ISSN 2581 – 4303

Available Online at www.ijpba.info
International Journal of Pharmaceutical & Biological Archives 2019; 10(2):78-82

RESEARCH ARTICLE

Fourier-transform Infrared Analysis and *In Vitro* Antibacterial Activity of *Ormocarpum cochinchinense* (Elumbotti)

Sivakumar Thirumal[1,2]*, Gajalakshmi Duraikannu[3]

[1]*Department of Botany, Annamalai University, Annamalai Nagar, Tamil Nadu, India,* [2]*Department of Botany, Thiru A. Govindasamy Govt. Arts College, Tindivanam, Tamil Nadu, India,* [3]*Department of Chemistry, University College of Engineering Kakuppam, Villupuram (A Constituent College of Anna University-Chennai) Tamil Nadu, India*

Received: 02 January 2019; Revised: 01 March 2019; Accepted: 4 April 2019

ABSTRACT

The present research is to assess the Fourier transform infrared (FT-IR) analysis and antibacterial activities of *Ormocarpum cochinchinense* leaf extract using different solvents dimethyl sulfoxide (DMSO), ethyl acetate, ethanol (EtOH), methanol (MeOH), and chloroform. To investigation of FT-IR analysis and antibacterial activities become used agar well diffusion method. FT-IR vibrational bands confirmed that the fractions of *O. cochinchinense* had lots of biologically active compounds which include H–Bonded Phenols, alkanes, carboxylic acid, carboxylic acid, flavonoids, polyphenols, catechins, aromatics, and aliphatic amines. Antibacterial activity showed that the strongest activities had been produced by MeOH solvent reaction with all the human pathogens. This research may be concluded that MeOH solvent extract of *O. cochinchinense* might be a capability for the treatment of antibacterial activities.

Keywords: Antimicrobial activity, Fourier-transform infrared, methanol, *Ormocarpum cochinchinense*, solvents

INTRODUCTION

Plant medicine had been used for historic time to fashionable for human diseases.[1] Medicinal plants are geared up from a variety of plant substances as leaves, stems, roots, barks, inflorescence, etc.[2] A medicinal plant contains biologic energetic principles with unique therapeutic effects. Herbal vegetations are herbal resources of phytochemical constituents that may be used in opposition to many human diseases in present day.[3] Novel healing sellers were advanced through the use of pharmacological houses of plants and may be used as leads.[4] The therapeutic values of this herbal lie in bioactive compounds that produce genuine physiological moves in the human body. Those phytochemical parts in the medicinal plant include alkaloids, steroids, flavonoids, terpenoids, saponins, acidic glycosides, tannins, fats and oil compounds, and coumarins.[5] The separation is now seeking to India due to its wealthy biodiversity of medicinal plant life and an abundance of traditional therapeutic systems[6]. In India, many herbal flowers are generally used by all sections of people either immediately as folk remedies or indirectly in prescription drugs arrangements of a cutting-edge medical drug. There is a required that the medicinal flowers be evaluated for phytochemistry if you want to determine the potentials of these indigenous resources of drugs. Consequently, in cutting-edge study, one medicinal plant changed into decided on for phytochemical analysis. *Ormocarpum cochinchinense* (OC) is a small herb observed in Tamil Nadu, typically referred to as "Elumbotti" belongs to Leguminosae family.

This herb was confirmed as a medicinal drug using people from in advance days to until now. Maximum drugs in practice were formulated by plant-based metabolites.[7] The traditional expertise about medicinal herbs and their effect in opposition to sicknesses became recognized by historic Indians.[8] However, clinical evidence turned into unknown because it has been kept secreted using village vaidyas.[9] However, there is no clinical evidence justifying the traditional use

***Corresponding Author:**
Sivakumar Thirumal,
E-mail: drtsivanano@gmail.com

of *O. cochinchinense* leaves inside the treatment of "bone healing." The existing research turned into made to look at the biochemically energetic herbal products, observed antimicrobial activity inside the extraordinary solvent extracts prepared from the leaves of OC. The prepared solvent leaf extract of *O. cochinchinense* qualitative, *in vitro* antioxidant activities, GC-MS analysis.[10-12] In the present work, I reported that Fourier-transform infrared (FTIR) analysis and antimicrobial activity of OC.

MATERIALS AND METHODS

Plant materials

The leaves of OC leaves collected from local place of Villupuram District, Tamil Nadu, India, during October–January, 2015.

