



Research Article

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Phytochemical screening by FTIR spectroscopic analysis of methanol leaf extract of herb *Andrographis echinoides*

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ABSTRACT

The plant *Andrographis echinoides* play a vital role in curing various human diseases. According to traditional siddha medicinal system till date it is accountable as to cure 81 diseases. The cost of fresh leaves is Rs 1750/Kg in Medicinal live, a largest online medicinal supplier in India. This much of cost may be due to its demand in siddha medicine to prepare various medicine is so high. Even though, this much of demand is exists but no any scientific validation and documentation for this plant possessing phytochemicals to cure the disease. Hence the present study was aimed to evaluate the possible bioactive functional group present in the methanol leaf extract of *Andrographis echinoides*. The major functional group present in this plant was determined by FTIR analysis showed the existence of functional groups such as alkanes, aromatic compound, conjugated alkene, cyclic alkene, nitro compound, aromatics, carboxylic acid, phenol, aromatics ester, alkyl aryl ether, vinyl ether, ester, tertiary alcohol, primary alcohol, alkyl halides, alkene and halo compounds.

Keywords: Phytochemicals, Functional group, *Andrographis echinoides*, FTIR, Leaf extract.

INTRODUCTION

The nannual herb *Andrographis echinoides* L. belongs to family Acanthaceae is present throughout South India; in particular, it is available everywhere in Vellore District. This plant is commonly known as false water willow. It has a wide range of medicinal properties therefore it is used to treat many diseases (Mathivanan and Suseem, 2016) [17] including dyspepsia, influenza, malaria and respiratory infections, and as astringent and antidote for poisonous stings of some insects (Chopra *et al*, 1980) [13], goiter, liver diseases (Nadkarni *et al.*, 1976) [18], fertility problems, bacterial (Qadre *et al.*, 2009) [23], malarial, fungal, helminthic (Padma *et al*, 2012) [21], diarrhea and larvicidal disorders (Pandikumar *et al.*, 2007, Krithikar and Basu, 1975 and Nazar *et al*, 2009) [22, 16, 19], Leaf juice boiled with coconut oil had controlled the falling and graying of hair (Pandikumar, 2007., Nirubama and Rubalakshmi, 2014) [22, 20], antioxidant activities (Mathivanan and Suseem, 2016., Ruba and Mohan, 2016, Jeevanantham and Zahir Hussain, 2018) [17, 24, 15], analgesic, anti-inflammatory and antipyretic effect (Basu *et al*, 2009) [2], anti-fungal activities (Hemalatha *et al*, 2020) [14], antibacterial activity (Mathivanan and Suseem, 2016) [17] Hence the present study was aimed to identify the bioactive phytochemicals present in the methanol leaf extract of such a medicinally important herb *Andrographisechinoides*

Plant description

False Water willow is an annual herb with hairy stems growing up to 10-50cm. The leaves of both dorsal and ventral side are hairy, oblong and opposite decussate with 7.5cm long and 2.4 cm wide. Flowers are erect, spike like racemes, 1-2 branched, 2cm long with dense hairy stalk. Sepals are thread like 9mm long with 2mm sepal tubes. The structure of flowers are tube like appearance with purple colour and opens into upper lip with to 5.5 x 2 mm size 2 lobes and lower lip with 7 mm long 3 oblong- lance shaped lobes. Stamen filaments are broad and flattened with 2 celled anthers. The flowering period is March to June and October to December.

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CLASSIFICATION

Kingdom: Plantae

Division : *Magnoliophyta*

Class : *Magnoliopsida*

Order : *Lamiales*

Family : *Acanthace*

Genus : *Andrographisae*

Species : *Andrographis echioides*



Wet leaves



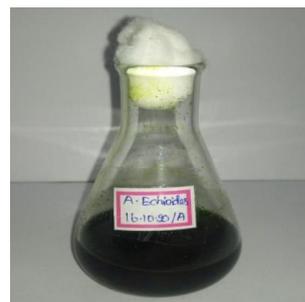
Whole plant Single leaf



Dried leaves



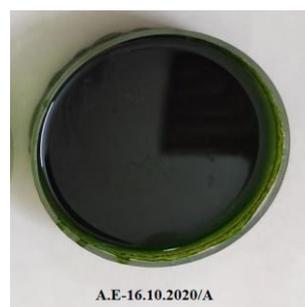
Single leaf



Plant extract in in conical



Inflorescence



plant extract in petri disc



Flower flask

Andrographis echioides names in various language

Common name: *False Water willow*, Tamil: *GopuramTangi*, Gujarati: *Kalukariyatun*, Malayalam: *Pitumba*, *Gopuramthangi*, Marathi: *RanchimaniOriya*: *Lavalata*, Others: *False Waterwillow*, Synonym: *Eriatheraechioides* (L.) M.R. Almeida, *Eriatheralobelioides* Nees, *Indoneesiellaechioides* (L.) Sreemadh., *Justiciaechioides* L., *Neesiellaechioides* (L.) Sreemadh.

