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FTIR Spectroscopic analysis of methanol leaf extract of *Stachytarpheta jamaicensis*

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Abstract:

The plant *stachytarpheta jamaicnsis* belong to the family of *verbenacae* is act as an important mdicinal plant in the folk medicinal systems. It has multi theraptic properties and traditionally is usd to treat several diseases such as urinary traet infections, rheumatic and pharyngitis. The methanol extract of *stachytarpheta jamaicnsis* leaf prepared were analysed by FTIR showed the following bioactive compoundes such as alcohols, phenols, alkene, thiocyanate, aromatic compound, aldehyde, conjugated alkene, nitro compound, carboxylic acid, phenol, sulfone, aromatic estr, vinyl ether, tertiary alcohol, scondary alcohol, anhydride, alkans and halo compounds. Moreover it has a strong DPPH (free radical) scavenging activites.

Key words:

Stachytarpheta jamaicnsis, FTIR, UV, methanol leaf extract, phytocompounds, functional group.

Introduction:

Primitive people have depended on nature for basic needs such as food, shelter, clothing and medicine to cure ailments and also distinguished useful herbs with beneficial effects from those that were inactive or toxic [1]. According to available literature approximately 50,000 plant species have medicinal properties [2]. This much of plants documented in the literature is a very good evidence for the human decadence of plants for their health care system. Eventoday, one third of human nearly 80% of the world's population depends traditional medicine for their health care system, especially in the developing countries [3-4].Traditionally, the crude extracts of different parts of medical plants, including root, stem, flower, fruit, and twigs, were widely used for treatments of some human diseases [5]. Medicinal plants contain several phytochemicals such as flavonoids, alkaloids, tannins, and terpenoids, which possess antimicrobial and antioxidant properties [6]. Hence, the present study has been carried out to investigate the possible bioactive phytocompounds present in the methanol leaf extract of *stachytarpheta jamaicnsis* by FTIR analysis.

Plant Description

Stachytarpheta jamaicnsis is a perennial woody herb that grows to a height of 60-120cm. Stems are green, woody, and grow from the plant's base. When young, it has a square cross-section. It has a strong tap root and erect annual shoots with swollen nodes, followed by several slender erect spikes of flowers. The leaves are paired, oppositely arranged, elliptic, 3-10 cm long, leathery, strongly nerved with veins depressed above and prominent below, dark green, hairless or very finely hairy, and merge into the short petioles. The margins are toothed on a regular basis. Flowers are lilac, lavender, blue, or purple and open 1-3 at a time from the base to the tip of 20-40 cm long spikes at the branches' tips. Each flower is partially buried in the spike and has five unequal petals 5-8 mm across as well as two stamens. Flowers normally only bloom for a day and die within an hour of being picked. Seeds are 5 mm long, concavo-convex, ridged, and brown, and are held within spikes that thicken to 5 mm diameter over the seeds and are thinner in the intervening furrows.

Fig:1 Leaves of **S***tachytarpheta jamaicnsis*

Fig:2 Flowers of *Stachytarpheta jamaicnsis*

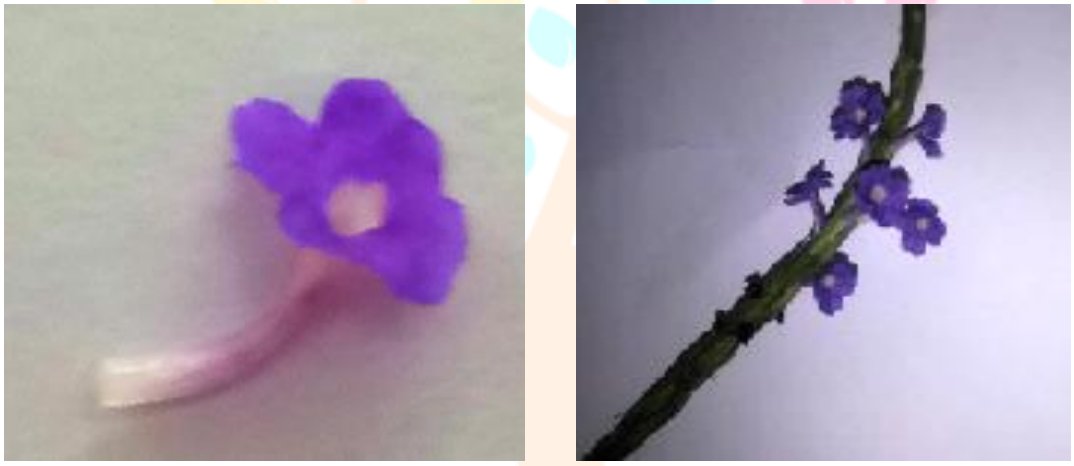
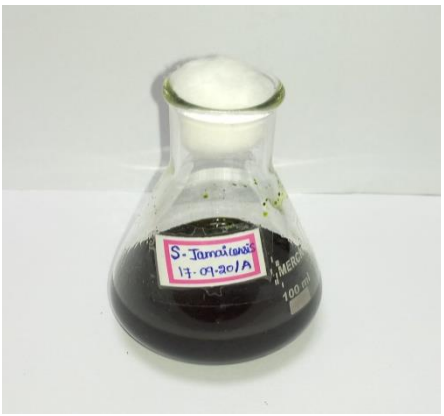
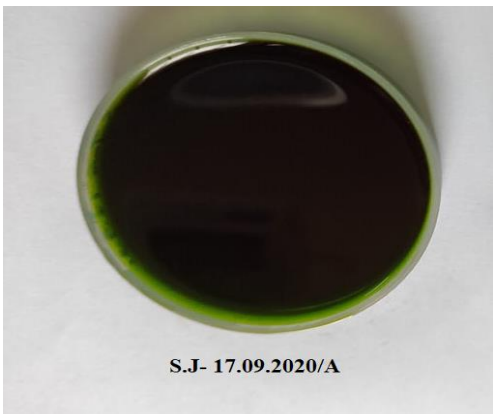


