in the treatment of leucorrhoea, blood disorder, burning sensation, fatigue, urinary discharges, leprosy, intestinal worms and carminative. They are useful in miscarriage, menorrhagia, spermatorrhoea, cancer, scabies, haemoptysis and visceral obstructions [13,17,19]. Roots are used in dysentery, pectoral complaints and diabetes, applied in mumps, other inflammatory glandular enlargements and hydrophobia [12]. Latex is aphrodisiac and administered in haemorrhoids, diarrhoea, diabetes, boils, traumatic swelling, toothache and vaginal disorders. Root sap is used for treating diabetes [15]. The sap of this plant is a popular remedy for mumps and other inflammatory enlargements [3,4,17].

2 MATERIALS AND METHODS

2.1 Materials

Commercial grade reagents and solvents were used without further purification. EDXRF spectrophotometer (AMETEX, England) was applied to determine the chemical elements in the sample. Silica gel (Merck Co. Inc Kiesel gel 60 F254, 70-230 mesh) was used for Column Chromatography. UV-Lamp (Lambda – 40, Perkin – Elmer Co, England) and iodine vapor were used as developing agents in column chromatography. FT-IR spectrometer (Shimadsu, Japan) was used for the identification of the functional groups of isolated organic compounds.

2.2 Sample Collection

The fruits of *Ficus racemosa* were collected from Kyaukse Township, Mandalay Region, Mandalay, Myanmar. The fruits were divided into two parts. The inner part of the seeds of fruits were air dried at room temperature for used throughout the experiment.

2.3 Preliminary Phytochemical Constituents of the Seeds of *Ficus racemosa*

Phytochemical investigation on the extracts of sample was carried out according to standard procedures and the presence of chemical constituents were identified and each of test was expressed as negative(-) or positive(+). [9]

2.4 Mineral Contents of Seeds of *Ficus racemosa*

The elemental composition of seeds of *Ficus racemosa* were examined by the Energy Dispersive X-ray Fluorescence (EDXRF) spectrophotometer at Department of Chemistry, Monywa University. (SPECTRO XEPOS EDXRF Spectrometer, Germany)

2.5 Extraction and Isolation of Pure Organic Compounds from Seeds of *Ficus racemosa*

The sample 500 g was percolated with 95% ethanol 2000 mL for about two months and then filtered and the filtrate was concentrated. The residue was re-extracted with 300 mL of ethyl acetate (EtOAc) and checked by TLC. The EtOAc extract (3.25 g) was separated by column chromatography using silica gel and eluent as n-hexane and ethyl acetate. The pure compound I (pale yellow needle crystal form), compound II (yellow oil form) and compound III (pale yellow oil form) were obtained. The R_f value of pure compound I is 0.52 (n-hexane:ethylacetate 2:3 v/v), pure compound II is 0.40(n-hexane: ethylacetate 1:1 v/v) and pure compound III is 0.51(n-hexane: ethylacetate 3:2 v/v) .

2.6 Study on FT-IR Spectrum of Pure Compounds

The Fourier Transform Infrared spectrum of compound I, compound II and compound III were measured at Department of Chemistry, Monywa University. The FT-IR spectrum informs the prominent functional groups containing the compounds. The infrared spectrum of compound I, compound II and compound III were described in Figure.

3 RESULTS AND DISCUSSION

3.1 Preliminary Phytochemical Test for Seeds of *Ficus racemes*

Phytochemical test were carried out to detect the presence of organic constituents in the seeds of F*icus racemosa*. The result were tabulated in Table (1).

Table (1) Phytochemical Tests of the Seeds of *Ficus racemosa*

No	Test	Solvent extract	Test reagent	Observation	Remark
1.	Alkaloid	1%HCl	Dragendorff's Reagent	Pale orange ppt	+
			Wagner's Reagent	Reddish brown ppt	+
2.	Flavonoid	95% Ethanol	Conc: HCl, Mg turning	Yellow	+
3.	Glycoside	D/W	10% lead acetate	White ppt	+
4.	Steroid	95% ethanol	$CHCl_3$, acetic anhydride Conc: H_2SO_4	Green colour	+
5.	Polyphenol	95% ethanol	1% K_3 [Fe $(CN)_3$]	Greenish blue ppt	+
6.	Phenolic	D/W	10% $FeCl_3$	Brown colour	+
7.	Reducing Sugar	D/W	Benedict's Solution	Brick red	+
8.	Saponin	D/W	Shaken	Forth	+

(+) = Presence, (–) = absence D/W = distilled water

According to these results, the seeds of *Ficus racemosa* extract consists of alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic compound, reducing sugar and saponnin respectively.

