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Gas Chromatography Mass Spectrometry Analysis and Phytochemical Screening of Sterculiasetigera Oil

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ABSTRACT

This research explored studied the gas chromatography mass spectrometry (GC-MS) analysis of the volatile organic compounds for normal hexane extract of Sterculia setiger seeds. The oil was extracted by cold extraction method, . the The phytochemical screening was tested for extracted oil . (GC-MS) analysis was carried out according to the standard analytical methods for crude oils. A total of 46 compounds were reported for normal hexane extract ,extract, besides there are some new compounds that have not been previously reported. All secondary metabolized compounds hashave been reported in the normal hexane extract except the phenolic compounds. The most abundant compounds in normal hexane extract are Pentadecanoic pentadecanoic acid, 1-(1,1-dimethylethyl)-2-methoxy- 4- methy-3,5 - dinitrobenzene, 3-cyano-2-oxa -1- ethoxy adamanane and Methyl pentcosanoate.

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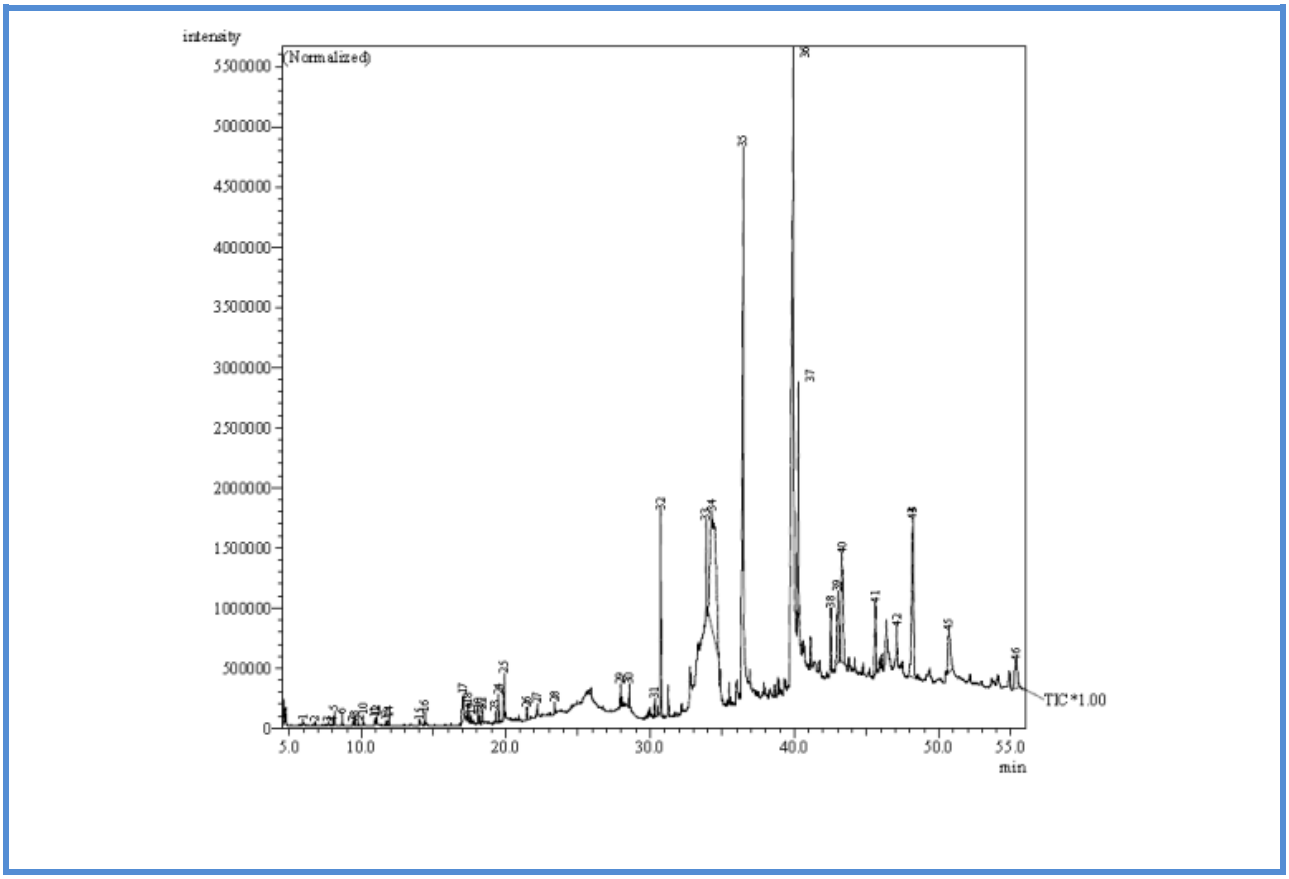
Graphical Abstract