Fig:3 Drying process *Stachytarpheta jamaicnsis* leaf powder

Fig:4 *Stachytarpheta jamaicnsis* extract

Fig:5 Evaporating the extract





Classification:

Kingdom: Plantae
Phylum: Spermatophyta
Class: Dicotyledonae
Order: Lamiales
Family: Verbenaceae
Genus: Stachytarpheta
Species: Stachytarpheta jamaicensis

***Stachytarpheta Jamaicensis*names in various language:**

Tamil: Ceemainayuruvi, Seemainaayuruvi (சீமைநாயுரிவி)**English:** Aaron's rod, Jamaican Blue Spike, Jamaican Bluespike, Jamaica vervain, Wild Verbena, Blue poterweed, Bastard Vervain, Brazilian tea, **Beng:** Jarbo,**Hindi:** Kariyartharani,**Irula:** Aanaiidumudi, Kuchipoo, Yeluthanipundu, **Kannada:** Kaadu uttharaani,**Malayalam:** Narivalan, Kattupunnuthu, Seemakongini,**Oriya:** Koraputia buta**,Telugu:** Maeda balaku, **Others:** Joee, Kariyuttarani (Kannada), Blue Snakeweed, Jamaican Snakeweed, Seemai nayuruvi, Blue Porterweed, Brazilian Tea, Neer Panai Utharani, Jamaica Vervain, சீமைநாயுரிவி Seemai Nayuruvi (Tamil),Blue Flower, Rat Tail

***Stachytarpheta Jamaicensis* names in different countries**

Australia: Jamaica snakeweed, **Caribbean:** verbena, vervain, **Colombia:** golondrina, verbena azul, **Cuba:** verbena cimarona, **Dominican Republic:** verbena morada, **Guam:** false verbena, Jamaica vervain, **India:** kariyartharani, katapunuttu, semainyuruvi, **Indonesia:** gewongan, jarong, **Indonesia/Java:** gajihan, ngadi rengga, **Madagascar:** ombimboalareo, **Malaysia:** ramput tahi babi, selaseh dandi, **Mauritius:** queue de rat, **New Caledonia:** herbe blue, nettle leaf vervain, **Niue:** mautofu Samoa, **Philippines:** albaka, bilu-bilu, bolomaros, Brazil tea, kandi-kandilaan, limbagat, sentemiento, verbena de las Antilles, **Samoa:** mautofu tala, **Solomon Islands:** kinilio, **Sri Lanka:** bulunakuta; hai-or ingi, **Tonga**: iku'i kuma, **Trinidad and Tobago:** rough-leaved false vervain, vervine, **USA/Hawaii:** Jamaica vervain.

Medicinal uses

In order to treat "asthma" and "ulcerated stomachs," the fresh leaves are brewed into tea and consumed as a "cooling" tonic and blood cleanser. Other conditions that *Stachytarphetajamaicensis* is used to treat include high blood pressure, worms, constipation, respiratory problems, blisters/boils, chills, and fevers. A tea made from the leaves has been used to treat gonorrhoea, as well as eye and ear sores, in Central America and Africa. Additionally, it has been used locally to treat syphilis, amenorrhea, yellow fever, and malaria. For treatments of diarrhoea, dysentery, diabetes, low blood pressure, and fractures, the entire plant is utilised. For a bath, use a decoction of the entire plant to treat liver, head, and gripe problems. The plant's tincture is applied topically as a lotion to soothe nervous discomfort.