3.2 Mineral Contents of Seeds of *Ficus racemosa*

The mineral contents of seeds of *Ficus racemosa* were determined and the result are show in Table (2).

Table (2) Mineral Contents of seeds of *Ficus rocemosa*

No	Symbol	Element	Amount of Concentration
1.	K	Potassium	1.1100%
2.	Ca	Calcium	0.5022%
3.	P	Phosphorous	0.1291%
4.	S	Sulfur	0.0921%
5.	Fe	Iron	0.0122%
6.	Cu	Copper	0.0010%
7.	Ti	Titanium	0.0101%
8.	Zn	Zinc	0.0011%
9.	Mn	Manganese	0.0012%
10.	Rb	Rubidium	0.0012%
11	Sr	Strontium	0.0013%

From the above data, the mineral composition of the seeds was shown in Table. It was observed that potassium was the most abundant mineral in sample. The seeds was a god source of calcium and phosphorous. The trace elements such as sulfur, iron, copper, titanium, zinc, manganese, rubidium and strontium were detected.

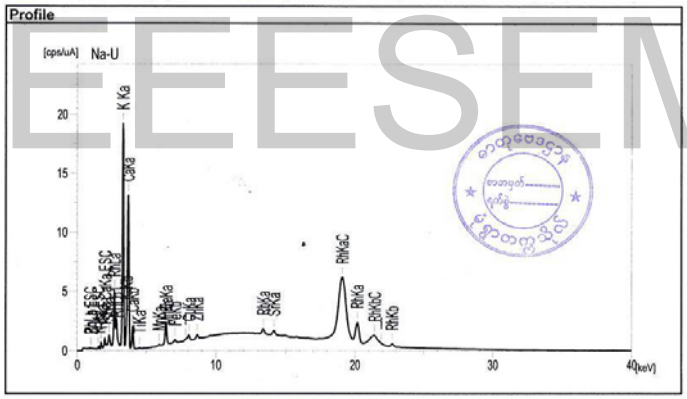

Figure (1) EDXRF Analysis of Seeds of *Ficus racemosa*

3.3 Thin- Layer Chromatography of Pure Compound I, II and III

The isolated organic compound I, II and III were checked by TLC (using n hexane : ethyl acetate (2:3, v/v), (1:1, v/v) and (3:2/ v/v) iodine developer. The R_f values of these three organic compound were determined. [8] The R_F values of compound I, II and III are 0.52, 0.40 and 0.51.

Compound I		**Compound II**		**Compound III**	
Solvent system	= n-hexane :EtOAc (2:3, v/v)	Solvent system	= n-hexane : EtOAc (1:1,v/v)	Solvent system	= n-hexane :EtOAc (3:2, v/v)
Developer	= Uv and Iodine	Developer	= UV and Iodine	Developer	= Uv and Iodine
Adsorbent	= Silica-gelplate	Adsorbent	= Silica-gel plate	Adsorbent	= Silica-gelplate
R_F value of Compound I	= 0.52	R_F value of Compound II	= 0. 40	R_F value of Compound III	= 0.51

3.4 FT-IR Assignment of Isolated Compound (I)

In the FT-IR spectrum of compound (1), the peaks at 2924.50 and 2854.25 cm^{-1} are due to the asymmetric and symmetric C-H stretching vibrations of sp^3 hydrocarbons. The band at 1710.40 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The band which occur at 1461.34 cm^{-1} should be the C-H in plane bending vibration of sp^3 hydrocarbons. The C-O stretching vibration of alcohol group was observed at 1376.68 and 1244.06 cm^{-1}. Finally, the bands at 784.36 cm^{-1} and 761.11 cm^{-1} represent the $=CH^2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (2), the compound (1) contains the sp^3 hydrocarbon and carbonyl functional groups.

