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ISOLATION AND IDENTIFICATION OF PHYTOCHEMICAL CONSTITUENTS FROM VARIOUS POLAR SOLVENT CRUDE LEAF EXTRACTS OF VULNERABLE AROMATIC TREE - *CHLOROXYLON SWIETENIA* DC

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ABSTRACT

Chloroxylon swietenia DC is a known as East Indian satinwood and this species has been utilized as a part of folkloric drug. The present examination was intended to disengagement of auxiliary metabolic mixes through FTIR and GCMS investigation of different polar solvent leaf extracts. The preparatory phytochemical screening was completed by different compound test, FTIR spectra was done through the potassium bromide (KBr) pellet (FTIR review) technique and GCMS broke down by NIST library. In preparatory phytochemical screening the vast majority of optional metabolites, like alkaloids, flavonoids, triterpenoids, tannins and steroids are available in *Chloroxylon swietenia* leaf ethanol (CSLE) and *Chloroxylon swietenia* leaf methanol (CSLM) extracts. Alcohols, phenols, alkanes, aldehydes, immersed aliphatic, aliphatic amines and alkyl halides were available all concentrates of this species. GCMS examination of six dissolvable concentrates has revealed 117, 112, 30, 48, 76 and 63 phytocompounds separately. Numerous mixes hentriacontane, tritetracontane, triacontane, hexacosane, pentacosane, tetracontane, dotriacontane, nonacosane and oleic acid of have potential bioactive uses, for example, antimicrobial action, cell reinforcement movement, calming action, anticancer action and so forth. A few concentrates have same mixes of oleic corrosive with name bioactive uses. In

light of the outcomes this plant all concentrates have report numerous bioactive mixes. So those bioactive mixes additionally partitioned and it will be instead of rather chemo drugs.

KEYWORDS: *Chloroxylon*, potassium bromide, triterpenoids, saturated aliphatic and oleic acid.

INTRODUCTION

Phytomedicines or natural prescriptions, have assumed a basic part in World wellbeing for a large number of years. As per the World Health Organization (WHO), "natural medications incorporate herbs, home grown materials, home grown arrangements and completed home grown items, that contain as dynamic fixings parts of plants, or other plant materials, or blends.[1] and furthermore the World Health Organization (WHO) bolsters the utilization of conventional pharmaceutical gave they are turned out to be solid and safe. Various pharmaceutical mixes have been created from regular items utilized as conventional solutions.[2] Auxiliary metabolites are chemicals created by plants for which no part has been found in development.[3] Numerous optional metabolites are poisonous or repellent to herbivores and organisms and help in safeguarding against pathogens. Confirmations demonstrate that the generation of optional metabolites increments when a plant is assaulted by herbivores or pathogens and notwithstanding amid barrier component a few mixes are discharged into the air when the plant are assaulted by bugs.[4]

Chloroxylon swietenia DC is a traditional therapeutic plant coming under the family Rutaceae. This species conventionally call as East Indian satinwood, prevail in dry mixed evergreen forest. *C. swietenia* play a key role in folkloric medicine. The parts of the plant species are utilized for various medicinal purposes.[5,6,7] Various parts of the plant are traditionally used in snakebites[8], stem bark is used for common cold and cough[9], ophthalmic infection and cataract[10], wounds[11,12] and as an astringent.[13] The leaf crude extract and leaf essential oil is used to kill mosquito larvae.[14] Apart from this, it is also having antimicrobial activity.[15] In general, this plant extensively utilized in folk medicine. In this study, we screened preliminary phytochemical, and to identify the possible functional groups and organic compounds present in the various extracts of *Choroxylon swietenia* using FTIR and GCMS analysis.

2. MATERIALS AND METHODS

2.1. Plant collection and authentication

A plant shoots with flowers were collected from Madukarai hills, Western Ghats region, Coimbatore, Tamil Nadu, India. The species identified by Botanical Survey of India, Tamil Nadu, India. Plant authentication reference number is **BSI/SRC/5/23/2015/Tech/1478.**

2.2. Plant extract preparation

A 150 grams of *Chloroxylon swietenia* dried leaf were subjected to Soxhlet extraction utilizing progressive strategy by the adjusted methodology of Elwekeel et al.[16] Different polar solvents like hexane, petroleum ether, chloroform, ethyl acetate, ethanol and methanol were utilized for this extraction. Amid extraction warming mantle time kept up as 20° C in light of low polar solvents hexane, petroleum ether and chloroform and also 30° C kept up as polar solvents of ethyl acetate, ethanol and methanol. After extraction every dissolvable concentrates were evaporated at room temperature and collected in amber bottle. The dried extracts were stored under - 4° C for additional investigations of preparatory phytochemical screening, FTIR and GC-MS examination.

2.3. Preliminary phytochemical screening

A preliminary phytochemical quantitative screening of various polar solvent extracts *Chloroxylon swietenia* leaf were analyzed by standard methods. The different polarity solvent extracts are *Choloroxylon swietenia* leaf hexane extract (CSLH), *Choloroxylon swietenia* leaf petroleum ether extract (CSLPE), *Choloroxylon swietenia* leaf chloroform extract (CSLC), *Choloroxylon swietenia* leaf ethyl acetate extract (CSLEA), *Choloroxylon swietenia* leaf ethanol extract (CSLE) and *Choloroxylon swietenia* leaf methanol extract (CSLM). Four different screening test like Draggendorff´s test, Mayer's test, Wagner's test and Hager's test by method of Ciulci[17] flavonoids in 10% HCl & 5% NaOH test and alkaline test[18], tannins used 5% $FeCl_3$ test[17], steroids is Liebermann-Burchard test[17], triterpenes using the Liebermann-Burchard test and Salkowski's test[19], saponins was used foam test[20], glycosides Killer & Kilian test[21], Gum & Mucilages Whistler & BeMiller test[22], Fixed oils Spot test[20] and finally Anthraquinones used in NH_4OH test.[23]

2.4. FTIR spectroscopy

FTIR analysis of the CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM extracts were carried out through the potassium bromide (KBr) pellet (FTIR grade) method in 1:100 ratio and spectrum was recorded using Jasco FT/IR-6300 Fourier transform infrared spectrometer

equipped with JASCO IRT-7000 Intron Infrared Microscope using transmittance mode operating at a resolution of 4 cm−1 (JASCO, Tokyo, Japan).

2.5. Gas Chromatogram Mass Spectroscopy (GCMS) analysis

The Clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethylpolysiloxane, 30 m × 0.25 mm ID × 250 µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 ml/min. The injector temperature was set at 260° C during the chromatographic run. The 1 µL of each extract samples injected into the instrument the oven temperature was as follows: 60 °C (2 min); followed by 300 °C at the rate of 10 °C min−1; and 300 °C, where it was held for 6 min. The mass detector conditions were: transfer line temperature 240 °C; ion source temperature 240 °C; and ionization mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST (2008) library.

3. RESULTS

3.1. Plant extract

Successive extraction of *Chloroxylon swietenia* (150 g) leaf powder yielded 2.492, 0.99, 6.45, 2.24, 5.56 and 12.86 percentage by of CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM extracts respectively (Table 1). The highest yield (12.86) was obtained from CSLM extract and followed by CSLC and CSLE extracts, its percentage of yield is 6.45 and 5.56. The lowest percentage of yield (0.99%) was earned in CSLPE extract.

Table 1. Successive extraction of various polar solvent extracts of *Chloroxylon swietenia* leaf through Soxhlet apparatus.

Sample weight (Grams)	Solvent	Solvent volume (mL)	Temperature	Extraction time (Hours)	Yield %
150	CSLH	1650	20 °C	24.00 h	2.492
146	CSLPE	1650	20 °C	12.00	0.99
144	CSLC	1650	20 °C	24.00	6.45
143	CSLEA	1650	30 °C	15.00	2.24
140	CSLE	1650	30 °C	24.00	5.56
133	CSLM	1650	30 °C	24.00	12.86

3.2. Preliminary phytochemical screening

Phytochemical qualitative analysis of *Chloroxylon swietenia* were performed for the leaf explant of hexane (CSLH), petroleum ether (CSLPE), chloroform (CSLC), ethyl acetate (CSLEA), ethanol (CSLE) and methanol (CSLM) solvent extracts. The results of various chemical tests for the detection and identification of chemical constituents were summarized in table 2. Based on this result most of the secondary metabolites like alkaloids, flavonoids, tannins, steroids and triterpenoids are present in CSLE and CSLM extracts. Absent of secondary metabolites in CSLE extract was glycosides, gum & mucilages, fixed oils and the same kind of compounds are absent in CSLM extract including saponins. CSLH extract have the compounds of steroids, triterpenoids, glycosides, gum & mucilages and fixed oils. Also, CSLPE extracts contain same secondary metabolites of CSLH extract expect glycosides and fixed oils, but alkaloids present in Wagner's test only.

