

FT-IR analysis of methanolic extract of leaf of *Indigoferatinctoria*

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Abstract

Indigoferatinctoria is a best medicine to remove all toxicity in human body. The illiterate people in rural India, (even an educated) believe the Hindu sorceress to kill their enemy by giving some poisonous substance secretly through food. These poisonous substances may be plant origin or the composition made by heavy metals. Suppose if any person affected by these types of poison unknowingly. They were treated by *Indigoferatinctoria* leaf powder to remove all poison from the body by some traditional healer. Hence, in the present investigation, the FTIR analyses were done to evaluate the existence of bioactive phytochemicals in methanol leaf extract of plant *Indigoferatinctoria*. The methanol extract was taken to column chromatography to separate the various fractions present in extract. The obtained results showed two major fractions. They are, fraction –I and II. These fractions were analyzed in FTIR. The obtained results showed that the fraction I of *Indigoferatinctoria* shows the following peak values such as 420.48, 470.63, 530.42, 597.93, 669.3, 754.17, 900.76, 1076.28, 1234.44, 1382.96, 1514.12, 1612.49, 1705.07, 1890.24, 1965.46, 2119.77, 2208.49, 2362.8, 2929.87, 3392.79, 3774.69, 3878.85, 3927.07 and 3975.29 indicates the existence of bands such as C-I Stretch, C-O-H Bending, CH out-of-plane-deformation, SO₂ sym stretch, Skeletal vibration, SO₂ antisym stretch, CH₃ antisym deformation, COO⁻ antisym stretch, C=O stretch, P-H stretch, CH antisym and sym stretching, CH antisym and sym stretching, OH stretch, OH stretch and OH stretch and the presence of bands related functional groups such as IodoCompounds, C-OH in alcohol, o-disubst benzene, SO₃H in sulfonic acids, *t*-butyl in hydrocarbon, SO₂ in sulfonyl chloride, CH₃ Aliphatic compounds, COO⁻ Carboxylic acid salts, C=O in carboxylic acids, -PH in phosphines, -CH₃ and -CH₂ in aliphatic compounds, -CH₃ and -CH₂ in aliphatic compounds, -OH in alcohol and phenols, -OH in alcohol and phenols and -OH in alcohol and phenols respectively. The fraction II of *Indigoferatinctoria* shows the following peak values such as 418.55, 466.77, 601.79, 1114.86, 1354.03, 1427.32, 1620.21, 2931.8, 3404.36 and 3533.59 indicates the existence of bands such as Cl-C=O plane deformation, out of plane ring bending, SO₂ scissoring, C-N Stretch, NO₂ sym stretch, OH Plane bending, C=C stretch, CH- antisym and sym stretching, OH stretch (Solids

and Liquids) and OH stretch (dilsoln) and the presence of bands related functional groups such as C=C in acid chlorides, Naphthalenes, SO₂ in sulfones, C-NH₂ in primary aliphatic amines, NO₂ in aromatic nitro compounds, Carboxylic acids, C=C in vinyl ethers, CH₃ and -CH₂-OH in alcohols and phenols, and -OH in alcohols and phenols respectively.

Key words: FTIR, *Indigoferatinctoria*, Neeli, Fabaceae

Introduction

India has richest natural resources with variety of medicinal plants. Traditionally, Indian peoples are having the famous medicinal system called Siddha and Auyvedha since the ancient period to treat the various human diseases. Now a day, the Indian researchers dig out the medicinal secrets found in both Auyrvedha and Siddha based on these they use the plants in the health care systems as well as in international herbal and pharmaceutical markets to earn the money. Indigo is one of the oldest natural dye in the world and has been used since the ancient periods. This dye is obtained from plants species *Indigofera arrecta* and *Indigoferatinctoria*. Addition to these, *Indigoferatinctoria* used as a medicine to cure various diseases such as *Indigoferatinctoria* are bitter, thermogenic, laxative, trichogenous, expectorant, anthelmintic, gastropathy, splenomegaly, cephalgia, cardiopathy, hepatoprotective anticancer, epilepsy, neuropathy, chronic bronchitis, asthma, ulcers, skin diseases, diuretic and are useful for promoting the growth of hair (Asuntha et al, 2014). Hence, in the present investigation, FTIR analysis was made to find the bioactive phytochemicals present in the methanolic leaf extract of *Indigoferatinctoria*.