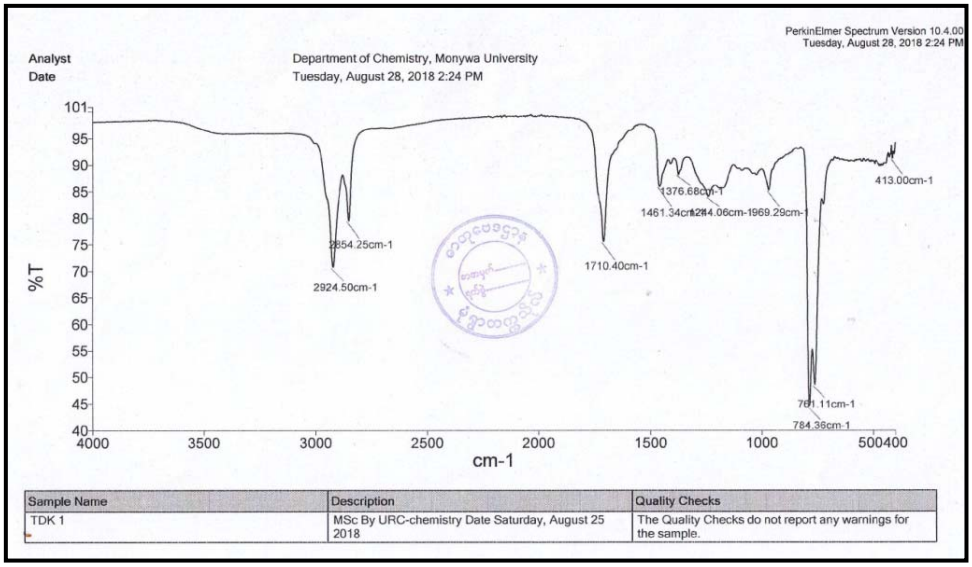

Figure (2) FT-IR Spectrum of Isolated Compound (I)

3.5 FT-IR Assignment of Isolated Compound (II)

In the FT-IR spectrum of compound (1), the peaks at 2923.42 and 2852.91 cm^{-1} are due to the asymmetric and symmetric C-H stretching vibrations of sp^3 hydrocarbons. The band at 1712.01 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The band which occur at 1652.92 cm^{-1} should be the C-H in plane bending vibration of sp^3 hydrocarbons. The C-O stretching vibration of alcohol group was observed at 1456.03 and 1376.85 cm^{-1}. The bands appeared at 1245.68 and 1172.80 cm^{-1} should be C–C–O stretching vibration of ester group. Finally, the bands at 784.35 cm^{-1} and 761.07 cm^{-1} represent the $=CH^2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (3), the compound (2) contains the sp^3 hydrocarbon and carbonyl functional groups.

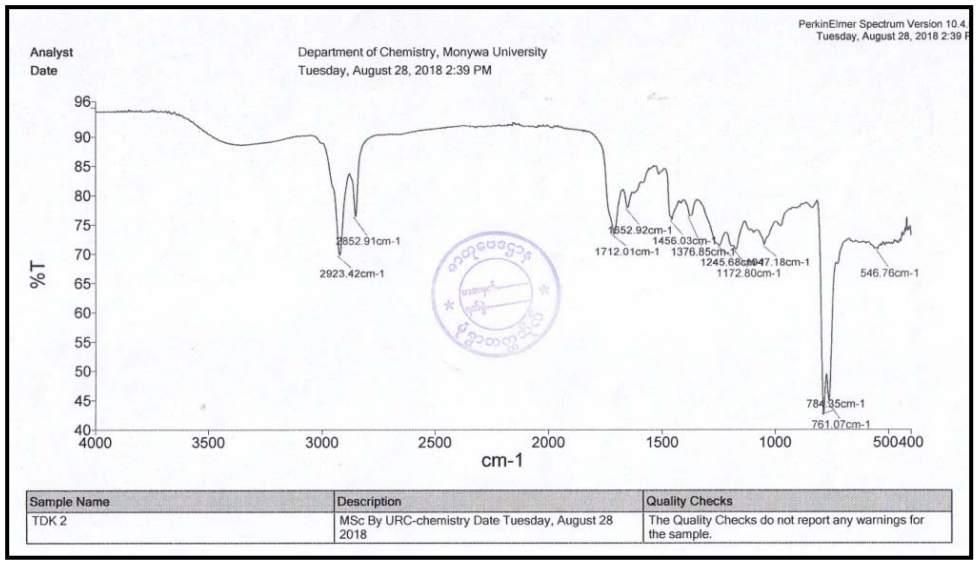

Figure (3) FT-IR Spectrum of Isolated Compound (II)