Introduction

Sterculia setiger, Family (Sterculia ceae), Synonyms), Synonyms (Sterculia tomentosa Guill and Perr., S. cinerea A. Rich. Vernacular) . karaya gum tree; Local names: tartar, faider and telieh, posemporgo (Mooré), kongosira (Bambara) [1]. The wood is white and very soft, which makes it unsuitable for fuel wood and charcoal. It is therefore used for non timbernon-timber forest products (NTFP). It is also used for insulation and concealed items in carpentry. The tree produces a water-soluble gum (karaya). This can be tapped and used in cooking as an emulsifier, stabiliserstabilizer and viscosifier; the gum is used medically as a laxative, diuretic and tranquillisertranquillizer and technically as an adhesive and for glazing pottery[2]. The bark is used for rope making and the bark sap can be made into a refreshing drink. In local medicine the bark is also used to treat snake bites, leprosy, syphilis, coughs, bronchitis, rickets and insanity. The seeds can be eaten and contain an edible oil, while the leaves are used as fodder for cattle[cattle [3]. This research objected to analysis of Sterculia setiger seed oil by gas chromatography mass

spectrometry technique and identification of primary and secondary metabolites compounds by Classical classical phytochemical screening.

Materials and Methods

Materials

All chemicals used were of analytical reagent grade (AR) with the and of highest purity degree available. They included: normal hexane, Deionized deionized water, Ferric ferric Chloridechloride, Copper copper II Sulfatesulfate, Iodieneiodiene, Chlorformchlorform, Sulfuric sulfuric acid, Copper copper II acetate, Ethanol ethanol and Potassium potassium hydroxide. Sterculia setigera seeds .

Procedures

The experimental work were carried out at Chemical Laboratory of Omdurman Islamic University and Central laboratory - University of Khartoum.

Sample Collection

The Sterculia setigera seeds were purchased from the local market in Omdurman area. The taxonomic authentication of the plant has beenwas carried out in medicinal and aromatic plants research institute in Sudan.

Extraction of Sterculiasetigera Seeds Oil

Fresh of the Sterculia setigera seeds (100g) were washed with distilled water to remove the dust particles. The shade dried seeds were powdered. The ground fine powder was extracted with normal hexane (1L) at room temperature (37 ^{0}0C) for 72 hoursh. The extract was filtered through filter paper, then concentrated at room temperature[temperature [6].

Qualitative phytochemical evaluation

Phytochemical screening was conducted to determine the presence of natural products in the oil[oil [13].

Phenols (Ferric chloride test)

In a clean test tube normal hexane extract (1mL) was added to 2 mL of distilled water, then two drops of 10% ferric chloride (FeC13) was also added. Appearance of blue or green colour indicated presence of phenols.

Flavonoids (potassium hydroxide test)

About 1 mL of extracts was treated with 5 drops of 10% potassium hydroxide solution. Formation of intense yellow colour indicated the presence of flavonoids.

Tannins (Ferric chloride test)

Normal hexane extract (0.5 mL) was boiled with 10 ml of distilled water in a test tube and then, few drops of 5% ferric Chloride solution was added and the reaction mixture was observed for blue, greenish black colour change.