Preparation of plant extract

In green leaves had been dried powdered the usage of with a mechanical grinder and stored in a jib lack cover. Leaf powder (1.5 kg) turned into refluxed with unique solvents, dimethyl sulfoxide (DMSO), ethyl acetate (EtoAc), ethanol (EtOH), methanol (MeOH), and chloroform ($CHCl_3$) for 7 days. The filtrate changed into concentrated to dryness in a warm air oven at 32° C to render five solvent extract for research.

Chemicals

All chemical had been purchased from SD fine chemical company Mumbai, and all chemical substances had been an analytical agent.

Antibacterial activity

Bacterial strains of *Klebsiella aerogenes* (MTCC 98), *Escherichia coli* (MTCC 443), *Bacillus subtilis* (MTCC 2295), and *Staphylococcus aureus* (MTCC 3160) were used and maintained in nutrient agar (HiMedia, Mumbai) slants at 4°C. Muller-Hinton agar (HiMedia, Mumbai) plates had been prepared, sterilized, solidified, and swabbed uniformly. *In vitro* antibacterial activity assay of aqueous solvents DMSO, EtoAc, EtOH, MeOH, and $CHCl_3$ was determined by way of agar well diffusion methods. The various concentrations of aqueous solvents 10, 20, 30, 40, and 50 µl have loaded into the wells of all plates. All bacterial strains are (*K. aerogenes*, *E. coli*, *B. substilis*, and *S. aureus*), obtained from Rajah Muthiah Medical College, Annamalai University, Annamalai Nagar. Area of inhibition changed into measured(mm) after incubating the plates at 37°C for 24 h triplicates have been maintained.

FT-IR evaluation of aqueous leaf extract

In order to identify the biomolecules present in the leaf extract of *O. cochichinense*, FT-IR spectra of the aqueous leaf extract had been analyzed with the aid of FT-IR spectroscopy (FT-IR Shimadzu 8400 s, Japan). The FT-IR analysis changed into complete with KBR pellets at the Department of Chemistry, Annamalai University, Annamalai Nagar, Tamil Nadu, India. The FT-IR turned into recorded inside the range of 4000–500 cm/g. The various modes of vibrations had been recognized and assigned to determine the phytochemicals are a presence in the leaf extract.

Statistical analysis

Experiments have been performed in triplicates and the results have been expressed as mean±standard deviation. The statistical analysis was made with origin software (Origin Pro evaluation, 2018).

RESULTS AND DISCUSSION

FT-IR analysis

The FT-IR spectrum of clean and dried leaf extracts of *O. cochinchinense* are shown in Figure 1 resolved peaks at 3938, 3911, 3874, 3763, 3381, 2922, 2854, 2335, 2034, 2007, 1965, and 466 cm/g unresolved height at 1645, 1425, 1381, 1321, 1244,1153, 1024, 829, 665, 615, and 1730 the peaks received have been due to amide i, ii, and iii, H–Bonded Phenols, alkanes, carboxylic acid, alkanes, aromatic rings, aliphatic amines, and saturated methyl agencies discovered in the *O. cochinchinense* leaf extracts.

The FT-IR spectra of the leaf extracts are shown in Tables 1 and 2 as the dependence of radiation absorption on wave number. The FT-IR spectrum indicates three absorption bands between 2854 and 3938 cm^{-1} that correspond to the c–h stretching