3.6 FT-IR Assignment of Isolated Compound (III)

The band at 3382.24 cm^{-1} indicates the O-H stretching vibration of alcohol group. The peaks at 2923.20 cm^{-1} and 2853.10 cm^{-1} should be asymmetric and symmetric C-H stretching vibration of sp^3 hydrocarbons. The band at 1715.10 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The bands at 1171.43 cm^{-1} and 1047.04 cm^{-1} should be C–C–O stretching vibration of ester group. The bands which occur at 1456.19 cm^{-1} and 1376.37 cm^{-1} representing the C-H bending vibration of methyl groups. Finally the bands at 784.17 cm^{-1} and 762.92 cm^{-1} represent the $=CH^2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (4), the compound (III) shows the presence of –OH functional groups, sp^2 hydrocarbons, ether and Z- or cis- alkene groups.

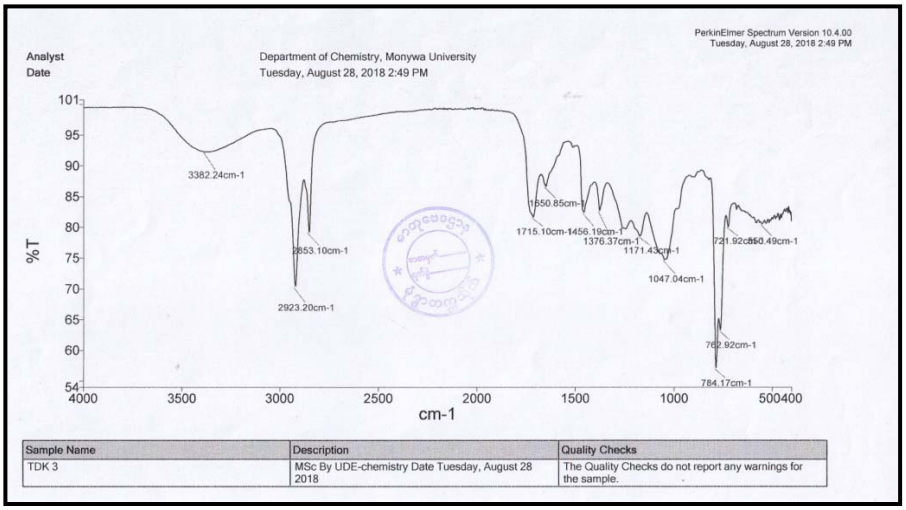

Figure (4) FT-IR Spectrum of Isolated Compound (III)

4. CONCLUSION

In this research work, the crude extract of seeds of *Ficus racemosa* gave positive tests for alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic, reducing sugar and saponin respectively. The elemental composition of seeds of *Ficus racemes* were determined by using EDXRF method. The mineral composition of the seeds was shown in Table. It was observed that potassium was the most abundant mineral in sample. The seeds was a good source of calcium and phosphorous. The trace elements such as sulfur, iron, copper, titanium, zinc, manganese, rubidium and strontium were detected. The elements are potassium, calcium, phosphorus, sulfur, iron, copper, titanium, zinc, manganese, rubidium and strontium respectively.

The yield percent of Compound I, Compound II and Compound III were observed as 0.0039%, 0.0027 % and 0.025%. The R_f values of these three organic compound were determined. The R_F values of compound I, II and III are 0.52, 0.40 and 0.51 respectively. The functional groups determinations of the compounds I, compound II and compound III were done by FT- IR spectral data. Compounds I contain the sp^3 hydrocarbon and carbonyl functional groups. Compound II contain contains the sp^3 hydrocarbon and carbonyl functional groups. Compound III contain shows the presence of –OH functional groups, sp^2 hydrocarbons, ether and Z- or cis- alkene groups. Especially, in compound I, compound II and compound III contains the same $=CH^2$ wagging vibration of exo-methylene group.

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