Table 2. Preliminary phytochemical screening of various polar solvent extracts of *Chloroxylon swietenia.*

Compounds	Tests	CSLH	CSLPE	CSLC	CSLEA	CSLE	CSLM
Alkaloids	Dragendroff's test	-	-	-	-	+	+
	Mayer's test	-	-	-	-	+	+
	Wagner's test	-	+	-	+	+	+
	Hager's test	-	-	-	-	+	+
Flavonoids	10% HCl & 5% NaOH test	-	-	+	-	+	+
	Alkaline test	-	-	-	-	+	+
Tannins	5% $FeCl_3$ test	-	-	-	-	+	+
Steroids	Libermann - Burchard's test	+	+	+	+	+	+
Triterpenoids	Libermann - Burchard's test	+	+	+	+	+	+
	Salkowski's test	+	+	-	+	+	+
Saponins	Foam test	-	-	-	-	+	-
Glycosides	Killer & Kilian test	+	-	+	+	-	-
Gum & Mucilages	Whistler & BeMiller test	+	+	-	+	-	-
Fixed oils	Spot test	+	-	+	-	-	-
Anthraquinones	NH_4OH test	-	-	-	-	-	-

–, absent; +, presence

CSLC extract possessed in flavonoids in 10% HCl & 5% NaOH test, also steroids, triterpenoids, glycosides, fixed oils and which is absent in alkaloids, tannins, saponins, gum & mucilages, fixed oils. Another extract CSLEA having in alkaloids in Wagner's test only,

along with steroids, triterpenoids, glycosides, gum & mucilages. Anthraquinones was absent in all the extracts.

3.3. FTIR analysis

The results of FTIR spectra of six various polar solvent extracts of CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM were analyzed with range from 4000 cm^{-1} to 500 cm^{-1}. The samples peak were given in figure 1, 2, 3, 4, 5 and 6 and also each sample peak intensity, assignment, characters and its type of compounds were reported in table 3, 4, 5, 6, 7 and 8. The presence of various functional groups of different compounds were noticed. The absorption spectra of CSLH sample are reported 13 peaks which are shown in figure 1. The dominant band was observed at 3427.51, 2916.37, 2848.86, 1720.50, 1624.06, 1462.04, 1377.17, 1259.52, 1091.71, 1024.20, 800.46, 723.31 and 453.27 cm-1. The band at 3427.51 was due to alcohols and phenolic compounds which assignment is –OH stretch. Five alkanes groups were represented which peaks are 2916.37, 2848.86, 1624.06, 1462.64 and 1024.20, that stretch is C-H. Two aliphatic amines group are presented that peaks are 1091.71, 1024.20 and this stretch is C-N. Finally one peaks is 1720.50 with C=O stretch which is aldehyde and saturated aliphatic groups.

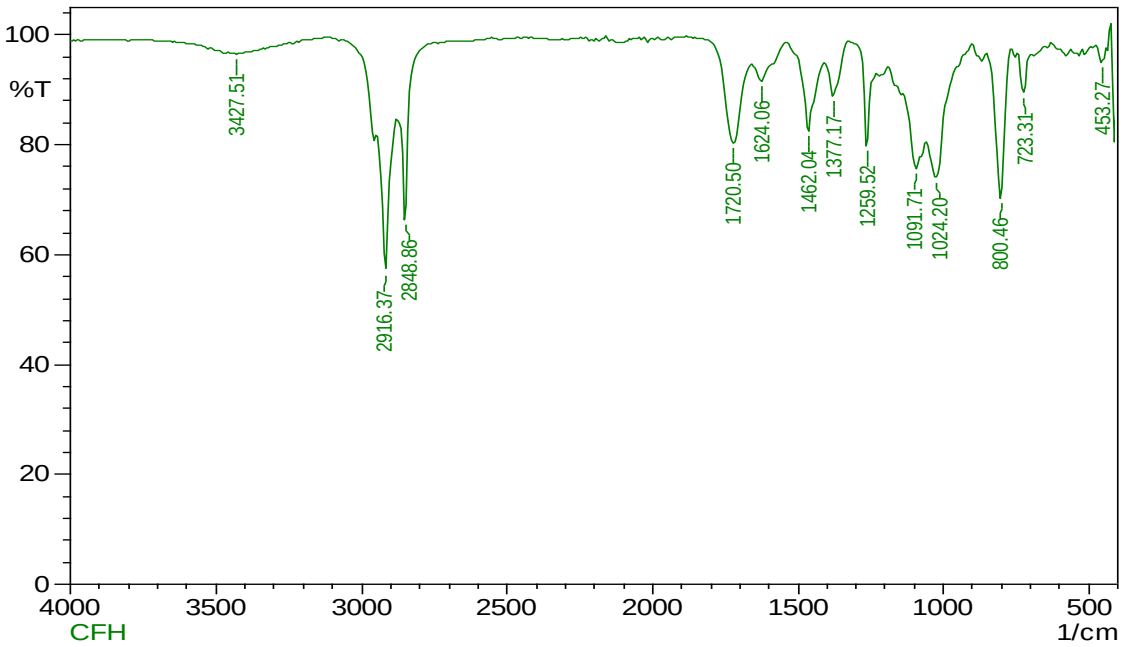

Figure 1. FTIR spectrum analysis of CSLH extract.

Table 3. FTIR spectrum analysis of CSLH extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3427.51	Strong, Sharp	–OH group	Alcohols, Phenols
2	2916.37	Medium	C-H group	Alkanes
3	2848.86	Medium	C-H group	Alkanes
4	1720.50	Strong	C=O stretch	Aldehydes, Saturated aliphatic
5	1624.06	Medium	-C=C	Alkenes
6	1462.04	Medium	C-H groups	Alkanes
7	1377.17	Medium	C-H groups	Alkanes
8	1259.52	Medium	C-H groups	Alkanes
9	1091.71	Medium	C-N	Aliphatic amines
10	1024.20	Medium	C-N	Aliphatic amines
11	800.46	Medium	C-Cl	Alkyl halides
12	723.31	Medium	C-H rock	Alkanes
13	453.27	Medium	C-H rock	Alkanes

In CSLPE extract have reported 14 major bands at 4000 – 500 cm-1 which are represented in figure 2. The strong band were observed at 3446.79, 2916.37, 2848.86, 1726.29, 1622.13, 1462.04, 1373.32, 1259.52, 1091.71, 1018.41, 950.91, 800.46, 723.31 and 509.21 cm^{-1}. The functional groups are alcohols, phenols, carboxylic acid, aldehydes, saturated aliphatic, 1° amines, aromatics, alkanes, ester, ether, aliphatic amines, alkanes, 1°, 2° amines, alkyl halides with assignments are O-H stretch, H-bonded, C=O stretch, N-H bend, C-C stretch (in-ring), C-H bend, C-N stretch, C-H wag (-CH2X), =C-H bend, N-H wag, C-H "oop", C-Cl stretch, N-H wag, C-H "oop", C-Cl stretch, C-H rock and C-Br stretch respectively.

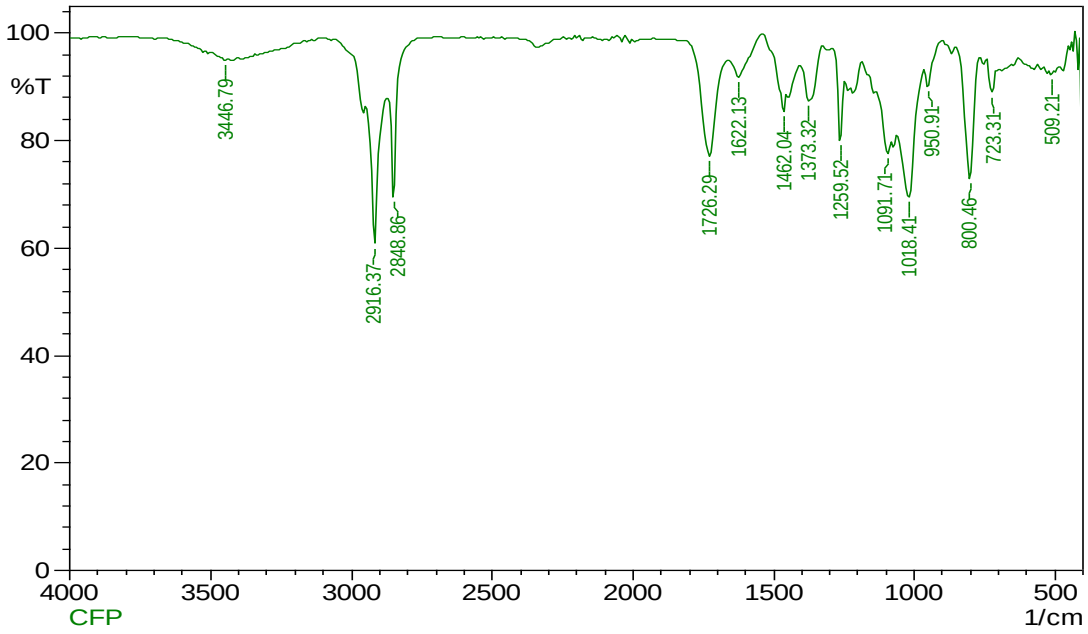

Figure 2. FTIR spectra of CSLPE extract.