Alkaloids (Wagner's test)

To 0.5 mL of the extract 2 mL of Wagner's reagent was added and the reaction mixture is observed for the formation of reddish brown precipitate.

Triterpenes and Steroids (Salkowski test)

To 0.5mL of extract, 2 mL of chloroform were added and then 3 mL of concentrated H2SO4 was carefully added to form a layer. A reddish brown colouration of the interface indicated the presence of terpenoids and steroids.

Diterpenes (Copper acetate test)

Hexanic extract was dissolved in water and treated with 3-4 drops of copper II acetate solution. Formation of emerald green colour indicated the presence of diterpenes.

Test for Saponins (Frothing test)

The extract (0.5mL) were added to 5 mL of distilled water. The solution was shaken vigorously and observed for the stable persistent froth.

Gas Chromatography Mass Spectrometry (GC-MS) Analysis

The gas chromatography mass spectrometry analysis of the normal hexane extract was performed on a GC-MS equipment (Thermo Scientific Co. Thermo GC-TRACE ultra ver.: 5.0, Thermo MS DSQ II). The Experimental experimental conditions of GC-MS system were as follows: TR 5-MS capillary standard non-polar column, dimension: 30Mts, ID: 0.25 mm, Film thickness: 0.25 µm. The Flow flow rate of the mobile phase (carrier gas: He) was set at 1.0 ml/min. In the gas chromatography part, temperature program (oven temperature) was 75 °C raised to 250 °C at a rise of 5 °C/min, and held for 30 min. The injection volume was 1 µl and sample was injected in split less mode. The sample was carried out fully at a range of 50–650 m/z and the results were compared by using Wiley Spectral library search program[[4].

Results and Discussion

The percentage yield percentage and phytochemical screening results of Sterculiasetigera seeds oil is shown in Table1 and table Table 2, respectively.

Table 1. Percentage Yield for n-Hexane and Petroleum etherEther Extracts.

Name of oil	Yield percentage (%w/w)
Sterculia setigera seed oil	21.12

The obtained results in Table 1 above table revealedrveals that the yield percentage of Sterculia setigera oil is high because the extraction was carried out by the cold extraction methods.

Table 2. Preliminary screening of secondary metabolites in the Sterculia setigera oil.

Test	Result
Phenols	-ve
Tannins	+ve
Flavonoids	+ve
Alkloids	+ve
Triterpenes	+ve
Diterpenes	+ve
Steroids	+ve
Saponins	+ve

The detected various phytochemical compounds detected are known to have beneficial importance in to industrial andthe medicinal sciences. The Plant plant phenolic compounds especially the flavonoids are currently of growing interest owning due to their desired supposed properties in promoting the health (anti-oxidants)[oxidants) [13].

The Flavonoids flavonoids have been demonstrated to have anti-inflammatory, antiallergenic, anti-viral, anti-aging, and anti-carcinogenic characteristicsactivity. In addition to an antioxidant effectAlso, the flavonoid compounds may exert protection against the heart disease through the inhibition of the cyclooxygenase and lipoxygenase activities in the platelets and macrophages. Tannins are reported to possess physiological astringent and haemostatic properties[properties [13], which hasten wound healing and ameliorate inflamed mucus membrane and also inhibit the growth of microorganisms by precipitating microbial proteins and making nutritional proteins unavailable for them; they form irreversible complexes with proline rich proteins, resulting in the inhibition of the cell protein synthesis.

They have some desirable characteristics important roles such asincluding stable high stability and potent anti-oxidants. They act as binders, using to treat and for treatment of diarrhea and dysentery. Tannin also reported to exhibit antiviral, antibacterial, and anti-tumor activities. It was also reported that certain tannin areis able to inhibit HIV replication selectivity and is also used as diuretic.

Plant tannin has been recognized for their pharmacological properties and is known to make trees and shrubs a difficult meal for many caterpillars. Plant steroids are known to be important for their cardiotonic, insecticidal and anti-microbial properties.