Materials and Methods

Preparation of the plant extract

The wet leaves of *Indigoferatinctoria* were purchased from Sunday market Madurai. They were shade dried and ground well. From this, 100 grams were taken and packed inside the thimble of the Soxhlet apparatus. The adequate amount of solvent was filled in the bottom flask and the temperature of the Soxhlet was fixed based on the solvent boiling point. The extract comes from the syphon after condensation was collected in a conical flask. Then these methanol extract of leaves of *Indigoferatinctoria* was subjected to chromatographic separation using column chromatography and resultant two fractions were subjected to FT-IR.

Biology of the study plant

The plant *Indigoferatinctoria* belongs to the family Fabaceae which popularly known as Neeli in Tamil and found throughout India. This plant is commonly named as true indigo because of the original source of Indigo dye.

Name in various languages

English : Indian indigo; Hindi : Nili; Kannada : karunili; Malayalam : Neelamar Amar; Sanskrit : Nilini, Nili, Thuni, Kala, Dola, Nilika, Ranjani, Sriphala, Tuccha, Gramina, Madhuparni, Klithaka, Kalakeshi, Nilapushpa; Tamil : Avuri; Telugu: NiliChettu, Nili

Description

Plant *Indigoferatinctoria* is a branching shrub grow upto 2 m high with 1-2.5 cm long and 0.3 -1.2 cm wide 7-13 leaflets. The tender branches are bluish red in colour. The leaves are green in colour in fresh condition with 1-7mm petiole, 0.5- 3mm blade and obovate to round shape but turned into greyish black on drying. The flowers are sessile lax spicateracemes, with 3.5-4.5mm sepals, lanceolate, keeled, stellate-tomentose and much shorter than leaves and with red to pink in color. The fruit is 3.4-4.5mm in size with 0.4-0.6mm size orange-brown seed.

Distribution

This plant is naturally abundant in the tropical and temperate Asia, as well as parts of Africa and has been in cultivation worldwide for many centuries.

Classification

Kingdom : Plantae Phylum: Angiosperms
(unranked): Rosids Division : Magnoliophyta
Class: Magnoliopsida Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Tribe: Indofereae
Genus: *Indigofera*
Species : *Indigoferatinctoria*

Chemical constituents

Indigoferatinctoria contains the phytochemicals belonging to rotenoids groups such as deguelin, dehydrodeguelin, rotenol, rotenone, tephrosin and sumatrol, alkaloids, flavanoid, glycosides, saponin, steroids, tannin and terpenoids.

Medicinal uses

Indigoferatinctoria has been used to cure wide variety of diseases in human being in various countries. In China the roots and leaves are used to treat depression, swollen glands, and heat rash. The leaves show anticancer activity and used as anti- tumour, anti-leukemia and anti-inflammatory medicines. It also used as a medicine for calculus, liver and spleen enlargement, epilepsy and other nervous disorders, eyeball injury and eyelid inflammation, hydrophobia, asthma, hepatitis, whooping cough, heart palpitation, various lung and renal problems, oedema, antidote for arsenic poisoning and belived to stimulate the bladder for cases of urine retention

Fig 1.Plant *Indigoferatinctoria*with leaves and flowers.



Results and discussion

The fraction I of methanol leaf extract of *Indigoferatinctoria* showed the functional groups such as acid chlorides, indo compounds, pyridines, alkynes, hydrocarbons, chloro compounds, vinilidenes, sulfonic acids, esters and lactones, insulfonyl chlorides, β - diketones, ketones, alkenes, phosphines, aliphatic compounds, alcohols and phenols. The fraction II shows presence of functional groups such as acid chloride, naphthalenes, iodo compound, alkynes, alkyl chlorides, vinyl compounds, sulfonic ascid, ethers, sulfonyl chlorides, aromatic compounds, pyridine derivatives, carboxylic acids, benzene rings, alkenes, phosphines, aliphatic compounds, alcohols and phenols. These results shows some agreement with that the plant extract of *Indigoferatinctoria* contains the phytochemicals such as flavonoids apigenin, kaempferol, luteolin and

quercetin (Kamal and Mangla, 1990), carotenoids, coumarins and flavonoids (Mohammed, *et al.*, 1994), Indirubin leaves (Han, 1994), furano-flavonoids (pseudosemiglabrin, semiglabrin and glabritephrin) and a rare flavonoid glycoside: kaempferol-4'-7'-dirhamnoside (Narender *et al.*, 2006) rotenoids (deguelin, dehydrodeguelin, rotenol, rotenone, tephrosin and sumatrol) (Kamal and Mangala, 1993).