Table 4. FTIR spectrum analysis of CSLPE extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3446.79	Strong, sharp	O-H stretch, H-bonded	Alcohols, phenols
2	2916.37	Medium	O-H stretch	Carboxylic acid
3	2848.86	Medium	O-H stretch	Carboxylic acid
4	1726.29	Strong	C=O stretch	Aldehydes, saturated aliphatic
5	1622.13	Medium	N-H bend	1° amines
6	1462.04	Medium	C-C stretch (in-ring), C-H bend	Aromatics, alkanes
7	1373.32	Medium	C-C stretch (in-ring), C-H bend	Aromatics, alkanes
8	1259.52	Medium, strong	C-N stretch, C-O stretch and C-H wag (-CH_2X)	Aliphatic amines, alcohol, carboxylic acids, esters, ethers, alkyl halides
9	1091.71	Strong	C-O stretch, C-N stretch	Alcohol, carboxylic acid, ester, ether, aliphatic amines
10	1018.41	Strong	C-O stretch	Alcohols, carboxylic acids, esters, ethers
11	950.91	Strong	=C-H bend	Alkanes
12	800.46	Strong, broad, medium	N-H wag, C-H “oop”, C-Cl stretch	1°, 2° amines, aromatics, alkyl halides
13	723.31	Strong, broad, medium	N-H wag, C-H “oop”, C-Cl stretch, C-H rock	1°, 2° amines, aromatics, Alkyl halides, alkanes
14	509.21	medium	C-Br stretch	Alkyl halides

Fifteen peaks were identified in CSLC extract which are represented in figure 3 and its functional groups, assignment, intensity and characters are summarized in table 5. The peaks were observed at 3448.72, 2953.02, 2924.09, 1716.65, 1622.13, 1463.97, 1367.37, 1263.37, 1130.37, 1033.85, 937.40, 864.11, 804.32, 565.14 and 455.20 with its functional groups O-H stretch, H-bonded, O-H stretch, C-H stretch, O-H stretch, C-H stretch, C-H stretch, N-H bend, C-C stretch (in-ring), C-H bend, C-N stretch, C-O stretch, C-H wag (-CH2X), C-O stretch; =C-H bend, C-O stretch; =C-H bend, =C-H bend; O-H, bend, N-H wag; C-H “oop” , N-H wag; C-H “oop” C-Cl stretch and C-Br stretch respectively.

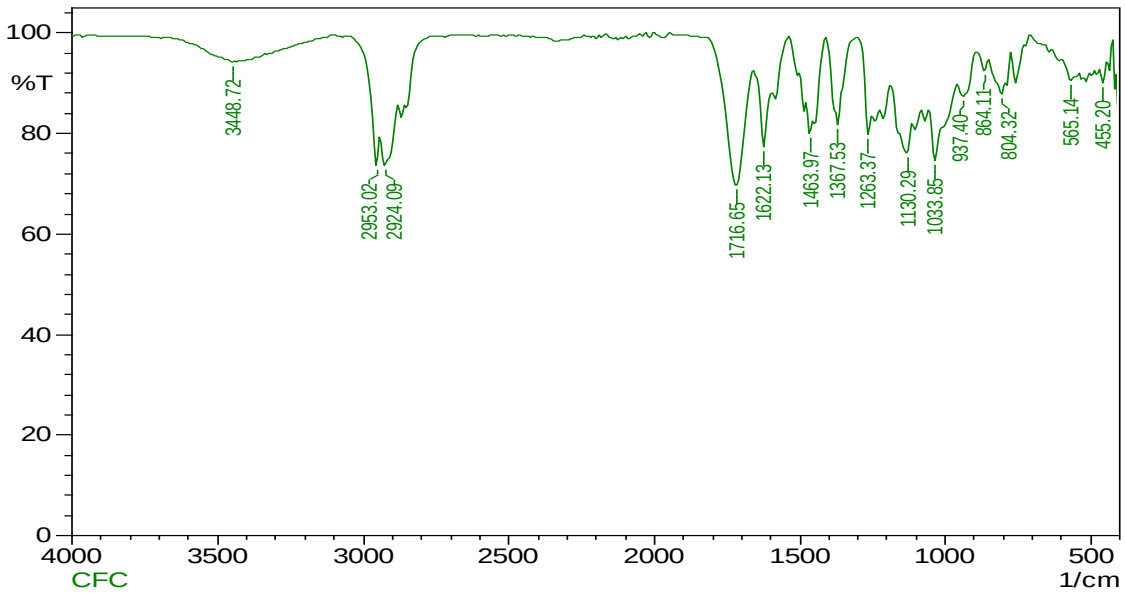

Figure 3. FTIR spectra of CSLC extract.

Table 5. FTIR spectrum analysis of CSLC extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3448.72	Strong, sharp	O-H stretch, H-bonded	Alcohols, phenols
2	2953.02	Medium	O-H stretch, C-H stretch	Carboxylic acid, alkanes
3	2924.09	Medium	O-H stretch, C-H stretch	Carboxylic acid, alkanes
4	1716.65	Strong	C-H stretch	α, β-unsaturated aldehydes, ketones
5	1622.13	Medium	N-H bend	1° amines,
6	1463.97	Medium	C-C stretch (in-ring), C-H bend	Aromatics, alkanes
7	1367.37	Medium	C-C stretch (in-ring), C-H bend	Aromatics, alkanes
8	1263.37	Strong, medium	C-N stretch, C-O stretch, C-H wag (-CH_2X)	Aromatic amines; Carboxylic acids, esters, ethers; Alkyl halides
9	1130.37	Strong	C-O stretch; =C-H bend	Carboxylic acids, esters, ethers; alkanes
10	1033.85	Strong	C-O stretch; =C-H bend	Carboxylic acids, esters, ethers; alkanes
11	937.40	Strong, medium	=C-H bend; O-H bend	Alkanes; carboxylic acid
12	864.11	Strong, broad	N-H wag; C-H "oop"	1°, 2° amines; aromatics
13	804.32	Strong, broad	N-H wag; C-H "oop" C-Cl stretch	1°, 2° amines; aromatics; Alkyl halides
14	565.14	Medium	C-Br stretch	Alkyl halides
15	455.20	medium	C-Br stretch	Alkyl halides

Thirteen peaks were observed in CSLEA extract, the peak frequency are 3344.57, 2926.01, 1714.72, 1616.35, 1512.19, 1444.68, 1371.39, 1259.52, 1064.71, 1031.92, 800.46, 659.66 and 509.21 cm^{-1} (Fig. 4). Each peaks shown strong, sharp and medium intensity. The peaks frequency, intensity, assignment and characterization are represented in table 6. Alcohol, phenols; 1°, 2° amines, carboxylic acid; alkanes, carbonyls (general), aldehydes, saturated aliphatic, α, β-unsaturated ester, 1° amines, nitro compounds, aromatics, aromatic amines, esters, ethers; aliphatic amines, alkyl halides, alkynes; alkyl halides and alkynes are the characters presented in CSLEA extract.

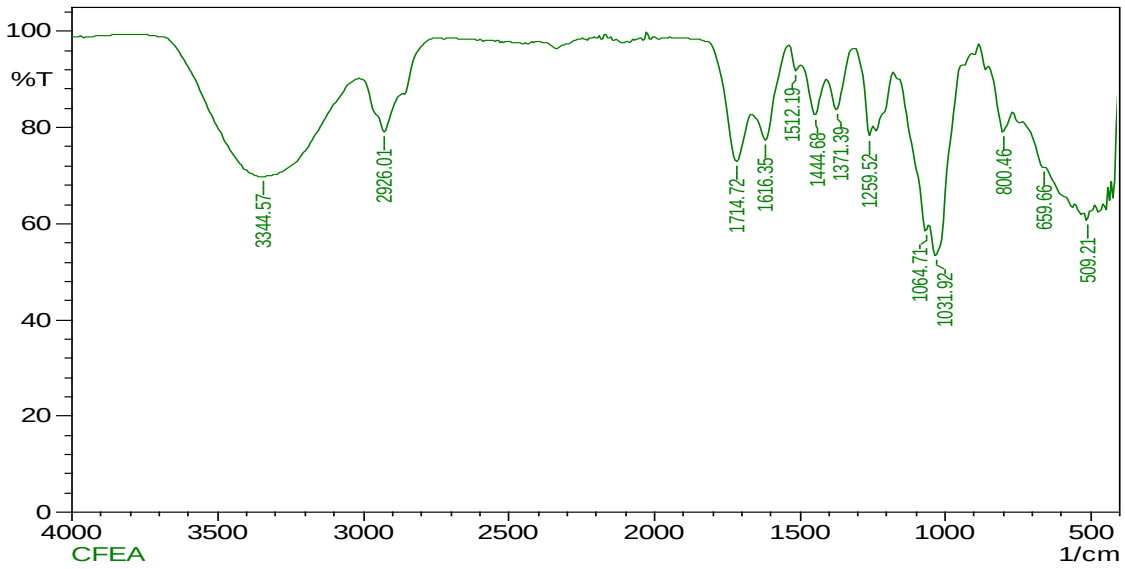

Figure 4. FTIR spectra of CSLEA extract.