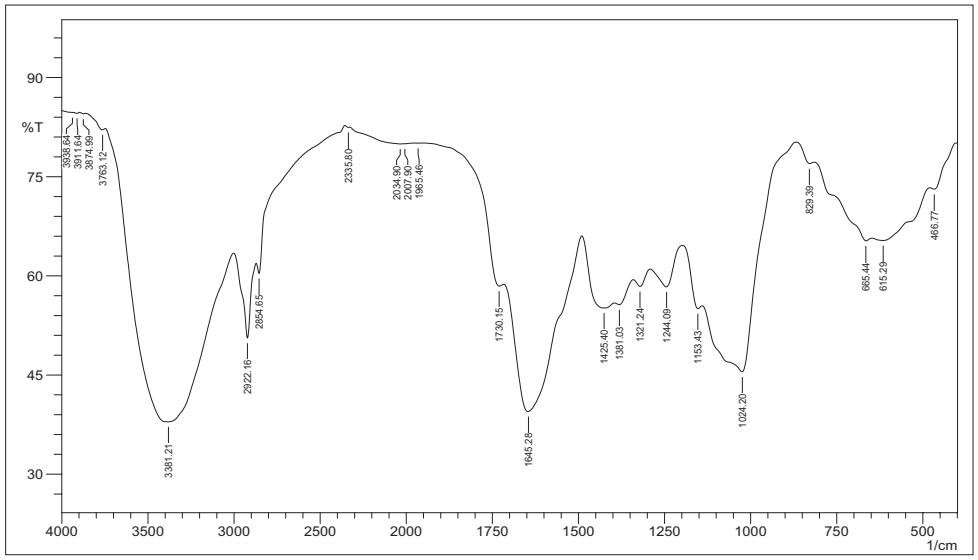

Figure 1: Fourier-transform infrared analysis of *Ormocarpum cochinchinense* leaf extracts

Table 1: Infrared vibrational bands, intensity, area of *Ormocarpum cochinchinense* leaf extract

S.no	Peak	Intensity	Correlated intensity	Base (H)	Base (L)	Area	Correlated area
1	466.77	73.126	1.265	478.35	405.05	8.649	0.23
2	615.29	65.352	1.767	646.15	480.28	28.015	1.761
3	665.44	65.311	1.593	813.96	648.08	25.547	1.043
4	829.39	76.988	1.021	866.04	815.89	5.353	0.131
5	1024.2	45.485	20.529	1139.93	867.97	62.396	15.587
6	1153.43	55.044	2.379	1195.87	1141.86	12.455	0.439
7	1244.09	58.34	4.476	1290.38	1197.79	20.021	1.34
8	1321.24	58.404	1.665	1340.53	1292.31	10.899	0.291
9	1381.03	55.649	1.159	1394.53	1342.46	12.689	0.253
10	1425.4	55.146	3.912	1489.05	1396.46	22.313	2.203
11	1645.28	39.488	21.549	1716.65	1490.97	68.439	22.071
12	1730.15	58.457	1.332	1948.1	1718.58	30.139	0.189
13	1965.46	80.083	0.009	1973.18	1950.03	2.232	0.001
14	2007.9	79.989	0.017	2013.68	1975.11	3.73	0.002
15	2034.9	79.958	0.187	2328.08	2015.61	28.898	0.674
16	2335.8	82.473	0.074	2355.08	2330.01	2.089	0.008
17	2854.65	60.367	2.124	2870.08	2357.01	60.356	0.221
18	2922.16	50.588	11.902	3001.24	2872.01	30.811	4.564
19	3381.21	37.921	35.113	3745.76	3003.17	218.647	113.714
20	3763.12	82.113	0.022	3765.05	3747.69	1.479	0.002
21	3874.99	84.507	0.123	3894.28	3867.28	1.963	0.01
22	3911.64	84.59	0.147	3932.86	3896.21	2.651	0.015
23	3938.64	84.717	0.027	4000.36	3934.78	4.69	0.014

Table 2: Infrared vibrational bands of *Ormocarpum cochinchinens*e leaf extract

Wave number (cm−1)	Vibration band/group	Chemical group
3938–3381	O–H stretch	H–bonded phenols
2922–2007	C–H stretch (asym.), O–H stretch, C–H stretch (sym.)	Alkanes, carboxylic acid, alkanes
1965–1730	Asymmetric –CH2–, symmetric –CH3 and –CH2– stretching vibrations	Carboxylic acid
1645–1425	C=O stretch (carbonyls)	Flavonoids, polyphenols, catechins
1381–1244	C–C stretch (in ring)	Aromatics
1153–1024	C–N stretch	Aliphatic amines
829–466	C–H strech	Alkanes