Table-1. Peak values, band type and functional group for FTIR (Fourier Transform Infrared Spectroscopy) spectra of fraction I ethanol extract of *Indigofera*

No	Peak value	Bonds	Functional group
1.	420.48	Cl-C=O plane deformation	Cl-C=O in acid chloride
2.	470.63	out-of-plane ring bending	Napthalenes
3.	530.42	in plane ring bending	Napthalenes
4.	597.93	C-Cl stretch	C-I in iodo compound
5.	669.3	C≡C-H Bending	C≡C-H in alkynes
6.	754.17	C-Cl stretch	C-Cl alkyl chlorides
7.	900.76	CH=CH ₂ out of plane wag	CH=CH ₂ in vinyl compounds
8.	1076.28	SO ₃ H Sym stretch	SO ₃ H in Sulfonic acid
9.	1234.44	C-O-C stretch	C-O-C in ethers
10.	1382.96	SO ₂ Antisym stretch	Sulfonyl chlorides
11.	1514.12	Ring stretch; sharp band	Benzene in aromatic compounds Pyridine derivatives
12.	1612.49	ring stretch; doublet.	C=O in carboxylic acids
13.	1705.07	C=O stretch; fairly broad	Substituted benzene rings
14.	1890.24	Several bands from overtone and combination bands	C=C=C in allenes
15.	1965.46	C=C=C antisym stretch	C≡C in allenes
16.	2119.77	C≡C stretch	C≡C in alkynes (Disubst)
17.	2208.49	C≡C stretch; strong in Ramam	-PH Phosphines
18.	2362.8	P-H stretch; Sharp peak	-CH ₃ and -CH ₂ in aliphatic compounds
19.	2929.87	antisym and sym stretch	-OH in alcohols and phenols
20.	3392.79 Above	-OH stretch (solids and liquids)	

Table-2. Peak values, band type and functional group for FTIR (Fourier Transform Infrared Spectroscopy) spectra of fraction II methanol extract of *Indigofera*

No	Peak value	Bands	Functional group
1.	592.15	C-I Strech	Iodo Compounds
2.	667.37	C-O-H Bending	C- OH in alcohol
3.	748.38	CH out-of-plane-deformation	o-disubst benzene
4.	1072.42	SO ₂ symstretch	SO ₃ H in sulfonic acids
5.	1255.66	Skeletal vibration	<i>t</i> -butyl in hydrocarbon
6.	1386.82	SO ₂ antisym stretch	SO ₂ in sulfonyl chloride
7.	1442.75	CH ₃ antisym deformation	CH ₃ Aliphatic compounds
8.	1608.63	COO ⁻ antisym stretch	COO ⁻ Carboxylic acidsalts
9.	1705.07	C=O stretch	C=O in carboxylic acids
10.	2357.01	P- H stretch	-PH in phosphines
11.	2873.94	CH antisym and sym stretching	-CH ₃ and-CH ₂ in aliphatic compounds
12.	2929.87	CH antisym and sym stretching	-CH ₃ and-CH ₂ in aliphatic compounds
13.	3377.36	OH stretch	-OH in alcohol and phenols
14.	3784.34	OH stretch	-OH in alcohol and phenols
15.	3836.42	OH stretch	-OH in alcohol and phenols