DPPH activity

In the current study, the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical was used to measure the scavenging activity using a 96-well microplate method [7-8]. In this study, dried plant compounds weighing 10 mg each were diluted in various volumes of methanol after being weighed in a digital balance. On this method, various concentrations of plant extract were created, including 10:1, 10:2, 10:4, 10:6, and 10:8 concentrations. The commonly used DPPH radical was used to test the radical scavenging ability. To prepare 0.2mM, 7.89 mg of DPPH were weighed and diluted in 100 ml of methanol. From there, each concentration of plant extract was added to 96 wells along with 20 L of DPPH. The plate was incubated for 30 min. at room temperature and in the dark. Time causes the colour of the DPPH reagent solution when combined with antioxidant sample to change from purple to yellow. By measuring absorbance with a spectrophotometer at 517 nm, the colour change is identified. Although this approach is thought to be very straightforward and effective, it does have some drawbacks. The need for a spectrophotometer is one of the primary drawbacks of the traditional DPPH method. The new technique does not require the use of a spectrophotometer and instead evaluates colour change by scanning the image and using free image processing software (Image J). Hence, in the present study, this new method was used to estimate the DPPH activities.

Materials and method

Plant collectionand processing

Using a plant cutter, mature leaves were extracted from the slope of the Vallimalai Hills at 6 a.m. befor e sunrise.The collected leaves were spread out on dried news paper in a shaded area

Extract and KBr pellet preparation for FTIR analysis

After one week, 100% completion was guaranteed by hand crushing and the dried leaves were ground into po wder with the aid of a mechanical grinder.200g of this fine powder were measured out and placed in a soxhlet e thimble. A thimble was attached to the bottom flask of the soxhlet and heated with the mantle switch while t he solvent, methanol, was added. The bottom flask's green colour extract was eventually collected and sent fo r FTIR analysis.*Stachytarpheta jamaicensis* leaf methanol was dried under a vacuum pressure pump and mad e into a powder form for pellet preparation for FTIR analysis. In order to create the translucent disc, 10mg of this powder was taken and encapsulated with 100mg of KBr. The disc was loaded into the FTIR, and wave le ngths between 400 and 4000 cm were used for the scan.

Fig:6 FTIR Chromatogram for plant extract *Stachytarpheta Jamaicensis*

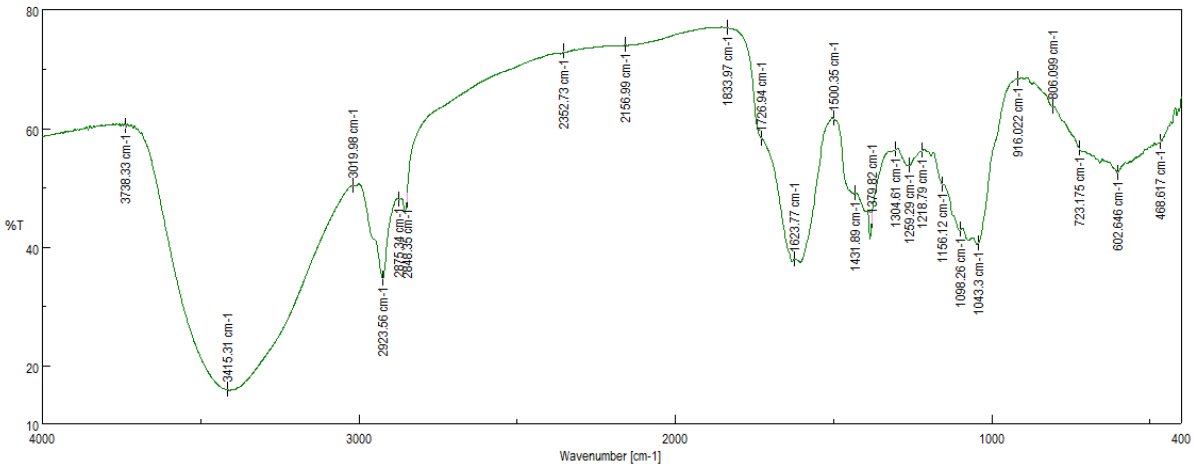


Table :1 FTIR peak values, reference ranges, functional group and phytocompounds for plant extract *Stachytarpheta jamaicensis*.