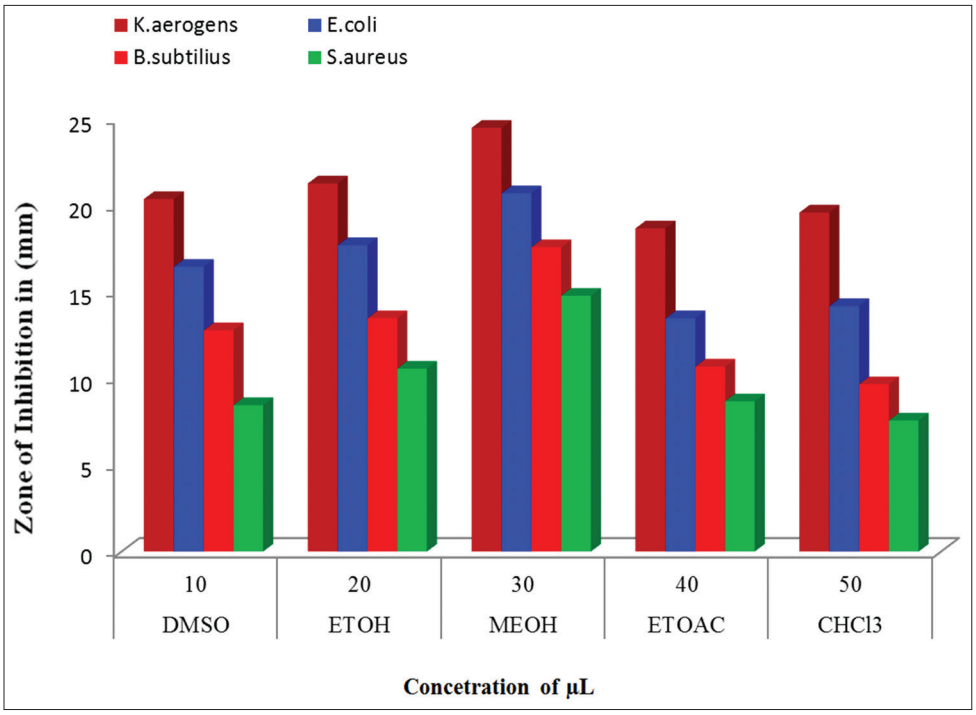

Figure 2: Antibacterial activity of *Ormocarpum cochinchinense* leaf extracts against different human pathogens

vibration in aliphatic and H-Bonded phenols. The aromatic systems are showed using the skeleton vibration bands among 1381 and 1645 cm^{-1}.[13,14] The variety of those bands and their intensities relies on substitution in fragrant compounds. Among 1024 and 1200 cm^{-1}, you could have a look at a stretching absorption band of CAO for phenols. The "shoulder" peak at 1105 cm^{-1}[15] is from carbohydrate, whereas the bands at 1024 cm^{-1} and 829 cm^{-1} are from the vibrational frequency of the CH_2OH groups of carbohydrates.[16] The vibration band of OH is located between 1381 and 1024 cm^{-1}. An absorption band of low depth is visible at 1645 cm^{-1}, which can be related to the stretching vibration of the carbonyl group. The evaluation of the leaf extract FT-IR spectra confirms the presence of aromatic and/or aliphatic compounds that have hydroxyl and likely carbonyl groups. The following additional absorption band at 1645 cm^{-1} corresponds to the stretching vibration of the carbonyl group while the absorption bands at 1425 cm^{-1}, 1381, and 1244 cm^{-1} may be related to the presence of chlorophyll.[17] The location of that band depends at the presence and location of different functional groups. The presence of the wideband between 3300 and 3900 cm^{-1} and the bands inside the variety of 1024–1381 cm^{-1} can suggest that carbonyl group is derived from carboxyl groups or it can be found in phenyl compounds.

Antibacterial activity

Organic solvent leaf extracts exhibited more consistent antibacterial activity than aqueous leaf extract. Antibacterial activity is extended with the increase inside the attention of the extract MeOH DMSO, EtoAc, EtOH, and $CHCl_3$. The maximum zone of inhibition of (24±0.25 mm) turned into exhibited by way of MeOH leaf extract of *O. cochinchinense*. The DMSO, EtoAc, EtOH, and $CHCl_3$ ethanolic and aqueous leaf extract confirmed that the maximum area of inhibition in the various concentrations is shown in Figure 2.

This activity can be due to the potential of the secondary metabolites to shape a complex with extracellular proteins and with the cell wall of microorganism.[17] The inhibitory effect of MeOH leaf extract, on the increase of bacteria, might be due to better solubility of these capability secondary metabolites, which shows the presence of a wide spectrum of antibiotic compounds.[18] The organic solvent of the plant extract had greater antibacterial ability than the aqueous extract. This observation can be correlated with the polarity of the solvent used for extraction, essential bioactivity, and capability to diffuse in media utilized in assay.[19,20] Therefore, in many elements of the plant for herbal safety against microbial infection are packed with phytochemical substances. The phytochemical analysis of the leaves extracts h-bonded phenols, alkanes, carboxylic acid,

alkanes, fragrant earrings, aliphatic amines, and saturated methylation organizations. Therefore, phytochemical products can be responsible for the bacterial activity of *O. cochinchinense*.

