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Phytochemical, fourier transform infrared (FTIR) spectroscopy and gas chromatography: Mass spectroscopy (GCMS) studies on *Soymida febrifuga* a juss.

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Abstract
Medicinal plants are the major source of therapeutics and pharmaceutical industries. Phytochemicals present in plants are used in many ways for betterments of mankind's. The study of *Soymida febrifuga* with focusing its leves is associated to the medicinal properties of plant. Many research workers reported ethno medicinal aspects of plants. The current works is find phytochemical properties and therapeutics aspects of *Soymida febrifuga* with the help of modern analysis techniques like FTIR and GC MS analysis with standard methodology. The significant result was recorded as per GC MS data and further analyzed with analyzed results with data of National Institute of Standards and Technology (NIST) and on Dr. Duke's Phytochemical and tthno botanical Databases.

Keywords: *Soymida febrifuga*, fourier transform infrared spectrophotometer (FTIR), gas chromatography: Mass spectroscopy (GCMS), medicinal plant, acetone, solvent

Introduction

Plants are considerably useful and economically important for all mankind's. They may due to their food value or by means of their active constituents that are used in the treatment of many human diseases. Plants contain hundreds or thousands chemicals and metabolites make them medicinally important (Garg, *et al*. 1993) [7]. Medicinal and aromatic plants a gift of nature are being used against various infection and diseases in the worlds since past history. It represents extraordinary reservoir novel molecules. About 43% of totals plants from Indian subcontinent (approximately 7,500 species) are reported to have medicinal value and hence important field of isolation of novel chemicals from that (Patil *et. al.* 2015a) [13]. In recent years there has been a gradual revival of interest in the use of medicinal plants because herbal medicines have been reported to be safe and without any adverse side effects having natural phyto constituents in them (Amritesh *et. al* 2011) [3]. Much work has been done on ethno medicinal plant in India. Interests in a large number of traditional natural products have increased for finding their phytochemical and antimicrobial activity. It has been also suggested that aqueous and ethanolic extracts from plant used in allopathic medicines are potential sources of antiviral and antimicrobial agents (Patil and Khan 2015b) [13, 14]. That's leads to finding of antimicrobial potential among the local and wild plants. In India, lots of information is available about the medicinal plants, the sages mastered in unparallel knowledge of medicinal plants from ancient time and their medicinal practice is popularly known as Ayurvedic Medicine (Arash *et al.,* 2010) [5]. The oldest known repository of our Indian culture is *Rig-Veda* (4500-2500 BC) mentions about hundreds of medicinal plants and is followed by *Yajurveda* 81 species, *Atharva Veda* (2500-2000 BC) describes elaborate description of medicinal plants (Prakash & Gupta 2005) [15]. Among two important ancient treats *The Charak Samhita* (1000 BC) written by Charaka describes the use of over 1100 medicinal plant. Whereas *Sushruta Samhita* (1000-800BC) by *Sushruta* describes properties and use of 1270 species and their medicinal practice is popularly known as Ayurvedic Medicine (Arash *et al.,* 2010) [5]. The study of *Soymida febrifuga* focuses on the leaves, since this part is usually associated to the medicinal properties and scientific literature related are still less explored (Rahman *et al*., 2016). Many research efforts by scientist have been directed towards the provision of empirical proof to back the use of many tropical plants in traditional-medical practice (Dahiru *et al*., 2009) [6]. However, there still exist a vast number of plants with tremendous medicinal potentials but with no proof to support their claims of efficacy. Many researchers in India and abroad have been work carried out on stem bark, as per the literature, methyl angolensate and steryl glycosiden were isolated from the bark of *Soymida febrifuga* (Adesida *et al*., 1971; Adesogan *et al*., 1972) [1]. The stem bark of *Soymida febrifuga* were used ethno medico-botanically for treatment of various ailments of human beings (Shinde 2008) [16]. It was used in Unani Ayurveda system of medicine as astringent to bowels and fever. *Soymida febrifuga* is also a better tonic, antiperiodic, antimalerials and also beneficial to, apply a decoction for rheumatic swellings (Kirtikar, 1984; Nadkarni 1976) [10, 12].

