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Phytochemical And Ftir Analysis Of A Mangrove Plant – *Volkameria inermis* L.

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Abstract: *Volkameria inermis* L. is an important medicinal plant of mangrove region. The main objective of this work was to analyse the bioactive constituents and to identify the functional groups using preliminary phytochemical and FTIR studies. In the present study, finely grounded leaf powder of *V. inermis* L. was extracted with Hexane, Acetone and Methanol solvents separately. Qualitative and quantitative analysis of various extracts were carried out according to the standard methods. The methanol extract of *V. inermis* was examined under FTIR spectrophotometer method for identifying the kinds of chemical bonds (functional groups) present in plant powder and the characteristic peaks were recorded. In qualitative analysis, the various leaf extracts of *V. inermis* showed the presence of active phytochemical constituents, like alkaloids, flavonoids, glycosides, phenol, tannin and steroids and quantification of secondary metabolites showed 14.5mg/g of alkaloid, 67.97mg/g of phenol and 86mg/g of flavonoids. The FTIR spectrum study revealed the presence of many functional groups, such as hydroxyl group, methoxy, methyl ether, aromatic ring, carbonate ion, aliphatic fluoro compound, cyclohexane ring, polysulphides, iodide and bromide compounds. Thus the results of the present study confirms the medicinal potential of *V. inermis* in various treating system.

Keywords: *Volkameria inermis, mangrove plant,* phytoconstituents, qualitative, quantitative, FTIR analysis.

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1. INTRODUCTION

Medicinal plants, since time immemorial have been used in virtually all civilizations as a source of medicine[1]. The medicinal plants have gained precedence due to their extensive continuum of pharmacological effects[2]. In India, about 7000 plant species are used for medicine along with a few minerals, metals and animal products. Use of herbal medicine is becoming more popular than that of allopathic medicine[3]. Medicinal plants are valued for their phytochemicals, such as alkaloids, steroids, flavonoids, terpenes, glycosides etc[4]. Phytochemicals are actually organic compounds which contains medicinal properties[5]. Specific concentration of phytochemicals from the plants produces therapeutic effects with no significant toxicity. The spectrometric and chromatographic screening methods could provide the needed preliminary observations to select crude plant extracts with potentially useful properties for further chemical and pharmacological investigations[6]. Fourier transform infrared spectroscopy is an important tool for the identification of functional groups present in the plant extract. The technique helps for identification and structure determination of the molecule. Moreover; FTIR spectroscopy is time saving method to characterize and to identify the functional groups[7]. The traditional medicinal plants chosen for the present study is *Volkameria inermis* L. which is used in folk medicine for the treatment of fever, cough, scrofulous infection, venereal infection and skin diseases. The plant also used to clean the uterus and to treat umbilical cord infection[8-9]. *Volkameria inermis* L. [=*Volkameria* nerifolia Roxb., *Clerodendrum inerme* (L.) Gaertn.,*Clerodendrum nerifolium* (Roxb.) Schauer] belongs to the family Lamiaceae. It occurs predominantly in the mangrove regions of Coastal India. They are excellent competitors in saline environments. Mangrove plants have been used for centuries as prominent medicine for various health disorders[10]. *Volkameria inermis* is an evergreen erect shrub, often scrambling or scandent that can reach up to 3 m tall but sometimes a liana and measures upto 13 m long[11]. Stems are woody and smooth. Leaves are ovate to elliptical (5-10cm) long, acute to acuminate tip, green, smooth, slightly shiny upper surface. Cyme or umbel inflorescence with white, five lobed corollas. Stamens 4, reddish to purple, upwardly curved. The ovoid shape fruit is green in colour and turning black[12]. Traditionally it was used as an ornamental plant in home gardens. This plant was rich in secondary metabolites such as tannins, terpenoids, alkaloids, flavonoids etc[13]. It is an important medicinal plant reported for the treatment of anticancer properties [14].

2. MATERIALS AND METHODS

2.1 Collection and preparation of plant materials

The fresh leaves of *V. inermis* was collected from karaikal district, Tamil Nadu, in the month of January 2019. The collected plant parts were identified and authenticated by Dr. S. Soosairaj, Taxonomist, Department of Botany, St. Joseph's College, Tiruchirappalli, Tamil Nadu and the plant voucher number is 2814. The fresh leaves were washed in running tap water in order to remove the dust particles. The leaves were dried under shade at room temperature for several days. The air dried leaves were pulverized to powder in a mechanical grinder.