CONCLUSION

Various solvent extractions of *O. cochinchinense* leave contain significant phytochemical and antibacterial activity. Therefore, the current study leads the mixture from this research and creates a powerful design for bone treatment.

REFERENCES

1. Arokiyaraj S, Radha R, Martin S, Perinbam K. Phytochemical analysis and antidiabetic activity of *Cadaba fruticosa* R.Br. Indian J Sci Technol 2008;1:1-4.
2. Gordon DM. Geographical structure and host specificity in bacteria and the implications for tracing the source of coliform contamination. Microbiology 2001;147:1079-85.
3. Kubmarawa D, Ajoku GA, Okorie DA, Enwerem NM. Preliminary phytochemical and antimicrobial screening of 50 medicinal plants from Nigeria. Afr J Biotechnol 2007;6:1690-6.
4. Fawad SA, Rehman MU, Khalid N, Khan SA. Antimicrobial activity of *Eucalyptus tereticornis* and comparison with daily life antibiotics. Int J Pharmacol Sci Rev Res 2012:12;21-9.
5. Krishnaiah D, Devi T, Bon A, Sarbtly R. Studies on phytochemical constituents of six Malaysian medicinal plants. J Med Plant Res 2009;3:67-72.
6. Salahuddin A, Rahman MS, Jasim UC, Anwar MN. Antimicrobial activities of seed extracts and true alkaloids of Aegle marmelos. Greener J Sci 1998;22:77-81.
7. Samy RP, Pushparaj PN, Gopalakrishnakone P. A compilation of bioactive compounds from ayurveda. Bioinformation 2008;3:100-10.
8. Bisht C, Badoni A. Distribution and indigenous uses of some medicinal plants in district Uttarkashi, Uttarakhand. Indian J Res 2009;1:38-40.
9. Vedavathy S. Sustainability of traditional herbal medicine practiced in Anthrapradesh, India. Proceedings of the Workshop Sharing Local and National Experience in South Asia, 21-23 January. Pokhara, Nepal; 2001. p. 220-5.
10. Sivakumar T, Gajalakshmi D. *In vitro* antioxidant and chemical constituents from the leaves of *Ormocarpum cochinchinense* elumbotti. Am J Plant Physiol 2013;8:51-60.
11. Sivakumar T, Gajalakshmi D. Gas chromatography-mass spectroscopy analysis of *Ormocarpum cochinchinense* leaf extract-traditional bone healing plants. Int J Pharm Res Biosci 2014;3:352-9.
12. Sivakumar T, Gajalakshmi D. Phytochemical screening and GC-MS analysis of root extract from *Asparagus racemosus* L. 2014. Int J Pharm Sci Res 2014;5:1000-5.
13. Lu X, Wang J, Al-Qadiri HM, Ross CF, Powers JR, Tang J, *et al.* Determination of total phenolic content and antioxidant capacity of onion (*Allium cepa*) and shallot (*Allium oschaninii*) using infrared spectroscopy. Food Chem 2011;129:637-44.
14. Schulz H, Baranska M. Identification and quantification of valuable plant substances by IR and Raman spectroscopy. Vib Spectrosc 2007;43:13-25.
15. Andrus PG. Cancer monitoring by FTIR spectroscopy. Technol Cancer Res Treat 2006;5:157-67.
16. Mordechai S, Mordechai J, Ramesh J, Levi C, Huleihel M, Erukhimovitch V. Application of FTIR microspectroscopy for the follow-up of childhood leukaemia chemotherapy. Proceedings of SPIE Subsurface and Surface Sensing Technologies and Applications III. Vol. 44. San Diego, USA: Society of Photo Optical; 2001. p. 243-50.
17. Kuete V, Nguemeving JR, Beng VP, Azebaze AG, Etoa FX, Meyer M. Antimicrobial activity of the methanolic extracts and compounds from *Vismia laurentii* de wild (Guttiferae). J Ethnopharmacol 2007;109:372-9.
18. Ikigai H, Nakae T, Hara Y, Shimamura T. Bactericidal catechins damage the lipid bilayer. Biochim Biophys Acta 1993;1147:132-6.
19. Jigna PA, Darshana JA, Sumitra CH. Efficacy of aqueous and methanol extracts of some medicinal plants for potential antibacterial activity. Turk J Biol 2005;29:203-10.
20. Sivakumar T, Gajalakshmi D, Subramanian VK, Palanisamy K. Tuber extract mediated biosynthesis of silver nanoparticles and its antioxidant, antibacterial activity. J Biol Sci 2015;15:68-7.