They are also used innutrition, herbal medicine, cosmetics and they are routinely used in medicine because of their profound biological activities. Saponins have expectorant action which is very useful in the management of upper respiratory tract inflammation; saponins present in plants are cardiotonicin nature and are reported to have anti-diabetic and anti-fungal properties[properties [13].

The gas chromatography mass spectrometry chromatogram of extracted oil is shown in Figure 1. The organic compounds for extracted oil is shown in Table 3.

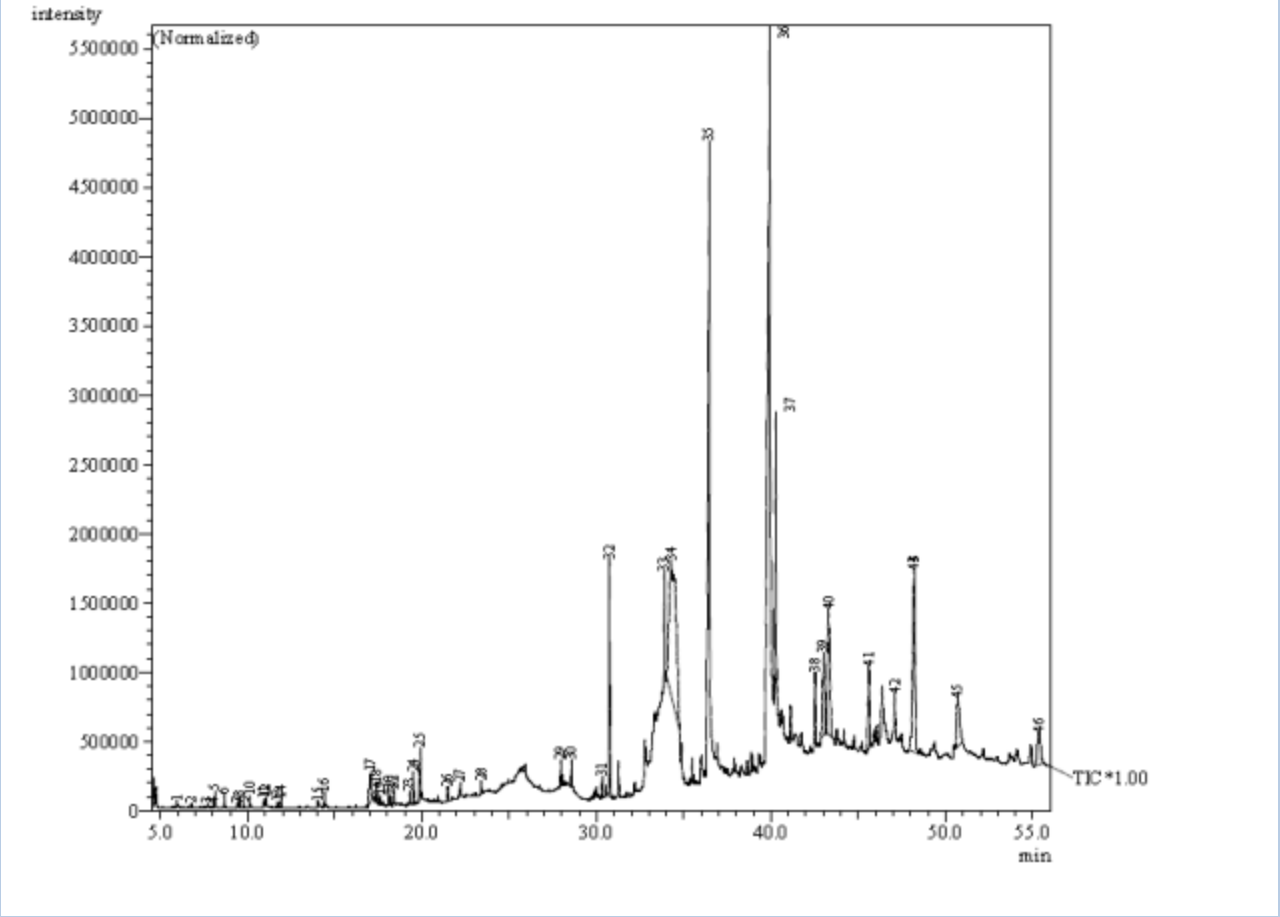


Figure 1. GC/ MS chromatogram of Sterculia setigera oil.