2.2 Preparation of plant extracts

Twenty five gram of fine powder were blended in 100 ml of Hexane, Acetone and Methanol solvents separately (Non polar - Polar), in a tightly covered conical flask. The set up was kept on an electro - magnetic stirrer for 3 days in each solvents at room temperature (30 -35 C). Then the extracts were filtered using standard Whatman No.1 filter paper and stored for further phytochemical and spectroscopic analysis.

2.3 Qualitative Phytochemical analysis

The leaf extracts of *V. inermis* was subjected to qualitative test, for the identification of carbohydrates, reducing sugar, alkaloid, flavonoid, saponin, phenol, tannins, steroids and glycosides using standard procedures[15, 16] .

2.4 Quantitative Estimation of phytochemicals

2.4.1 Quantitative Estimation of Alkaloid

One gram of dried leaf powder was mixed with 10% acetic acid solution in ethanol to form a ratio of 1:10 (10%). The mixture was allowed to stand for 4 hrs at 28°C and filtered using Whatman No. 42 filter paper. Then the filtrate was concentrated to one quarter of its original volume by evaporation and treated with drop wise addition of conc. aqueous NH_4OH until alkaloid precipitation. Finally the precipitated alkaloid was received in a weighed filter paper washed with 1% ammonia solution dried in the oven at 80 °C.

2.4.2 Quantitative Estimation of Phenol

One gram of the sample was extracted with 5 ml of 80% ethyl alcohol and centrifuged at 2000 rpm. The supernatant was taken for assay. One ml of folin – ciocalteu reagent was added to 1.0ml of the alcoholic extract of the sample. 2ml of 20% sodium carbonate was added and heated for one minute. It was allowed to cool at room temperature and the solution was made up to 10ml with distilled water. A blank was prepared by adding all the reagents except the sample. The absorbance was read at 650nm in Spectrophotometer.

2.4.3 Quantitative Estimation of Flavonoids

One gram of dried plant sample was extracted repeatedly with 10ml 80% aqueous methanol at room temperature. Then the solution was filtered using Whatman No.1 filter paper and they were transferred into a crucible and evaporated to dryness using a water bath and weighed to get a constant weight.

2.5 FTIR spectroscopic analysis

FTIR is a useful tool for identifying the various kinds of chemical bonds (functional groups) present in plant sample. The methanol extract of *V. inermis* was examined under FTIR spectrophotometer method, using a Perkin Elmer spectrophotometer and the characteristic peaks were recorded.

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3. RESULTS AND DISCUSSION

3.1 Qualitative Phytochemical analysis

Qualitative phytochemical screening of *V. inermis* confirms the presence of various phytochemicals such as reducing sugar, alkaloid, flavonoids, glycosides, phenols, tannins and steroids except saponin. Saponins were completely absent in all the three extracts tested and carbohydrates were absent in acetone and methanol extracts (Table - 1). Our results are in accordance with the report of *C. infortunatum*[17]. Thus the preliminary screening test indicates the presence of phytoconstituents. This may be used for the preparation of drug in a systematic way which may lead to the cure of many ailments in the future.

Table 1. Qualitative Phytochemical Analysis of *Volkameria inermis* L. Leaf Extracts.

S.No.	Phytochemical tests	Hexane	Acetone	Methanol
1.	Carbohydrates	+	-	-
2.	Reducing Sugar	+	+	+
3.	Alkaloid	+	+	+
4.	Flavonoids	+	+	+
5.	Glycosides	+	+	+
6.	Phenols	+	+	+
7.	Tannins	+	+	+
8.	Steroids	+	+	+
9.	Saponins	-	-	-

+ indicates Positive Result - indicates Negative Result

3.2 Quantitative Estimation of phytochemicals

Quantitative Estimation of phytochemicals of *V. inermis* leaf powder was carried out and the results presented in Fig - 1. While comparing the quantity of all three secondary metabolites tested, flavonoids content was found maximum as 86mg/g, phenol content was found moderate as 67.97mg/g and the alkaloid content was found as minimum of 14.5mg/g. Alkaloids and flavonoids are the potential phytochemicals which boost the immune system and are of anti inflammatory in nature and particularly useful in the maintenance of healthy circulation[18]. The quantification of alkaloids, flavonoids and phenols confirm the therapeutic potential of the plant *V. inermis*.