Table 6. FTIR spectrum analysis of CSLEA extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3344.57	Strong, sharp, medium	O-H stretch, H-bonded; N-H stretch	Alcohol, phenols; 1°, 2° amines
2	2926.01	Medium	O-H stretch; C-H stretch	Carboxylic acid; alkanes
3	1714.72	Strong	C=O stretch;	Carbonyls (general), carboxylic acid, aldehydes, saturated aliphatic, α, β-unsaturated ester
4	1616.35	Medium	N-H bend	1° amines
5	1512.19	Strong	N-O asymmetric stretch	Nitro compounds
6	1444.68	Medium	C-C stretch (in-ring)	aromatics
7	1371.39	Medium	C-C stretch (in-ring)	aromatics
8	1259.52	Strong	C-N stretch	Aromatic amines

9	1064.71	Strong	C-O stretch; C-N stretch	Alcohols, carboxylic acids, esters, ethers; aliphatic amines
10	1031.92	Strong, medium	C-O stretch; C-N stretch	Alcohols, carboxylic acids, esters, ethers; aliphatic amines
11	800.46	Strong, broad, medium	=C-N stretch; N-H wag; C-H "oop"; C-Cl stretch	Alkanes; 1°, 2° amines; aromatics; alkyl halides
12	659.66	Broad, strong, medium	-C≡C-H: C-H bend; C-Br stretch	Alkynes; alkyl halides
13	509.21	Strong	C-H bend	Alkynes

FTIR analysis of CSLE and CSLM extract have 10 and 9 major peak compounds (Fig. 5 and 6) and the peaks functional groups, intensity, characters are given in table 7 and 8. Both samples have more or less similar peaks and frequency range. CSLE peak frequency are 3284.77, 2929.87, 1610.56, 1442.75, 1346.31, 1257.59, 1029.99, 860.25, 815.89 and 491.85. Most of the peaks are strong, sharp, medium intensity. CSLE peak assignments are O-H stretch, H-bonded; N-H stretch, C-H stretch, N-H bend, C-C stretch (in-ring), N-O symmetric stretch, C-O stretch; C-H wag (-CH2X), N-H wag; C-H "oop" and N-H wag; C-H "oop" with characters of alcohols, phenols; 1°, 2° amines, alkanes, 1° amines, aromatics, nitro compounds, aromatic amines, carboxylic acids, esters, ethers; alkyl halides, aliphatic amines and aromatics.

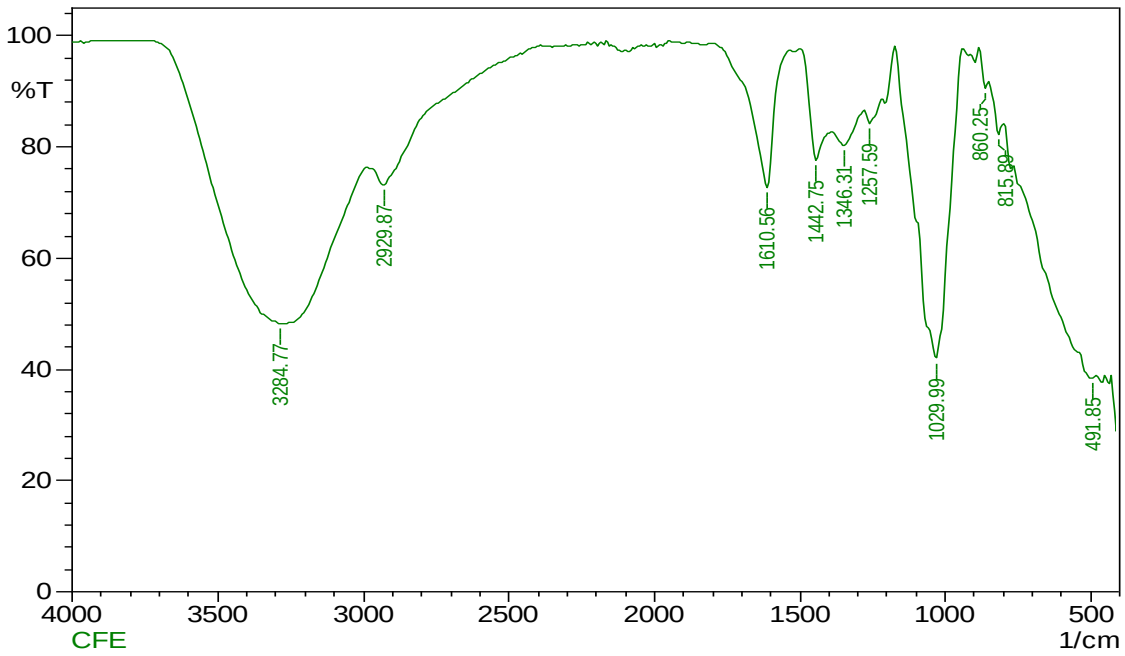

Figure 5. FTIR spectra of CSLE extract.

In CSLM extract peak functional groups are O-H stretch, H-bonded; N-H stretch; -C≡C-H: C-H stretch, C-H stretch, C=O stretch, N-H bend, C-H rock, C-O stretch; C-H wag (-CH2X); C-N stretch, C-O stretch; C-N stretch, N-H wag; C-H "oop"; C-Cl stretch, C-Br stretch with character of alcohols, phenols; 1°, 2° amines; alkynes (terminal), Alkenes, carbonyls (general), carboxylic acid; aldehydes, saturated aliphatic, α, β-unsaturated esters, 1° amines, alkanes, alcohols, carboxylic acids, esters, ethers; alkyl halides; aliphatic amines, alcohols, carboxylic acids, esters, ethers; aliphatic amines, 1°, 2° amines; aromatics; alkyl halides, alkyl halides.

Table 7. FTIR spectrum analysis of CSLE extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3284.77	Strong, sharp, medium	O-H stretch, H-bonded; N-H stretch	Alcohols, phenols; 1°, 2° amines
2	2929.87	Medium	C-H stretch	alkanes
3	1610.56	Medium	N-H bend	1° amines
4	1442.75	Medium	C-C stretch (in-ring)	aromatics
5	1346.31	Strong	N-O symmetric stretch	Nitro compounds
6	1257.59	Strong, medium	C-N stretch; C-O stretch; C-H wag (-CH_2X)	Aromatic amines; alcohols, carboxylic acids, esters, ethers; alkyl halides
7	1029.99	Strong, medium	C-O stretch; C-N stretch	alcohols, carboxylic acids, esters, ethers; aliphatic amines
8	860.25	Strong, broad	N-H wag; C-H "oop"	1°, 2° amines; aromatics
9	815.89	Strong,, broad	N-H wag; C-H "oop"	1°, 2° amines; aromatics
10	491.85	Strong,, broad	N-H wag; C-H "oop"	1°, 2° amines; aromatics

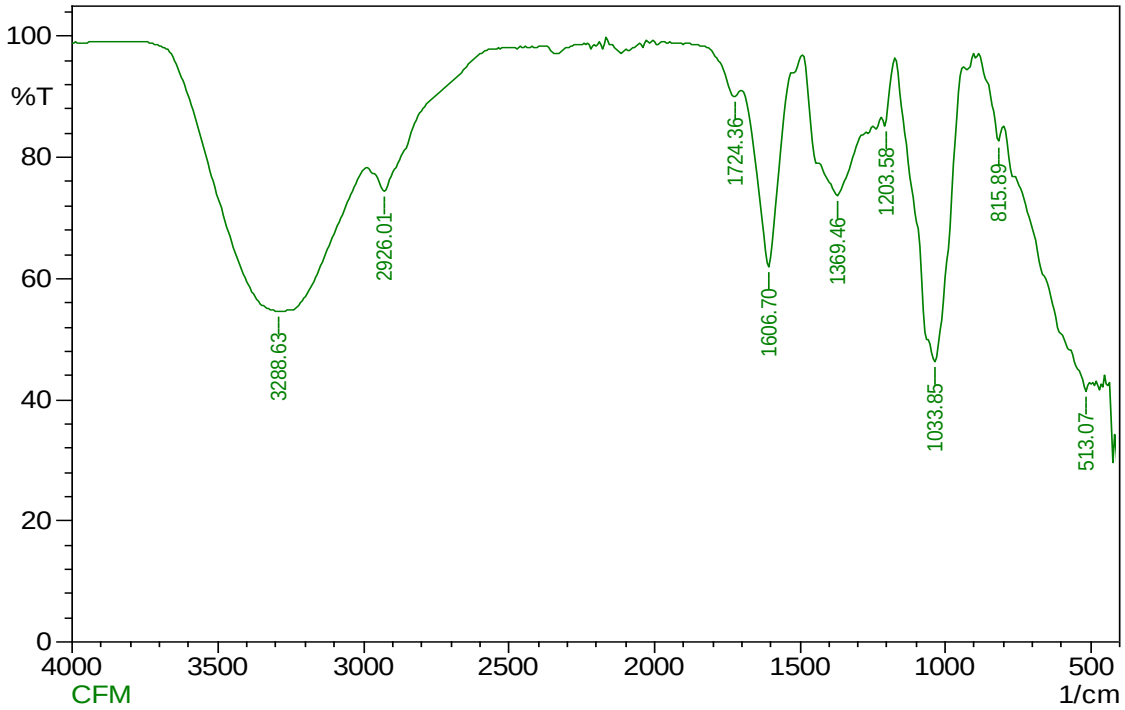

Figure 6. FTIR spectra of CSLM extract.

Table 8. FTIR spectrum analysis of CSLM extract.

S. No	Frequency (cm^{-1})	Intensity	Assignment	Characterization
1	3288.63	Strong, sharp, medium, narrow	O-H stretch, H-bonded; N-H stretch; -C≡C-H: C-H stretch	Alcohols, phenols; 1°, 2° amines; alkynes (terminal)
2	2926.01	Medium	C-H stretch	Alkenes
3	1724.36	Strong	C=O stretch;	Carbonyls (general), carboxylic acid; aldehydes, saturated aliphatic, α, β-unsaturated esters
4	1606.70	Medium	N-H bend	1° amines
5	1369.46	Medium	C-H rock	alkanes
6	1203.58	Strong, medium	C-O stretch; C-H wag (-CH_2X); C-N stretch	Alcohols, carboxylic acids, esters, ethers; alkyl halides; aliphatic amines
7	1033.85	Strong, medium	C-O stretch; C-N stretch	Alcohols, carboxylic acids, esters, ethers; aliphatic amines
8	815.89	Strong, broad, medium	N-H wag; C-H "oop"; C-Cl stretch	1°, 2° amines; aromatics; alkyl halides
9	513.07	Medium	C-Br stretch	alkyl halides

3.3. GC-MS analysis

GCMS analysis of CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM extracts were carried out by NIST 2008 library. Each solvent extracts reported various chemical constitutes, which are presented in table 8. In CSLH extract have 117 phytocompounds with retention time from 2.828 to 29.899 (Fig. 7). Totally 22 bioactive compounds were summarized in table 9 including compounds name, molecular formula, molecular weight, CAS number and its bioactive uses.