MATERIALS AND METHODS

Mature and healthy leaves of herb *Andrographisechioides* were collected from the forest situated at foot hills of Vallimalai Eastern Ghats, Vellore district, Tamilnadu, India. The collected leaves were brought to the laboratory 12 km away from the collection site. In the laboratory the leaves were washed thoroughly in running tap water to remove worms, small insects and dust adhered on the leaves. Thereafter the wet leaves were spread on waste daily newspaper and dried in a shadow place at room temperature for 15 days. The complete drying was ensured by hand crushing of leaves. Then this was made into fine powder by using mechanical grinder. From this powder 10g were weighed and transfer to a conical flask containing 25 ml of methanol solvent, kept in magnetic stirrer and stirred well for 3 days, then the extract was transfer to a glass petridish. This process was repeated 6 to 7 times until the green color powder in the conical flask turned into slight white color. The methanol present in the petridish was completely evaporated by applying vacuum pressure. Finally the dried extract was mixed with required amount of KBr and made into a translucent pellet. The pellet was kept in holder of FTIR unit and the phytocompounds analyzed.

RESULTS AND DISCUSSION

The FTIR analysis of methanol extract of *Andrographis echioides* showed 35 characteristic peaks. Among these, the peaks at 3401.82, 2995.87, 2954.41, 2923.56, 2848.35 and 2875.34 attributed to C-H stretching between the reference ranges 3000-2840 indicates the presence of bioactive functional group alkanes shows a concordance

with FTIR peak observed at 1366 corresponding to C-H rock for alkanes in the methanol leaf extract of *Annona squamous* (Chandran *et al*, 2016) [1] and peak at 1377 (C-H) for alkanes in the methanol extract of stem of *Sacrostemma viminaleae* (Chandran, 2014). The peak at 1844.58 (weak C-H bending), 1441.53 (C-C stretch (in-ring), 1276.65 and 1256.4 (C-O stretching), 757.888 (C-H 'Oop') evidenced for the exhibiting of aromatic (Satapathy and Pattnaik, 2020) and aromatic ester. The peaks at 1513.85 (N-O stretching) and 1486.85 (N-O asymmetric stretch) indicates the presence of nitro compounds similar to that peak value observed at 1519.56 (strong N-O Stretching) for nitrocompounds in the methanol stem extract of *Sarcotemma viminaleae* (Chandran *et al*, 2014). The spectral peaks at 1634.38 and 1603.52 related to C=C stretching indicates the presence of conjugated alkenes, 1575.56 (medium bending) for cyclic alkenes and 822.491 and 712.569 (C=C bending) for the presence of alkene. The peaks at 1080.91 and 1056.8 (strong C-O stretching) indicate the presence of primary alcohol shows a concordance with peaks at 1059.83 (strong C-O stretching) for primary alcohol in plant *Solanum surrattence* (Chandran, 2014). Peaks at 1159.97 and 1142.62 (strong C-O stretching) indicate the presence of Tertiary alcohol. The peaks at 1417.42 and 929.521 (medium O-H bending) indicate the presence of carboxylic acid showed an agreement with peak at 926 (O-H bend) observed for fraction -II methanol extract of leaves of *Leucasaspera* (Alaguchamy and Chandran, 2016) and peaks at 1228.43 and 1214.93 attributed to strong C-O stretching alkyl aryl ether. The peaks at 1386.57 and 1311.36 corresponding to medium O-H bending indicate the presence of phenol and peaks at 575.646 and 534.185 (strong C-I stretching) presence of halo compound shows an agreement with peak at 580.09 with C-Cl stretching and 657.78 with C-Br stretching for halocompounds in the methanol extract of leaf of *Solanum surattense* (Chandran, 2014). The peaks at 1204.33, 1184.08 (strong C-O stretching) for vinyl ether, ester and 846.597 with medium C-Cl stretch indicates the presence of and alkyl halides likeness with the characteristic peak with C-Br and C-Cl stretch for alkyl halides observed in aqueous extract of *Portula caderacea* (Desouky, 2021).