3.3 FTIR spectroscopy

The FTIR spectrum study of *V. inermis* revealed the presence of many functional groups with 15 peaks. The results of FT-IR standard peaks were presented in Table - 2. The profile was demonstrated in Fig-2. The FT-IR broad peak at 3331.07 cm-1 indicates the presence of hydroxyl group, H – Bonded OH stretch. It gave two small peaks at 2943.37 and 2831.50 cm-1 which indicates the presence of Methoxy and methyl ether with O – CH3 and C – H stretch. The peak obtained at 2042.62 indicates Thiocyanate related ion. The peak obtained at 1450.47, 1413.82, 1111 and 1020.34 indicates the presence of aromatic ring, carbonate ion, aliphatic fluoro compound and cyclohexane ring vibration. The obtained peak of 597.93, 555.5, 493.78, 480.28, 418.55, 383.83 and 351.04 indicates the presence of alcohol with OH out of plane bend, aliphatic iodo compounds with C- I stretch, polysulfides with S – S stretch, Aryl disulfides with S – S stretch, bromide, iodide and bromide. The FTIR spectrum confirmed the presence of alcohols, iodide, bromide, aliphatic, carbonate, methoxy, hydroxy, fluoro compounds in the leaf of *V. inermis*.

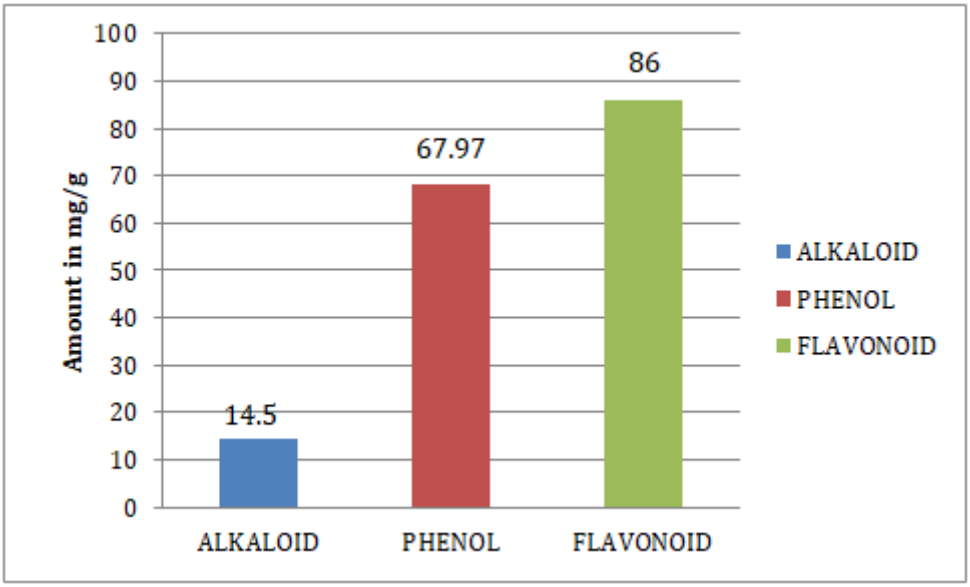

Fig 1. Quantitative Estimation of secondary metabolites in methanolic leaf extract of *V. inermis* L.