The bioactive compounds are N-Nitroso-2,4,4-Trimethyloxazolidine, hentriacontane, tritetracontane, triacontane, hexacosane, tetratetracontane, pentatriacontane, pentacosane, tetracontane, dotriacontane, nonacosane, heptacosane, 2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-Hexamethyl-, (All-E), pentadecanal, oxirane hexadecyl, tetradecanal, 1-octacosanol, octadecane, 1-(Ethenyloxy), N-tetracosanol-1, 1-Hentetracontanol, lupeol and 3-O-acetyl-6-methoxy-cycloartenol.

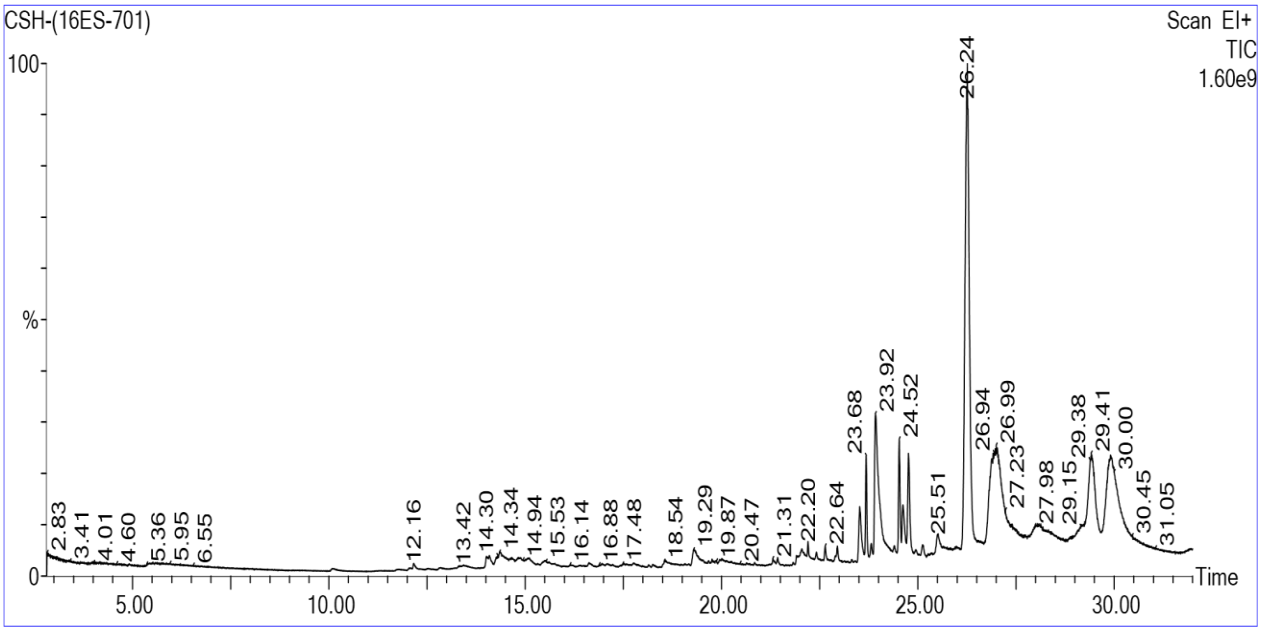

Figure 7. Gas Chromatogram of phytochemical constitute of CSLH extract.

In CSLPE extract have 112 phytochemicals with retention time from 2.848 to 28.899 which gas chromatogram is given figure 8. Among these compounds ten known bioactive compounds with their name, molecular weight, formula, CAS number and bioactive uses are represented in table 9. The bioactivity of these compounds are cycloheptasiloxane, tetradecamethyl; octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-Hexadecamethyl;

phthalic acid, Bis (7-Methyloctyl) ester; 1,2-Benzenedicarboxylic acid, diisooctyl ester; squalene; geranylgeraniol; dctadecanal; pentadecanal; oxirane, hexadecyl and tetradecanal.

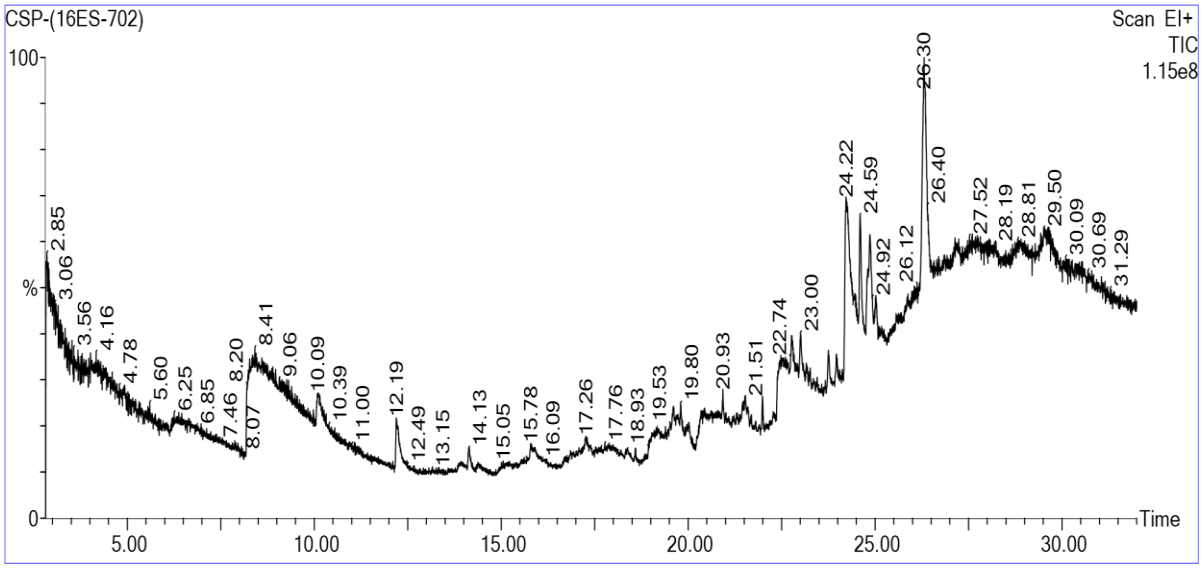

Figure 8. Gas chromatogram of phytochemical constitute of CSLPE extract.

The result of GCMS analysis of CSLC extract have 30 compounds with retention time from 19.715 to 24.572 (Figure 9). Six bioactive compounds with molecular formula, molecular weight, CAS number and bioactive uses were reported in table 9. The six bioactive compounds are cis-10-nonadecenoic acid, cis-11-eicosenoic acid, oleic acid, 22-tricosenoic acid, 9-nonadecene and pimpinellin with antitumor activity, antimicrobial activity, cancer preventive, anemiagenic, insectifuge, antiandrogenic, dermatitigenic, antixiokytic, antimycobacterial activity respectively (Table 9).

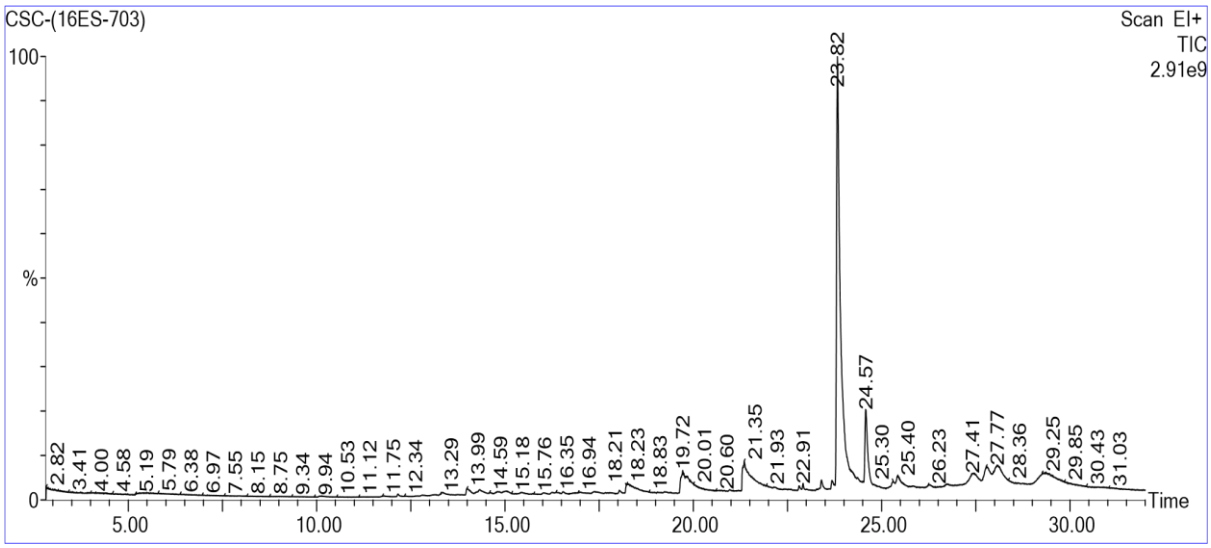

Figure 9. Gas chromatogram of phytochemical constitute of CSLC extract.