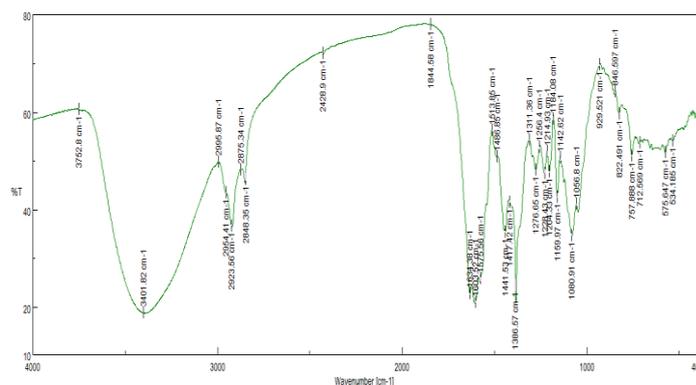


Figure 1: FTIR peak pattern of methanol leaf extract of *Andrographis echioides*

Table 1: FTIR peak value related functional groups and phytochemicals in the methanol leaf extract of *Andrographis echinoides*

S.No	Wave number cm ⁻¹ (reference article)	Wave number (cm ⁻¹) (Test Sample)	Functional group assignment	Intensity	Phytochemical identified
1.	-	3752.8	-	-	Unknown
2.	3550-3200	3401.82	O-H Stretching	strong, broad	Alcohol
3.	3000-2840	2995.87	C-H stretching	Medium	Alkanes
4.	3000-2840	2954.41	C-H stretching	Medium	Alkanes
5.	3000-2840	2923.56	C-H stretching	Medium	Alkanes
6.	3000-2840	2848.35	C-H stretching	Medium	Alkanes
7.	3000-2840	2875.34	C-H stretching	Medium	Alkanes
8.	-	2428.9	-	-	Unknown
9.	2000-1650	1844.58	C-H Bending	Weak	Aromatic compound
10.	1650-1600	1634.38	C=C stretching	Medium	Conjugated alkene
11.	1650-1600	1603.52	C=C stretching	Medium	Conjugated alkene
12.	1650-1566	1575.56	C=C stretching	Medium	Cyclic alkene
13.	1550-1500	1513.85	N-O stretching	Strong	Nitro compound
14.	1550-1475	1486.85	N-O asymmetric stretch	Strong	Nitro compound
15.	1500-1400	1441.53	C-C stretch (in-ring)	Medium	Aromatics
16.	1440-1395	1417.42	O-H bending	Medium	Carboxylic acid
17.	1390-1310	1386.57	O-H bending	Medium	Phenol
18.	310-1250	1276.65	C-O stretching	Strong	Aromatic ester
19.	1275-1200	1228.43	C-O stretching	Strong	Alkyl aryl ether
20.	1225-1200	1204.33	C-O stretching	Strong	Vinyl ether
21.	1210-1163	1184.08	C-O stretching	Strong	Ester
22.	1205-1124	1159.97	C-O stretching	Strong	Tertiary alcohol
23.	1085-1050	1080.91	C-O stretching	Strong	Primary alcohol
24.	1390-1310	1311.36	O-H bending	Medium	Phenol
25.	1310-1250	1256.4	C-O stretching	Strong	Aromatic ester
26.	1275-1200	1214.93	C-O stretching	Strong	Alkyl aryl ether
27.	1205-1124	1142.62	C-O stretching	Strong	Tertiary alcohol
28.	1085-1050	1056.8	C-O stretching	Strong	Primary alcohol
29.	950-910	929.521	O-H bend	Medium	Carboxylic acids
30.	850-550	846.597	C-Cl stretch	Medium	Alkyl halides
31.	840-790	822.491	C=C bending	Medium	Alkene
32.	900-675	757.888	C-H 'Oop'	Strong	Aromatics
33.	730-665	712.569	C=C bending	Strong	Alkene
34.	600-500	575.646	C-I stretching	Strong	Halo compound
35.	600-500	534.185	C-I stretching	Strong	Halo compound

CONCLUSION

The FTIR analysis of *Andrographis echinoides* showed the presence of functional groups such as alkanes, aromatic compound, conjugated alkene, cyclic alkene, nitro compound, aromatics, carboxylic acid, phenol, aromatics ester, alkyl aryl ether, vinyl ether, ester, tertiary alcohol, primary alcohol, alkyl halides, alkene and halo compounds. Due to the presence of all these bioactive compounds, the *Andrographis echinoides* act as an excellent and high potent medicinal plants.

Conflict of Interest

None declared.

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