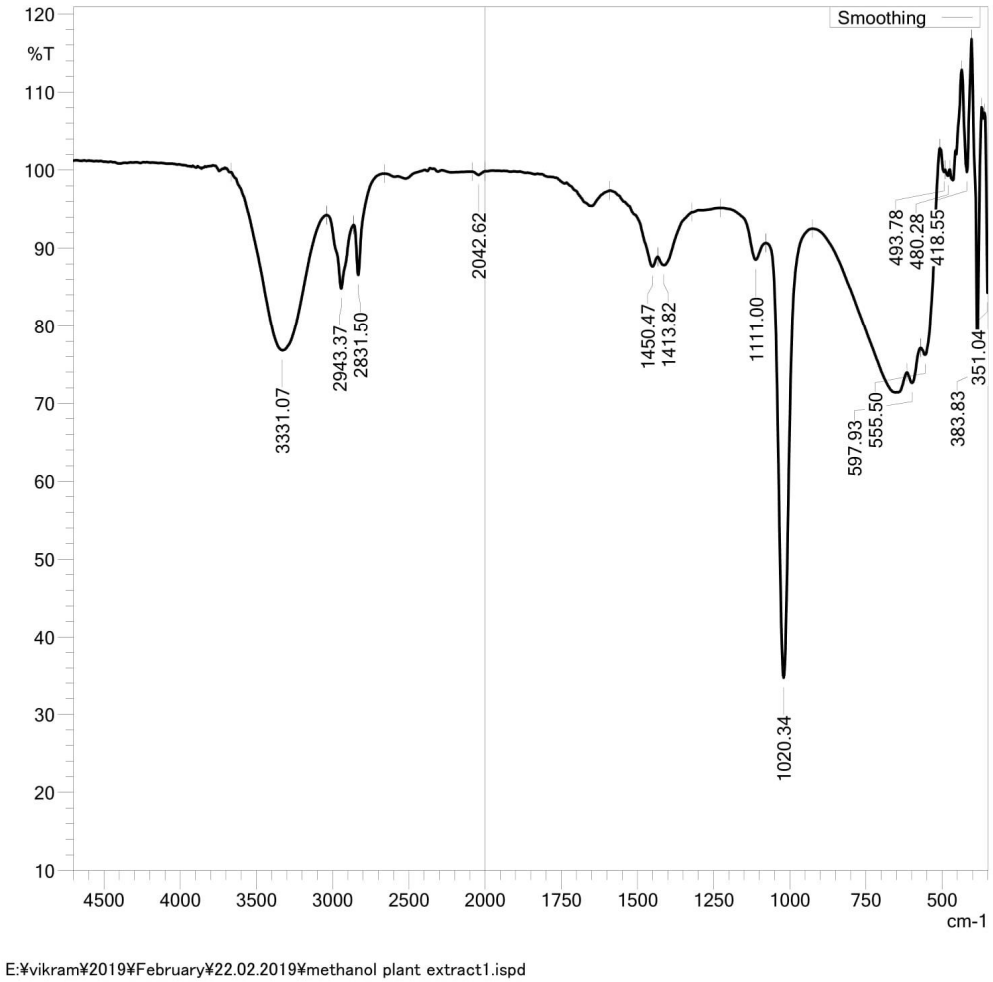

Fig 2. FTIR Analysis of Methanolic Leaf Extract of *V. inermis* L.

Table 2. Peak Values and Functional Groups of Leaf Methanolic Extract of *V. inermis* L.

S.No	Peak	Functional Group	Functional Group Name
1.	351.04	C-Br	Halo Compounds
2.	383.83	-C – I	Halo Compounds
3.	418.55	-C-Br	Halo Compounds
4.	480.28	S-S	Aryl disulfide
5.	493.78	S-S	PolySulphides
6.	555.5	C-I	Aliphatic Iodo Compound
7.	597.93	OH	Alcohol
8.	1020.34	C-CH	CycloHexane Ring
9.	1111	C-F	Aliphatic Fluoro Compound
10.	1413.82	C-C	Carbonate ion
11.	1450.47	C-H	Aromatic Compound
12.	2042.62	S-N	Thiocyanate
13.	2831.5	C-H	Methyl ether
14.	2943.37	O-CH3	Methoxy
15.	3331.07	H-OH	Hydroxyl group

4. CONCLUSION

The efficiency of a medicinal plants are principally depend upon the presence of phytoconstituents. Thus, the results of the present investigation on *V. inermis* confirms the presence of phytoconstituents like alkaloid, flavonoid, glycosides, phenol, tannin and steroids in qualitative and alkaloids, flavonoids and phenols in quatitative analysis. The FTIR spectrum confirms the functionl groups such as, alcohols, iodide, bromide, aliphatic, carbonate, methoxy, hydroxy, fluoro compounds in the leaf of *V. inermis.* However, further research is needed to identify the individual phytocompounds from the different extracts of the plant *Volkameria inermis.*.

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6. AUTHORS CONTRIBUTION STATEMENT

Dr. Mrs. P. Shanthi, the corresponding author of this article, designed the whole work to carryout, U. Thiripura Sundari and A. Nisha contributes to carry out the experiments and gathered data and information related to the work and designed the manuscript. C. Sowndhariya helps during sample preparation. All authors helped to shape the project and the manuscript.

7. CONFLICT OF INTEREST

Conflict of interest declared none.

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