Thirteen bioactive compounds of 48 compounds were identified by GCMS of CSLEA extracts. The various secondary metabolic chemical constitutes of CSLEA extract with retention time from 2.833 to 28.339 were presented in figure 10. Table 9 reported Thirteen bioactive compounds with molecular formula, molecular weight and bioactive uses. Most of the compounds bioactive uses are antioxidant and anti-inflammatory activity.

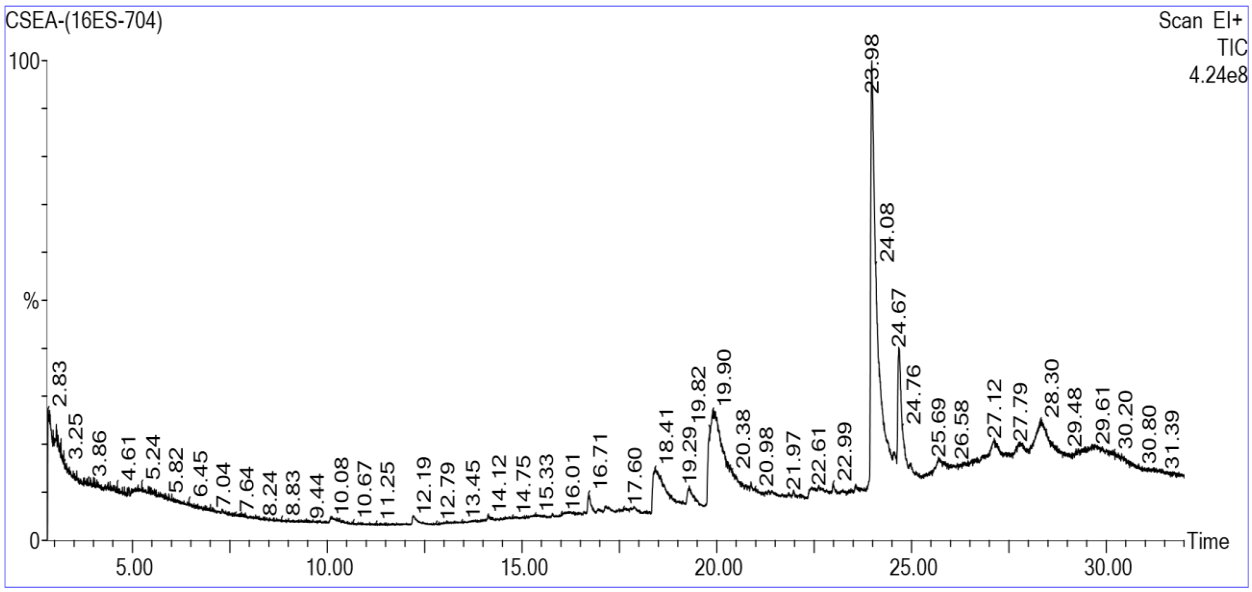

Figure 10. Gas chromatogram of phytochemical constitute of CSLEA extract.

GCMS analysis of polar ethanol solvent leaf extract *Chloroxylon swietenia* (CSLE) have 76 phytochemical constitutes with 18 bioactive compounds. Figure 11 showed 76 chemical compounds with retention time from 2.823 to 24.312. Table 9 reported 18 bioactive compounds with molecular formula, molecular weight and bioactive medicinal uses. The bioactive compounds are oxalic acid, isohexyl pentyl ester with antimicrobial activity; 5-acetoxypentadecane with antinephrotoxic and antioxidant activities; cyclohexan-1,4,5-triol-3-one-1-carboxylic acid which uses are acidifier, inhibit production of uric acid, urinary acidulan; silver acetate with bioactive use is antismoking therapies; 3-Methylmannoside with innate immunity; N-Hexadecanoic acid used as antioxidant, hypocholesterolemic, nematicide, pesticide, lubricant activities and hemolytic 5-alpha is a reductase inhibitors; octadecanoic acid with anti-inflammatory; pentadecanoic acid with antioxidant activity; tetradecanoic acid used as antioxidant, cancer preventive, nematicide, hypocholesterolemic, lubricant; L-(+)-Ascorbic acid 2,6 with antioxidant, anti-inflammatory and anti-nociceptive properties; dihexadecanoate which used as antibacterial, antifungal; tridecanoic acid used as antibacterial, antiviral, antifungal activity; dodecanoic acid that is used as antibacterial,

antiviral, antifungal activity; oleic acid have cancer preventive, anemiagenic, insectifuge, antiandrogenic activity etc.

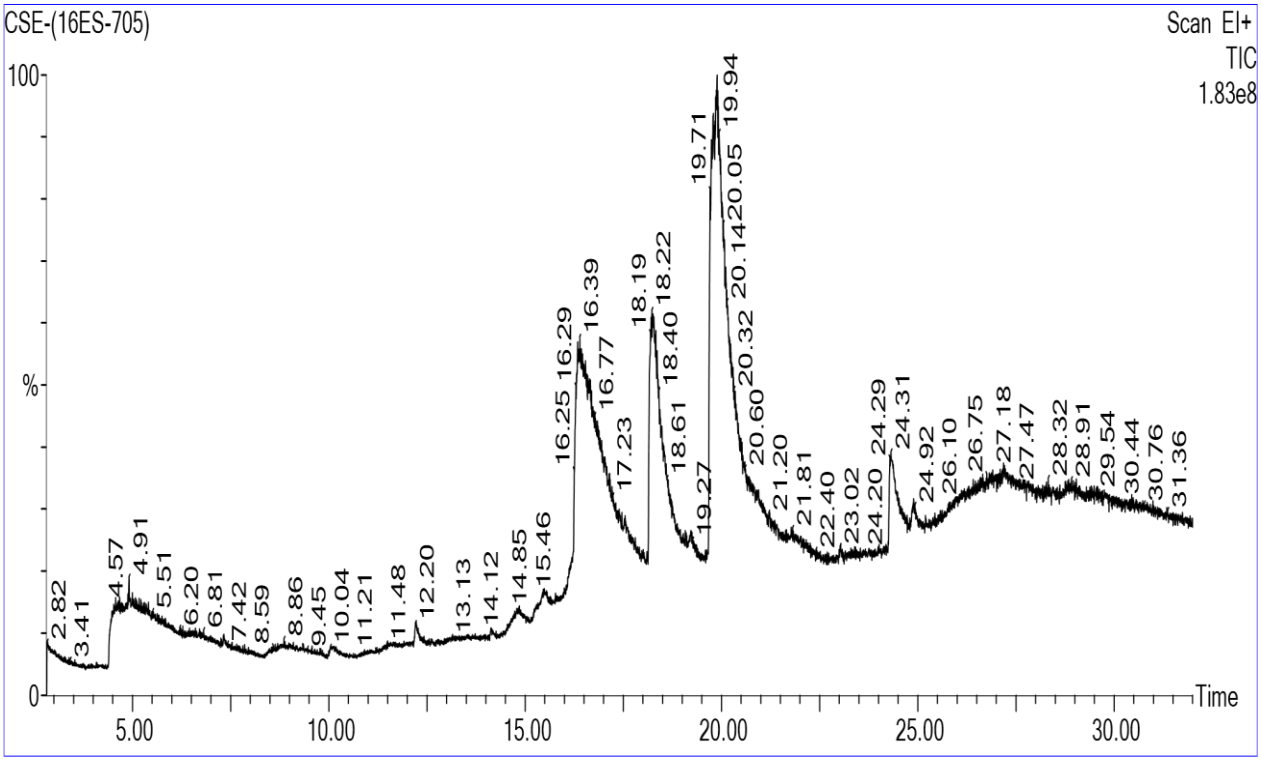

Figure 11. Gas chromatogram of phytochemical constitute of CSLE extract.

Figure 12 showed 63 phytocompounds with various retention time from 2.823 to 20.791 and table 9 reported 19 bioactive compounds with molecular weight, molecular formula and bioactive uses. The bioactive uses such as antimicrobial, antioxidant and anti-inflammatory activates are most reported medicinal uses of 19 bioactive compounds in CSLM extract.

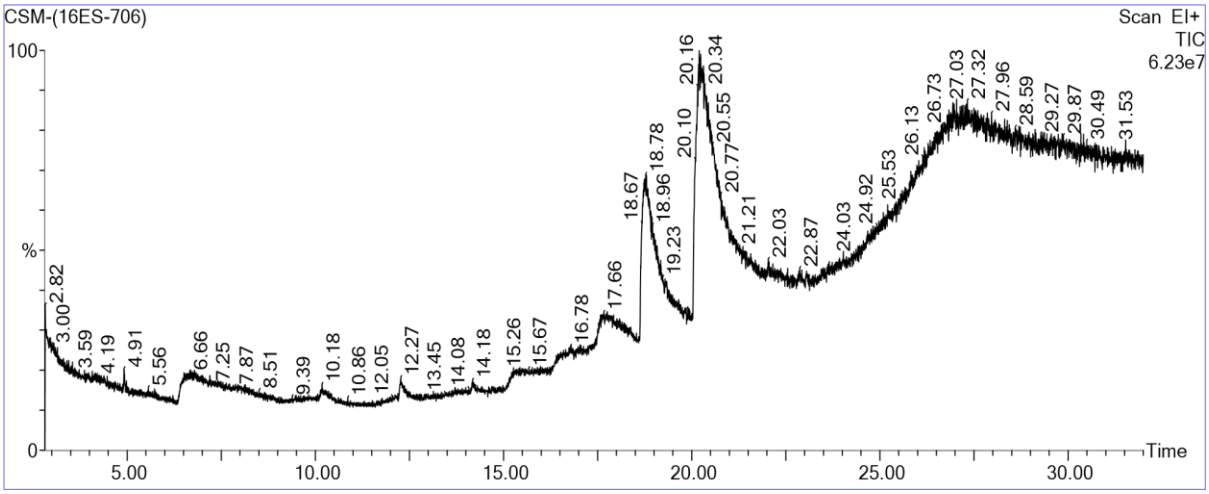

Figure 12. Gas chromatogram of phytochemical constitute of CSLM extract.