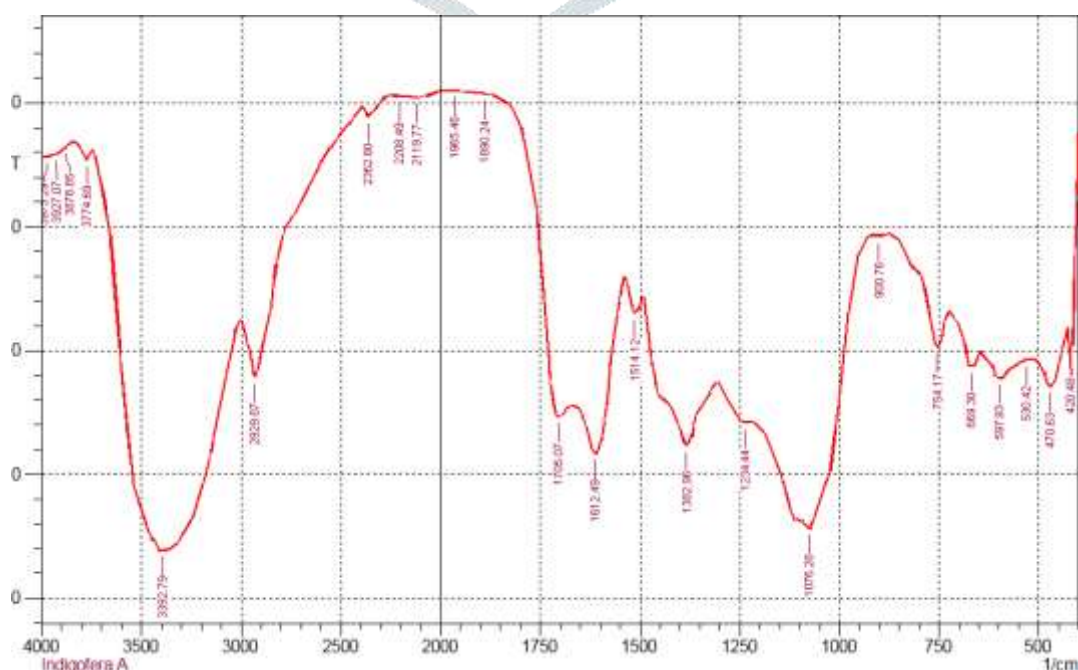
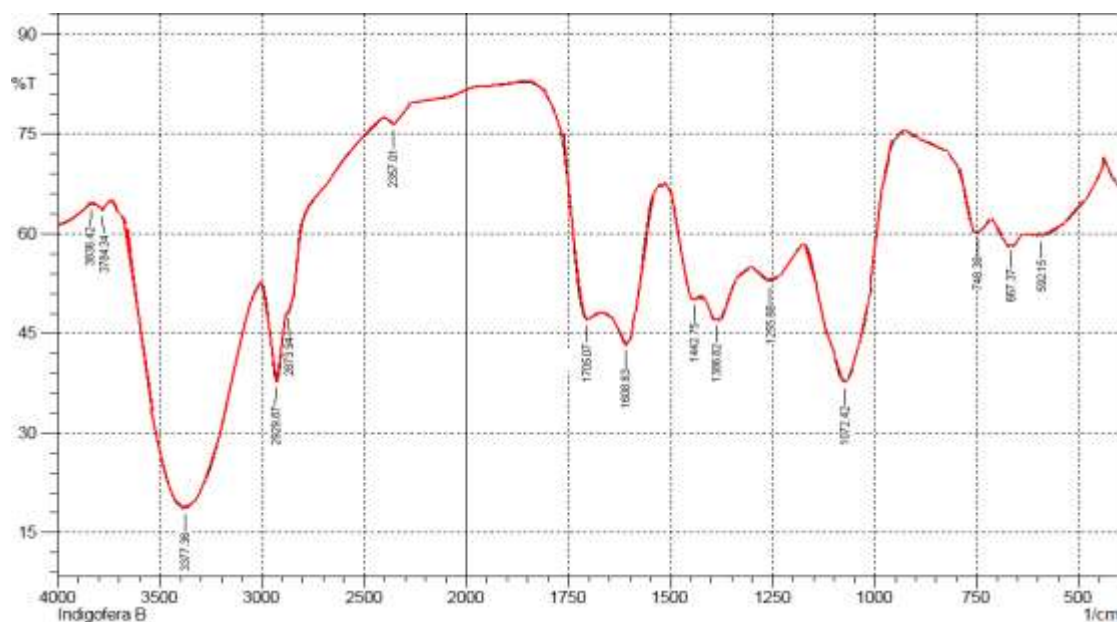
Fig1 .FTIR Pattern of fraction -I methanol extract of leaf of *Indigoferatinctoria*

Fig 2 .FTIR Pattern of fraction -II methanol extract of leaf of *Indigoferatinctoria*

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