Table 3. The organic compounds of Sterculia setigera oil

Peak NO	Name	MW	RT	Area %	Biological Activity

1	2-methyl-Cyclopentanol	100	5.957	0.12	Oxidation of malate and reduction of oxaloacetate
2	1-hexanol	102	6.795	0.08	Membrane integrity-
3	Heptanal	114	7.707	0.05	Antioxidant
4	2,2-dimethyl-Tetra hydro furan	100	8.056	0.06	NBA
5	3,3-dimethyl-2-hexanone	128	8.136	0.23	NBA
6	n-Hexyl ketone	124	8.686	0.20	NBA
7	2-methyl Hexane	100	9.443	0.05	NBA
8	4-fluro Benzaldhyde	124	9.517	0.16	inhibitory activity of mushroom tyrosinase
9	2-Methyl Hexane	100	9.767	0.10	NMA
10	1,1,2,2-Tetramethyl Cyclopropan	98	10.124	0.19	Oxidation
11	Hexanoic acid	116	10.961	0.12	NBA
12	Octanal	128	11.077	0.13	NBA
13	1-Decyne	138	11.728	0.07	NBA
14	4,4,4-trimethyl-3-oxobutanoate	144	11.926	0.12	NBA
15	Methyl pivaloylacetate	144	14.033	0.15	NBA
16	Heptanoic acid	130	14.414	0.26	NBA
17	Nonanaldehyde	142	17.072	1.32	NBA
18	Octanoic acid	144	17.397	0.28	NBA
19	Di-n-hexyl ether	186	17.593	0.15	NBA
20	2,2-dimethyl pentanol-1	116	18.097	0.22	NBA
21	2,2-dimethyl pentanol-1	116	18.189	0.14	NBA
22	Di(2-ethyl butyl)ether	186	18.408	0.18	NBA
23	Di(2-ethyl butyl)ether	186	19.284	0.16	NBA
24	2-Dodecenal(E)	182	19.510	0.48	NBA
25	5-ethyl-2,4-di methyl-2-Heptene	154	19.922	1.51	NBA
26	Nonanoic acid	158	21.480	0.20	Inhibition related teratogenicity
27	Nonanoic acid	158	22.196	0.22	Inhibition related teratgenicity
28	Acitic acid,4-methyl-3-oxopent-1-enyl ester	156	23.399	0.18	NBA
29	2-Undecenel	168	27.951	0.43	antifungal
30	Decanal	156	28.567	0.41	AntiMasthmatic
31	3-bromo pentane	150	30.335	0.23	Dielectric relaxation
32	Myristyl aldehyde	212	30.743	4.94	antibiotics
33	1-(3,3-di methyl-bicyclo[2.2.1] hept-2-yl)pentan-2-one	208	33.899	1.59	NBA
34	3-cyano-2-oxa-1-ethoxy adamanane	207	34.278	23.00	NBA
35	1-(1,1-dimethyl ethyl)-2-methoxy-4-methy-3,5-dinitrobenzene	268	36.467	11.78	NBA
36	Penta decanoic acid	242	39.917	9.66	antibodies
37	Heptadecene-(8)-carbonic acid	282	40.266	5.52	Antibacterial