Table 9. GCMS analysis of various polar solvent leaf extracts of *Chloroxylon swietenia.*

S. No	Compound name	Formula	Mol. Weight	CAS No.	Compound Uses
CSLH extract					
1	N-Nitroso-2,4,4-Trimethyloxazolidine	$C_6H_{12}O_2N_2$	144	96228-15-8	Antimicrobial, Anti-inflammatory[24]
2	Hentriacontane	$C_{31}H_{64}$	436	630-04-6	Anti-inflammatory[24] Antifungal against fungal spores germination, Antioxidant, Antitumour, Antibacterial[25]
3	Tritetracontane	$C_{43}H_{88}$	604	7098-21-7	Anti-inflammatory[26]
4	Triacontane	$C_{30}H_{62}$	422	638-68-6	Anti-inflammatory[27]
5	Hexacosane	$C_{26}H_{54}$	366	630-01-3	Antimicrobial Activities[28]
6	Tetratetracontane	$C_{44}H_{90}$	618	7098-22-8	Hypoglycaemic, Antioxidant activities[29]
7	Pentatriacontane	$C_{35}H_{72}$	492	630-07-9	Antioxidant activity, Anti-inflammatory activities.[29]
8	Pentacosane	$C_{25}H_{52}$	352	629-99-2	Antibacterial[30]
9	Tetracontane	$C_{40}H_{82}$	562	630-04-6	Hypoglycaemic, Antioxidant activities[29]
10	Dotriacontane	$C_{32}H_{66}$	450	544-85-4	Antimicrobial, antioxidant, Antispasmodic[31]
11	Nonacosane	$C_{29}H_{60}$	408	630-03-5	Antibacterial[30]
12	Heptacosane	$C_{27}H_{56}$	380	593-49-7	Anti-corrosive, Antioxidant[25]
13	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-Hexamethyl-, (All-E)	$C_{30}H_{50}$	410	111-02-4	Antimicrobial, Anti-inflammatory activities[29]
14	Pentadecanal	$C_{15}H_{30}O$	226	2765-11-9	Nutrient, Stabilizers, Surfactants and Emulsifier[32]
15	Oxirane, Hexadecyl-	$C_{18}H_{36}O$	268	7390-81-0	Adhesives[33]
16	Tetradecanal	$C_{14}H_{28}O$	212	124-25-4	Anticancer and antioxidant[34,35]
17	1-Octacosanol	$C_{28}H_{58}O$	410	900351-79-2	Antioxidant[36]
18	Octadecane, 1-(Ethenyloxy)-	$C_{20}H_{40}O$	296	930-02-9	Antisepsis[37]
19	N-Tetracosanol-1	$C_{24}H_{50}O$	354	506-51-4	Anti-bacterial activity[38]
20	1-Hentetracontanol	$C_{41}H_{84}O$	592	40710-42-7	Antimicrobial[39]
21	Lupeol	$C_{30}H_{50}O$	426	545-47-1	Anticancer, Anti-inflammatory and Antioxidant[40]
22	3-O-Acetyl-6-Methoxy-Cycloartenol	$C_{33}H_{54}O_3$	498	900286-40-9	anti-inflammatory and anticonvulsant[41]
CSLPE extract					
1	Cycloheptasiloxane, Tetradecamethyl	$C_{14}H_{42}O_7Si_7$	518	107-50-6	Antimicrobial, antifouling imunomodulatory and antitumor activities[42,43]
2	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11	$C_{16}H_{50}O_7Si_8$	578	19095-24-0	Antimicrobial activity[44]

	,11,13,13,15,15-Hexadecamethyl				
3	Phthalic Acid, Bis (7-Methyloctyl) Ester	$C_{26}H_{42}O_4$	418	20548-62-3	Anticancer activity[45]
4	1,2-Benzenedicarboxylic Acid, Diisooctyl Ester	$C_{24}H_{38}O_4$	390	27554-26-3	Antimicrobial, Antifouling[40]
5	Squalene	$C_{30}H_{50}$	410	7683-64-9	Antibacterial, antioxidant, antitumor, cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide[46]
6	Geranylgeraniol	$C_{20}H_{34}O$	290	24034-73-9	Apoptosis of carcinogen cells[47]
7	Octadecanal	$C_{18}H_{36}O$	268	638-66-4	alkane-lyase activity[39]
8	Pentadecanal	$C_{15}H_{30}O$	226	2765-11-9	Antimicrobial activity, act as a intermediate[48]
9	Oxirane, Hexadecyl	$C_{18}H_{36}O$	268	7390-81-0	Adhesives[33]
10	Tetradecanal	$C_{14}H_{28}O$	212	124-25-4	Antibacterial activity[31]
CSLC extract					
1	Cis-10-Nonadecenoic acid	$C_{19}H_{36}O_2$	296	73033-09-7	Antitumor activity[49]
2	Cis-11-Eicosenoic acid	$C_{20}H_{38}O_2$	310	5561-99-9	Antimicrobial activity[50]
3	Oleic acid	$C_{18}H_{34}O_2$	282	112-80-1	Cancer preventive, Anemiagenic, Insectifuge, Antiandrogenic, Dermatitigenic[51]
4	22-Tricosenoic Acid	$C_{23}H_{44}O_2$	352	65119-95-1	Antixiokytic[52]
5	9-Nonadecene	$C1_9H_{38}$	266	31035-07-1	Antimicrobial, Antifungal[53]
6	Pimpinellin	$C_{13}H_{10}O_5$	246	131-12-4	Antimycobacterial activity[54]
CSLEA extract					
1	N-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	57-10-3	Antioxidant, hypocholesterolemic, nematicide, pesticide, lubricant activities and hemolytic 5-alpha is a reductase inhibitors[55,56]
2	Octadecanoic Acid	$C_{18}H_{36}O_2$	284	57-11-4	Anti-inflammatory[57,58]
3	Tridecanoic Acid	$C_{13}H_{26}O_2$	214	638-53-9	Antibacterial, antifungal[59]
4	Pentadecanoic Acid	$C_{15}H_{30}O_2$	242	1002-84-2	Antioxidant[51]
5	Tetradecanoic Acid	$C_{14}H_{28}O_2$	228	544-63-8	Antioxidant, cancer preventive, nematicide, hypocholesterolemic, lubricant[60]
6	L-(+)-Ascorbic Acid 2,6-Dihexadecanoate	$C_{38}H_{68}O_8$	652	28474-90-0	antioxidant, anti-inflammatory and anti-nociceptive properties[61,62]
7	Dodecanoic acid	$C1_2H_{24}O_2$	200	143-07-7	Antibacterial, antiviral, antifungal[63]

8	Oleic Acid	$C_{18}H_{34}O_2$	282	112-80-1	Cancer preventive, Anemiagenic, Insectifuge, Antiandrogenic, Dermatitigenic[51]
9	6-Octadecenoic Acid, (Z)	$C_{18}H_{34}O_2$	282	593-39-5	Cancer preventive, Insectifuge[51]
10	9-Octadecenal, (Z)	$C_{18}H_{34}O$	266	2423-10-1	anti-alopcic, Antitumour, Cholerectic, Dermatitigenic, immunostimulant, Anti-leukotriene, anti- androgenic, Haemolytic, Hypercholesterolemic, Lubricant, Nimoticide, Pesticide, irritant, Flavour, 5 α reductase inhibitor, Percutanea-stimulant, Anemiagenic[64]
11	1-Hexyl-1-Nitrocyclohexane	$C_{12}H_{23}O_2N$	213	118252-09-8	Antioxidant, antimicrobial, anti-inflammatory[65]
12	Octadecanal, 2-Bromo-	$C_{18}H_{35}OBr$	346	56599-95-2	Anti-inflammatory and anti-apoptotic effects[66]
13	Vitamin E	$C_{29}H_{50}O_2$	430	59-02-9	Potent antioxidant[67]
CSLE extract					
1	Oxalic Acid, Isohexyl Pentyl Ester	$C_{13}H_{24}O_4$	244	900309-32-8	Antimicrobial activity[68]
2	5-Acetoxypentadecane	$C_{17}H_{34}O_2$	270	900245-62-3	Antinephrotoxic and antioxidant activities[69]
3	Cyclohexan-1,4,5-Triol-3-One-1-Carboxylic Acid	$C_7H_{10}O_6$	190	900128-45-5	Acidifier, inhibit production of uric acid, urinary acidulan[70]
4	Silver Acetate	$C_2H_3O_2Ag$	166	563-63-3	Antismoking therapies[71]
5	3-Methylmannoside	$C_7H_{14}O_6$	194	900130-08-6	Innate immunity[72]
6	N-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	57-10-3	Antioxidant, hypocholesterolemic, nematicide, pesticide, lubricant activities and hemolytic 5-alpha is a reductase inhibitors[55,56]
7	Octadecanoic acid	$C_{18}H_{36}O_2$	284	57-11-4	Anti-inflammatory[57,58]
8	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	1002-84-2	Antioxidant[51]
9	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	544-63-8	Antioxidant, cancer preventive, nematicide, hypocholesterolemic, lubricant[60]
10	L-(+)-Ascorbic acid 2,6-Dihexadecanoate	$C_{38}H_{68}O_8$	652	28474-90-0	antioxidant, anti-inflammatory and anti-nociceptive properties[61,62]
11	Tridecanoic acid	$C_{13}H_{26}O_2$	214	638-53-9	Antibacterial, antifungal[59]
12	Dodecanoic acid	$C_{12}H_{24}O_2$	200	143-07-7	Antibacterial, antiviral, antifungal[63]
13	Oleic acid	$C_{18}H_{34}O_2$	282	112-80-1	Cancer preventive,