Materials and Methods

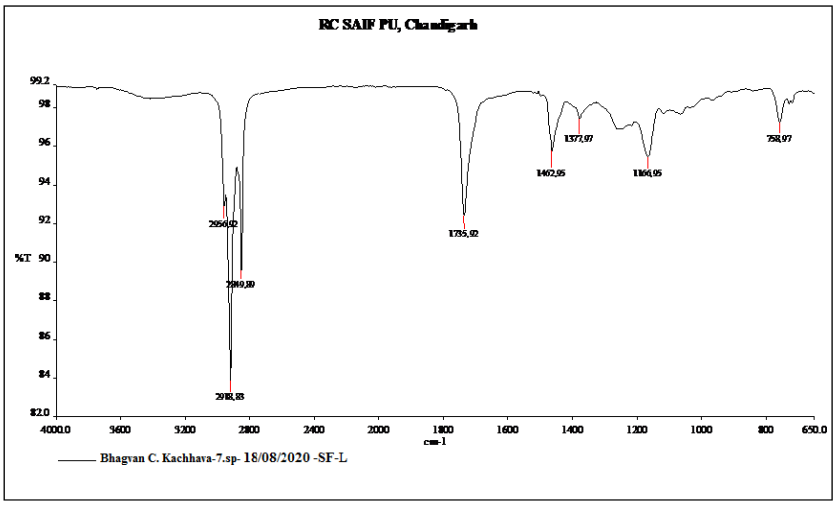
Soymida febrifuga leaves were collected from Manu Devi hilly area (21°20'05.0"N 75°33'07.8"E) from Jalgaon district India. The plant specimen was identified and authenticated by Professor Dr. S. R. Kshirsagar, Taxonomist, Department of Botany, S.S.V.P.S's L.K. Dr.P.R. Ghogrey Science College, Dhule (M.S). The voucher specimen has been deposited in herbarium of the same department for farther reference (Mohan 2008). Phytochemical components of the

plant leaf extracts were screened by using standard procedures as described by Harbone 1998. Leaf extract Soymida *febrifuga* are made from collected sample powder and extracted with different solvents with the help of soxhlet apparatus.

Acetone is used for both analyses that are FTIR and GCMS for leaf powder sample. GC-MS performed on a Shimadzu model QP 2010 plus were also analysed in Acetone extract of leaf sample.

Result and Discussion

FTIR results for the Leaves extract in acetone solvent shows characteristic absorption bands for Carboxylic acids (O-H) at 2956,92 cm^{-1}, Alkanes (O-H) at 2849,89 cm^{-1}, Aldehydes (C=O) at 1735,92 cm^{-1}, Aromatic Rings (C=C) at 1462,95 cm^{-1}, Alkanes (C-H) at 1377,97 cm^{-1}, Esters (C-O) 1166,95 cm^{-1} and Phenyl Ring (C-H) 758,97 cm^{-1} peak value these compounds are found between 4000 to 650 cm^{-1} in spectral search (Graph no. 1 and Table no. 1).



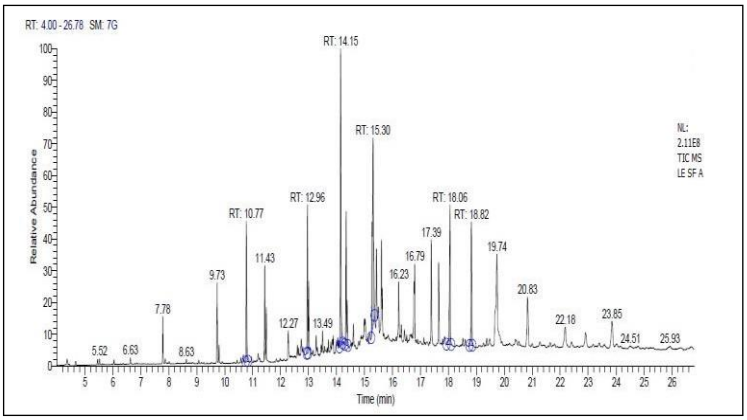
Graph no. 1: FTIR result of Acetone Leaf extract Soymida *febrifuga*