38	Octadecanoic acid	284	42.537	0.97	Antimalarial
39	Hexadecanoic acid,2-hydroxy-1,3-propanediyl ester	568	43.013	3.46	Plastics technology
40	1,2-Benzenedicarboxylic acid mono(2-ethylhexyl)ester	278	43.306	7.39	Cytotoxic Activity
41	1,2-benzenedicarboxylic acid mono(2-ethylhexyl)ester	278	45.624	2.73	Cytotoxic Activity
42	Methyl tetracosanoate	382	47.095	0.63	Antidiabetic
43	trans squalene	410	48.215	2.57	Antifungal
44	Methyl pentcosanoate	396	48.215	11.57	NBA
45	1,2,3-propanetriyl ester Octanoic acid	884	50.711	3.35	NBA
46	1,2,3propanetriylesteroOctanoic acid	884	55.364	2.61	NBA

NBA: No Biological Activity

The GC chromatogram in (see Figure 1) revealed reveals that the presence of 46 organic compounds at the normal hexane extract of Sterculia setigera seeds, . the The biological activities of all reported compounds were recorded from the published literature literatures of compounds, but the medicinal activity of 2, 2-dimethyl-Tetra hydro furan, 1, 2, 3 propanetriylesteroOctanoic acid, 1, 2, 3-propanetriyl ester Octanoic acid, Methyl pentcosanoate, trans squalene, Methyl tetracosanoate, 1, 2-benzenedicarboxylic acid mono (2-ethylhexyl) ester, 1, 2-Benzenedicarboxylic acid mono(2-ethylhexyl)ester, Hexadecanoic acid, 2-hydroxy-1, 3-propanediyl ester, Octadecanoic acid, Heptadecene-(8)-carbonic acid, Penta decanoic acid, 1-(1,1-dimethyl ethyl)-2-methoxy-4-methy-3,5-dinitro, 3-cyano-2-oxa-1-ethoxy adamanane, 1-(3,3-di methyl-bicyclo [2.2.1] hept-2-yl)pentan-2-one, 1-(3,3-di methyl-bicyclo[2.2.1] hept-2-yl)pentan-2-one, Myristyl aldehyde, 3-bromo pentane, Decanal, 1-Decyne, 2-Undecenel, Acitic acid,4-methyl-3-oxopent-1-enyl ester, 5-ethyl-2,4-di methyl-2-Heptene, Di(2-ethyl butyl)ether, 2,2-dimethyl pentanol-1, Di-n-hexyl ether and Methyl di valoyl acetateare didn't found in literates.

The most abundant compounds detected are 5-ethyl-2,4-di methyl-2-Heptene (1.51%), Myristyl aldehyde (4.94%), 1-(3,3-di methyl-bicyclo[2.2.1] hept-2-yl)pentan-2-one (1.59%), 3-cyano-2-oxa-1-ethoxy adamanane (23%), 1-(1,1-dimethyl ethyl)-2-methoxy-4-methy-3,5-dinitrobenzene (11.78), Penta decanoic acid (9.66), Heptadecene-(8)-carbonic acid (5.52%), Hexadecanoic acid,2-hydroxy-1,3-propanediyl ester (3.46%), 1,2-Benzenedicarboxylic acid mono(2-ethylhexyl)ester (7.39%), 1,2-benzenedicarboxylic acid mono(2-ethylhexyl)ester (3.46%), trans squalene (2.57%), Methyl pentcosanoate(11.57%), 1,2,3-propanetriyl ester Octanoic acid (3.35%) and 1, 2, 3propanetriylesteroOctanoic acid (2.61%) . Beside these were some new compounds that have not been previously reported.

Conclusion

From the data obtained in the gas chromatography mass spectrometry for the cold extraction of the oil of Sterculi asetigera seeds using normal hexane, it can be concluded that :

-A total of 46 organic compounds were detected for essential oil of Sterculi asetigera.

-The most abundant compounds detected are Penta decanoic acid, 1-(1,1-dimethyl ethyl) -2-methoxy-4-methy-3, 5-dinitrobenzene, 3-cyano-2-oxa-1-ethoxy adamanane, and Methyl pentcosanoate.

some new compounds that have not been previously reported.

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