					Anemiagenic, Insectifuge, Antiandrogenic, Dermatitigenic[51]
14	6-Octadecenoic acid, (Z)-	$C_{18}H_{34}O_2$	282	593-39-5	Cancer preventive, Insectifuge[51]
15	9-Octadecenal, (Z)-	$C_{18}H_{34}O$	266	2423-10-1	anti-alopcic, Antitumour, Cholerectic, Dermatitigenic, immunostimulant, Anti-leukotriene, anti- androgenic, Haemolytic, Hypercholesterolemic, Lubricant, Nimoticide, Pesticide, irritant, Flavour, 5 α reductase inhibitor, Percutanea-stimulant, Anemiagenic[64]
16	Octadecanal, 2-bromo-	$C_{18}H_{35}OBr$	346	56599-95-2	Anti-inflammatory and anti-apoptotic effects[66]
17	Oxirane, Hexadecyl-	$C_{18}H_{36}O$	268	7390-81-0	Adhesives[33]
18	1-Hexyl-1-nitrocyclohexane	$C_{12}H_{23}O_2N$	213	118252-09-8	Antioxidant, antimicrobial, anti-inflammatory[65]
CSLM extract					
1	Flurazepam	$C_{21}H_{23}ON_3$ CLF	387	1172-18-5	Insomnia[73]
2	2-Chloroethanol	C_2H_5OCL	80	107-07-3	Bacterial degradation[74]
3	N-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	57-10-3	Antioxidant, hypocholesterolemic, nematicide, pesticide and lubricant activities[55,56]
4	Octadecanoic acid	$C_{18}H_{36}O_2$	284	57-11-4	Anti-inflammatory activity[75]
5	L-(+)-Ascorbic acid 2,6-Dihexadecanoate	$C_{38}H_{68}O_8$	652	28474-90-0	Antioxidant, anti-inflammatory and anti-nociceptive properties[61,62]
6	Tridecanoic acid	$C_{13}H_{26}O_2$	214	638-53-9	Anthelminthic, Anti-inflammatory and Antimicrobial activities and anti- cancerous activity[76]
7	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	1002-84-2	Antioxidant[51]
8	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	544-63-8	Antioxidant, hypercholesterolemic, cancer-preventive, cosmetic[77]
9	Oleic acid	$C_{18}H_{34}O_2$	282	112-80-1	Cancer preventive, Anemiagenic, Insectifuge, Antiandrogenic, Dermatitigenic[51]
10	6-Octadecenoic acid, (Z)-	$C_{18}H_{34}O_2$	282	593-39-5	Cancer preventive, Insectifuge[51]
11	Cis-11-Eicosenoic acid	$C_{20}H_{38}O_2$	310	5561-99-9	Antimicrobial activity[50]

12	Cis-10-Nonadecenoic acid	$C_{19}H_{36}O_2$	296	73033-09-7	Antitumor[49]
13	1-Hexyl-1-Nitrocyclohexane	$C1_2H_{23}O_2N$	213	118252-09-8	Antimicrobial and anti-inflammatory activities[78]
14	Cyclohexane, 1-(1,5-Dimethylhexyl)-4-(4-Methylpentyl)	$C_{20}H_{40}$	280	56009-20-2	Antimicrobial, Antioxidant, antibacterial[79]
15	Pentadecanal	$C_{15}H_{30}O$	226	2765-11-9	antimicrobial activity, act as a intermediate[48]
16	Octadecanal, 2-Bromo	$C_{18}H_{35}OBR$	346	56599-95-2	anti-inflammatory and anti-apoptotic effects[66]
17	9-Octadecenal, (Z)	$C_{18}H_{34}O$	266	2423-10-1	Anti-alopcic, Antitumour, Cholerectic, Dermatitigenic, immunostimulant, Anti-leukotriene, anti- androgenic[64]
18	Oxirane, Hexadecyl	$C_{18}H_{36}O$	268	7390-81-0	Adhesives[33]
19	2-Dodecen-1-Yl(-) Succinic Anhydride	$C_{16}H_{26}O_3$	266	19780-11-1	Antineoplastic agents, Antioxidants, Antimicrobial[80]

DISCUSSION

Ethnobotanical study of regional medicinal plants has always guided the search for new remedy. In spite of the development of modern drug discovery and advanced evaluation techniques, traditional knowledge system have given sign to the discovery of valuable drugs. Now a days the analysis of the organic compounds from plants and their biological activity has increased because of side effects of modern medicine. The importance of medicinal plants is due to the presence of biologically active compounds that produce during normal metabolic processes of the plant and it plays an important role in plant defines mechanism.[81] Spectroscopic technique is a powerful diagnostic mechanism for the quantitative and qualitative analysis of traditional and pharmaceutical metabolites. The FTIR technique is an outstanding method for the quantitative analysis because the compound spectrum is individual with the exception of optical isomers. It offers a rapid and nondestructive investigation to fingerprint herbal extract or powders.[82]

The medicinal plants are exhibiting foundation of various secondary metabolites determined by GCMS spectra analysis.[83] The present research has been found helpful in the identification of many constituents present in the various extracts of *C. swietenia* leaf (CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM). Most of the identified compounds possess various known medicinal properties, whereas some of the compounds obtained in this work have not beet report earlier. The present investigation of preparatory phytochemical examination has been done in the different polar dissolvable concentrates of CSLH, CSLPE,

CSLC, CSLEA, CSLE and CSLM of *Choloxylon swietenia* leaf demonstrated the nearness of phytochemical constituents. Based on this result highly medicinal valuable compounds such as alkaloids, flavonoids, triterpenoids, steroids and tannins are present in CSLE and CSLM extracts compare to other extracts of CSLH, CSLPE, CSLC and CSLEA. Alkaloids are naturally occurring nitrogenous organic compounds with antimicrobial properties, due to their intercalation of the DNA of the microorganism.[84] Flavonoids and tannins are major group of phenolic compounds that act as an antioxidants. Due to their antioxidant and anti-inflammatory properties, they have reported to possess anticarcinogenic and antimutagenic activities.[84] Triterpenoids are used for pain relieving, antipyresis, hepatoprotective, cardio tonic, soothing, tonic impacts and also have hypocholesterolemic and antidiabetic properties.[85] Saponin are another kind of bioactive constituents which are associate with plant sickness safe on account of their antimicrobial action.[86] In addition, glycosides, flavonoids, tannins and alkaloids have hypoglycemic activities.[87] In general, this effectiveness of a medicinal plants may not be due to the one main active principle, but may be due the combined effect of more than one compound present in the plant.[88] Based on the preliminary phytochemical analysis, the results revealed that CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM extracts of *C. swietenia* leaf contain higher amounts of bioactive secondary metabolites they may be used as a ethnobotanical drugs. In the present study many of the known and unknown bioactive compounds are present in all the extracts. Best of our knowledge and literature survey there is no report of FTIR and GCMS analysis to identify the compounds from the CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM extracts of *C. swietenia* leaf.

FTIR analysis, six various polar solvent extracts showed possibility of identifying effective function groups in the chemical constituents and possible whereby identify the different compounds, since each compound has own fingerprint, and to can distinguished between aromatic and non-aromatic compounds and alkenes, alkanes, esters, ethers and carboxylic acid, amines etc. In the present study, the GC-MS analysis of the various polar solvent extracts of *Chlorxylon swietenia* leaf showed the presence of 117, 112, 30, 48, 76 and 63 compounds in the extracts of CSLH, CSLPE, CSLC, CSLEA, CSLE and CSLM and also each extracts have 20, 10, 6, 13, 18 and 19 known bioactive uses respectively. These bioactive compounds are with antimicrobial, anti-inflammatory, antioxidant, antitumor, hypoglycaemic, anti-androgenic, dermatitigenic, pesticide, nematicide, antiviral,

antinephrotoxic and anthelmintic activities. Many of the bioactive compounds are having related to anticancer activity, so this plant may be used for anticancer drug preparation.

CONCLUSION

Conventional remedial plants are every now and again utilized as a part of provincial parts, since the accessibility of extreme measure of restorative plants in those zones. The presence of phytochemicals in *Chloroxylon swietenia* demonstrated expansive range of various organic exercises and mechanical applications like cancer prevention agent, mitigating, antiviral, antibacterial, antifungal, anticancer and so forth. The GCMS profile can be utilized as pharmacognostical apparatus for the distinguishing proof of novel medications from *Chloroxylon swietenia*. The outcome showed that *Chloroxylon swietenia* plant can be used to find the bioactive normal items which may serve in the improvement of new pharmaceuticals. Further, refinement of the particular dynamic constituents should be completed, that can be utilized for the revelation of novel medications to treat different diseases.

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