Table 1: FTIR spectral peak values and functional groups obtained for the leaf extract

Extracts prepared in	Peak values	IR Spectrum Frequency range (cm^{-1})	Functional groups	Compound Type
Acetone Extract	2956,92	2800-3200 cm^{-1}	O-H	Carboxylic acids
	2918,83	2800-3200 cm^{-1}	O-H	Carboxylic acids
	2849,89	At 2800 cm^{-1}	C-H	Alkanes
	1735,92	1600-1800 cm^{-1}	C=O	Aldehydes, Ketones,
	1462,95	1400-1600 cm^{-1}	C=C	Aromatic Rings
	1377,97	1200-1400 cm^{-1}	C-H	Alkanes
	1166,95	1000-1200 cm^{-1}	C-O	Carboxylic acids, Esters
	758,97	650-800 cm^{-1}	C-H	Phenyl Ring

Gas chromatography and mass spectrometry (GC MS) Studies: The combined fractions eluted from column chromatography that showed single spot in TLC were further analyzed by GC-MS performed on a Shimadzu model QP 2010 plus to obtain molecular mass of pure and semi-pure compounds according to mass per charge (*m/z*) ratio for *Soymida febrifuga* leaf sample.

The GC-MS used was equipped with BPX-5 column (5% phenyl polysilphenylene-siloxane) of 30 m length, 0.25 µm of film thickness and 0.25 mm internal diameter. GC-MS was performed based on the method as described by Kalaiselvan *et al*. (2012) [9]. The electron ionization energy system with ionization energy of 70 eV was used for GC-MS detection. The carrier gas, helium (99.99%) was used at a constant flow rate of 1 mL/min and 1 µL purified sample was introduced into GC-MS using syringe for analysis (by using split mode with split ratio of 25:1).