S.No	Wave number cm^{-1} (reference article)	Wave number (cm^{-1}) (Test Sample)	Functional group assignment	Intensity	Phytocompound identified
1.	-	3738.33	-	-	Unknown
2.	3500–3200	3415.31	O-H Stretching, H-Bonded	Strong, broaad	Alcohols, phenols
3.	3100-3000	3019.98	C-H Stretching	Medium	Alkene
4.	3000-2840	2923.56	C-H Stretching	Medium	Alkene
5.	3000-2840	2875.34	C-H Stretching	Medium	Alkene
6.	3000-2840	2848.35	C-H Stretching	Medium	Alkene
7.	-	2352.73	-	-	Unknown
8.	2175-2140	2156.99	S-C≡N Stretching	Strong	Thiocyanate
9.	2000-1650	1833.97	C-H Bending	Weak	Aromatic compound
10.	1740-1720	1726.94	C=O Stretching	Strong	Aldehyde
11.	1650-1600	1623.77	C=C Stretching	Medium	Conjugated alkene
12.	1550-1500	1500.35	N-O Stretching	Strong	Nitro compound
13.	1440-1395	1431.89	O-H Bending	Medium	Carboxylic acid
14.	1390-1310	1379.82	O-H Bending	Medium	Phenol
15.	1350-1300	1304.61	S=O Stretching	Strong	Sulfone
16.	1310-1250	1259.29	C-O Stretching	Strong	Aromatic ester
17.	1225-1200	1218.79	C-O Stretching	Strong	Vinyl Ether
18.	1205-1124	1156.12	C-O Stretching	Strong	Tertiary Alcohol
19.	1124-1087	1098.26	C-O Stretching	Strong	Secondary alcohol
20.	1050-1040	1043.3	CO-O-CO Stretching	strong, broad	Anhydride
21.	950–910	916.022	O–H bend	Medium	carboxylic acids
22.	900–675	866.099	C-H ‘Oop’’	Strong	Aromatics
23.	725–720	723.175	C-H rock	Medium	Alkanes
24.	690-515	602.646	C-Br stretching	Strong	Halo compound
25.		468.617	-	-	Unknown

Results:

Bioactive phytocompounds

An FTIR analysis is done to methanol extract of *Stachytarpheta jamaicensis* shows 17 bioactive compounds. The spectrum peak at 3415.31 in between the reference ranges 3200-3500 with strong and broad O-H Stretching, H-Bonded evidence for the presence of alcohols, phenols lcohols, phenols which is supported by a similar peak observed at 3543.56 in C*umin cymiun* seeds [9] and 3471.24 in C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9] at 3412.42 in *Tephrosia purpurea* [10]. Likewise, the spectrum peaks at 3019.98, 2923.56, 2875.34, and 2848.35 in between the reference ranges 3000-2840 with (medium, C-H stretching) prove the existence of alkene, which shows a concrete resemblance with peaks at 822.491 and 712.569 for *Andrographis echioides* [11], peaks at 3008.41 and 3475.1 in C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9], peaks at 1627.63,1654.62, 977.733, 806.099 and 888.059 for *Tephrosia purpurea* [10], peaks at 1656.77, 832.133, 800.314 and 710.64 for *Cardiospermum halicacabum* [12]. The spectrum peak at 2156.99 between the reference ranges 2175-2140 (strong, S-C≡N stretching) proves the existence of thiocyanate has a mere concordance with the Peak at 1864.83 for Cocos nucifera and peaks at 1895.68, 184.22 and 1833.97 for C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9], at 1836,86 for *Tephrosia purpurea* [10]. The Peak at 1833.97 between the reference ranges 2000-1650 (weak C-H bending) indicates the presence of the bioactive aromatic compound. The spectral Peak at 1726.94 within reference ranges of 1740-1720 (Strong C=O Stretching) suggests the presence of aldehyde Aldehyde 1844.8 *Andrographis echioides* [11], and Peak at 1623.77, 1650-1600 (Medium C=C Stretching) proved the presence of conjugated alkene. Conjugated alkene 1606.41 *Tephrosia purpurea* [10], 1634.38, 1603.52 *Andrographis echioides* [11]. The Peak at 1500.35 with strong N-O Stretching indicates the existence of nitro compound, which resembles the results of spectral peaks at 1513.85, 1486.85 in *Andrographis echioides* [11], 1504.2, 1531.2 and 1482.99 in *Tephrosia purpurea* [10], 1522.52, 1478.17 and 1498.42 in *Cardiospermum halicacabum* [12] for the Nitro compound. The peaks at 1431.89 (medium O-H bending) proved the presence of carboxylic acid reflects observed for the same carboxylic acid at 935.306 in *Cardiospermum halicacabum* [12], 1706.69, 1424.17 and 918.914 in *Tephrosia purpurea* [10], 1716.34, 1436.71, 939.163, 921.807 in C*umin cymiun* [9], 940.128, 916.022 in *Solanum Lycopersicum* [9], 2672.86,1422.24 in *Cocus Nucifera* [9], 2676.71, 2621.75, 1557.24, 1422.24, 917.95 in C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9], 1417.42, 929.521 in *Andrographis echioides* [11], 1716.34, 1436.71 and 939.163 in C.cyminum [13]. The Peak at 1379.82 with medium O-H bending indicates the phenol shows certain similarities with the phytocompounds phenol at 1322.93 in C.cyminum [13] 1386.57, 1311.36 in *Andrographis echioides* [11], 1325.82 in C*umin cymiun, Solanum Lycopersicum and Cocus* ***Nucifera*** [9]. The Peak at 1304.61 (Strong, S=O Stretching) evidence for the presence of sulfone coincide with the results observed at 1329.68 C*umin cymiun, Solanum Lycopersicum, and Cocus Nucifera* [9], 1315.21 *Cardiospermum halicacabum* [12]. Peaks at 1259.29, 1218.79, 1156.12, and 1098.26 with strong C-O stretching indicate the presence of aromatic ester,vinyl ether, tertiary alcohol, and secondary alcohol, respectively exhibited a mere resemblance with the results aromatic ester observed at 1276.65 in *Andrographis echioides* [11] in 1297.86 *Tephrosia purpurea* [10], Vinyl Ether at 1225.54, 1208.18 in C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9] at 1204.33 in *Tephrosia purpurea* [10],Tertiary Alcohol at 1159.97,1142.62 in *Andrographis echioides* [11], at 1157.08 and 1129.12 C*umin cymiun, Solanum Lycopersicum, and Cocus Nucifera* [9]. The Peak at 1043.3 with strong, broad CO-O-CO Stretching indicates the presence of Anhydride has a strong concordance with spectral Peak observed at 1046.19 for anhydride in *Tephrosia purpurea* [10], 1042.34 C*umin cymiun, Solanum Lycopersicum and Cocus Nucifera* [9]. The spectral Peak at 916.022 (Medium O–H bend) evidenced the presence of carboxylic acids. The Peak at 866.099 (Strong C-H 'Oop'') indicates the presence of aromatics coincide with the spectral Peak at 1447.31 in *Cardiospermum halicacabum* [12], 3013.23, 861.06 and 788.743 in *Tephrosia purpurea* [10], 1454.06, 897.701 in C*umin cymiun* [9]. Moreover, this has some similarities with the Peak at 863.953 in *Solanum Lycopersicum* [9], 869.739 in C*umin cymiun, Solanum Lycopersicum, and Cocus Nucifera* [9], 1441.53, 757.888 in *Andrographis echioides* [11], 1454.06, 897.701 in C.cyminum [13] for the existence of aromatics. Peak at 723.175 with medium C-H rock indicates presence of alkanes has certain similarity with spectral peaks at 2991.05, 2873.42, 2856.06 in C.cyminum [13], 2995.87, 2954.41, 2923.56, 2848.35, 2875.34 in *Andrographis echioides* [11], 2953.45, 2925.48, 2884.02, 2853.17 in C*umin cymiun, Solanum lycoperisicum and Cocus nusifera* [9], 2886.17, 2856.06

in *Cocus nusifera* [9], 2991.05, 2921.63, 2873.42, 2856.06 in C*umin cymiun* [9], 2923.56, 2879.2, 2855.1, 1455.99, 1383.68, 723.175 in *Tephrosia purpurea* [10], 2925.48, 2856.06 in *Cardiospermum halicacabum* [12] for phytocompounds alkanes and Peak at 602.646 with strong C-Br stretching for the halo compound showed certain resemblance with spectral peaks at 624.823 in *Cardiospermum halicacabum* [12], 602.646, 534.185 in *Tephrosia purpurea* [10], 662.428, 590.111, 507.187 in *Cocus nusifera* [9], 755.96 in C*umin cymiun, Solanum lycoperisicum and Cocus nusifera* [9], 575.646, 534.185 in *Andrographis echioides* [11] for halo compounds.

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