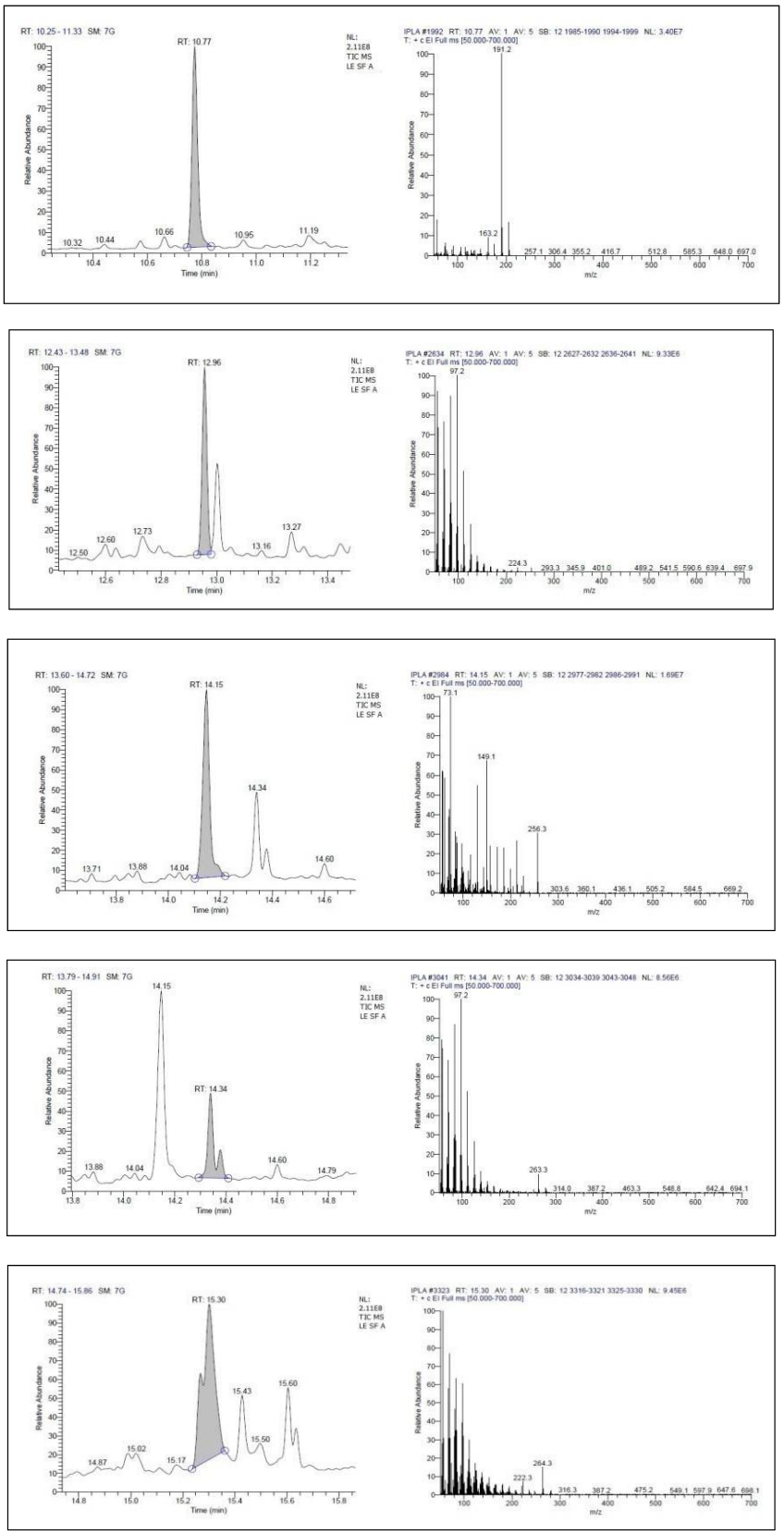


Graph 2: GC MS Results for *Soymida febrifuga* leaf

Extract in Acetone

Injector temperature was set at 260 ºC. The temperature of oven was programmed from 60 ºC (isothermal for 5 minutes), with an increase of 10 ºC per minute to 280 ºC, and ending with 10 min, isothermal at 280 ºC. At 70 eV, mass spectra were taken; a 71 scan interval of 0.5 second and fragments from 45 to 450 Da. By matching its average peak area to the total areas, the relative percentage quantity of each component was acquired. By matching the retention times with those of authentic compounds, compound identification was obtained and the mass spectral obtained from library data of the corresponding compounds (Kalaiselvan *et al*. 2012) [9].

Analysis of GC MS data:

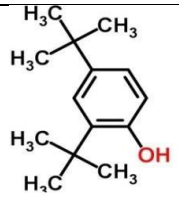
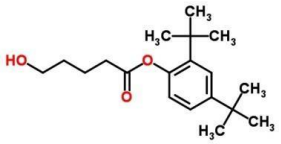
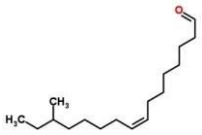
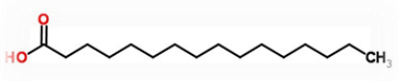
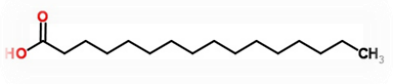
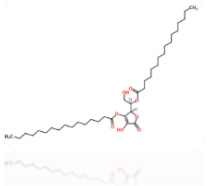
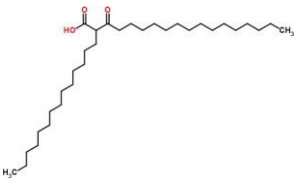


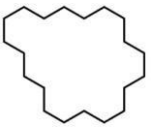
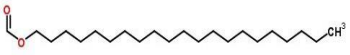
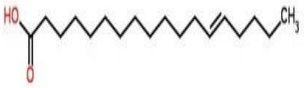
Graph 3: GC MS LE SF A Peak Analysis

Table 2: Library Search Results *Soymida febrifuga*

Sr No.	Compound Name	RT	Molecular Formula	MW (g/mol)
1	Phenol,,4-bis(1,1-dimethylethyl)	10.77	$C_{14}H_{22}O$	206.33
2	Phenol, 2,6-bis(1,1-dimethylethyl)	10.77		
3	Pentanoic acid, 5-hydroxy, 2,4-di-t-butylphenyl esters	10.77	$C_{19}H_{30}O_3$	306.44
4	E-15-Heptadecenal	12.96	$C_{17}H_{32}O$	252.44
5	Hexadecen-1-ol,trans-9	12.96	$C_{16}H_{32}O$	240.43
6	1-Hexadecanol	12.96	$C_{16}H_{34}O$	240.43
7	n-Hexadecanoic acid	14.15	$C_{16}H_{32}O_2$	256.42
8	l(+)-Ascorbic acid 2,6-dihexadecanoate	14.15	$C_{38}H_{68}O_8$	652.95
9	Palmitic anhydride	14.15	$C_{32}H_{62}O_3$	494.84
10	Cycloeicosane	14.34	$C_{20}H_{40}$	280.54
11	1-Heneicosyl formate	14.34	$C_{22}H_{44}O_2$	340.59
12	9-Nonadecene	14.34	$C_{19}H_{38}$	266.51
13	Cis-13-Octadecenoic acid	15.30	$C_{18}H_{34}O_2$	282.46
14	Cis-Vaccenic acid	15.30	$C_{18}H_{34}O_2$	282.46
15	Trans-13-Octadecenoic acid	15.30	$C_{18}H_{34}O_2$	282.46

Table 3: Name of the compounds and structural formula

Sr No.	Compound Name	Molecular Formula	Structural Formula
1	Phenol,,4-bis(1,1-dimethylethyl) or Phenol, 2,6-bis(1,1-dimethylethyl)	$C_{14}H_{22}O$	
3	Pentanoic acid, 5-hydroxy, 2,4-di-t-butylphenyl esters	$C_{19}H_{30}O_3$	
4	E-15-Heptadecenal	$C_{17}H_{32}O$	
5	Hexadecen-1-ol,trans-9	$C_{16}H_{32}O$	
6	1-Hexadecanol	$C_{16}H_{34}O$	
7	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	
8	l(+)-Ascorbic acid 2,6-dihexadecanoate	$C_{38}H_{68}O_8$	
9	Palmitic anhydride	$C_{32}H_{62}O_3$	

10	Cycloeicosane	$C_{20}H_{40}$	
11	1-Heneicosyl formate	$C_{22}H_{44}O_2$	
12	9-Nonadecene	$C_{19}H_{38}$	
13	Cis-13-Octadecenoic acid	$C_{18}H_{34}O_2$	

Conclusion

FTIR data reveals the absorption bands for Carboxylic acids, Alkanes, Aldehydes, Aromatic Rings, Alkanes, Esters and Phenyl Ring at deferent peak as reported in table 1. In this peak value are between 4000 to 650 cm^{-1} in spectral search. GC MS data were recorded for *Soymida febrifuga* leaf extract per designed methodology analyzed with data of National Institute of Standards and Technology (NIST) and on Dr. Duke's Phytochemical and Ethnobotanical Databases by Dr. Jim Duke of the Agricultural Research Service or USDA (Antony *et al.,* 2013 and Komal *et al,*. 2011). The spectrum of the unknown component was compared to the spectrum of known components stored in the NIST library and listed 15 compounds (Phenol, 4-bis(1,1-dimethylethyl), Phenol, 2,6-bis (1,1-dimethylethyl), Pentanoic acid, 5-hydroxy, 2,4-di-t-butylphenyl esters, E-15-Heptadecenal, Hexadecen-1-ol,trans-9, 1-Hexadecanol, n-Hexadecanoic acid, l(+)-Ascorbic acid 2,6-dihexadecanoate, Palmitic anhydride, Cycloeicosane, 1-Heneicosyl formate, 9-Nonadecene and Cis-13-Octadecenoic acid etc) as an expectation and probability of occurrence in leaf of *Soymida febrifuga*. The retention time, molecular weight, molecular formula and percentage composition of the sample material were recorded.

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