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Phytochemical, Physiochemical and Spectroscopic Analysis of Oil Extracted From the Seeds of *Hisbiscus Cannabinus* L. (Kenaf)

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Abstract

Hibiscus cannabinus L. is a plant that is found in many communities, where it is being used as an ingredient of soup for the sole aim of improving health and nutritional values. The aim of this study is to undertake a comprehensive assay of the seed oil of *Hibiscus cannabinus* L. (kenaf), a plant of growing industrial and medicinal interest and to present a detailed evaluation of its phytochemical, physicochemical, and spectroscopic properties. Standard procedures of evaluation were adopted and in some cases modified. The oil was extracted with Soxhlet extraction, phytochemical by adopting the methods of Pearson, Sofowora, Harbone and Evans. The physiochemical analysis was done by adopting the procedures of AOAC, ISO, Akubugwo, Akinola, Othman, Endo, Saeed and Shola; while for the spectroscopic analysis (UC, FTIR,GC-MS) suitable and reliable instruments were used. This study presented a detailed evaluation of the phytochemical, physicochemical, and spectroscopic properties of oil extracted from the seeds of *Hibiscus cannabinus* L. The percentage yield of the oil was 21 % which conformed with some reported values by other researchers on the Kenal seed oil. Phytochemical analysis revealed the presence of alkaloids, flavonoids, tannins, saponins, steroids, terpenoids, and phenolics, thus highlighting the therapeutic potential of the oil. Physicochemical analysis showed, density (0.810 g/ml), moisture content (14.5%), acid value (2.004 mg/g), saponification value (136.2 mgKOH/g), iodine value (115 g I_2/100 g), peroxide value (2.7×10^{-3} meq O_2/kg) meaning that the kenaf seed oil possesses favourable physicochemical qualities, such as moderate unsaturation, high oxidative stability, and characteristics. Therefore, the kenaf oil could be suitable for both nutritional and industrial purposes. Spectroscopic characterization results have provided further insights into the chemical structure of the oil. The FTIR spectroscopy identified these functional groups, carbonyl (C=O), hydroxyl (O–H), and aliphatic C–H stretches, confirming the presence of triglycerides and unsaturated fatty acids. UV-Visible spectroscopy indicated absorption peaks associated with conjugated double bonds and aromatic systems, suggesting antioxidant activity. Gas Chromatography-Mass Spectrometry (GC-MS) analysis revealed the presence of 31 components most of which are fatty acids. Some of these components apart from their industrial importance they equally have medicinal values ranging from antimicrobial, antiviral, anti-inflammatory and antioxidant properties. The results of the analysis affirmed that *Hibiscus cannabinus* seed oil is a valuable natural product with potential applications in the food, cosmetic, pharmaceutical, and nutraceutical industries. This study supports the broader utilization of kenaf seeds oil as an alternative source of bioactive oil.

Key words: *Hibiscus cannabinus*, Kenaf seed oil, Physico-chemical properties, Phytochemical analysis, Spectroscopic characterization

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Introduction

Hibiscus cannabinus L. (Kenaf) is an annual, fast-growing, and multipurpose crop that has traditionally been cultivated for its bast fiber, used in textiles, paper production, and biodegradable composites [1,2]. In recent years, attention has shifted toward the underutilized seeds of Kenaf, which are reported to be rich in oil, proteins, and bioactive compounds such as phytosterols, tocopherols, and polyunsaturated fatty acids [3,4]. Kenaf seed oil has shown potential applications in food, cosmetics, biodiesel production, and pharmaceuticals due to its favorable physicochemical and antioxidative properties [5,6]. However, despite these promising attributes, the oil extracted from Kenaf seeds remains relatively underexplored, particularly in terms of its detailed phytochemical constituents and physicochemical parameters under different extraction or storage conditions.

Hibiscus cannabinus L. also known as kenaf is one of the most important species of Hibiscus in Nigeria [7,8]. It is widely cultivated in West Africa, Bangladesh, India and Southern China and it belongs to the order Malvales , genus Hibiscus and the is family Malvaceae [9]. The Malvaceae family is noted for their economic and horticultural importance [10,11,12]. Kenaf is related to Cotton (*Gossypium hirsutum* L.), jute (Corchorus Spp.), and Okra (*Abelmoschus esculentus* L.) [13].

Kenaf is traditionally used for the treatment of bilious disorders, bruising, fever, and puerperium that is said to be anodyne, aperitif, aphrodisiac, fattening, purgative, and stomachic [14.15].Africans make use of the powdered leaves to treat Guinea worms while the peelings from the stem are used to treat anemia, weariness, laziness and so on. The leaf infusion is used to treat coughs in some countries such as the Gambia. The leaves are used in Ayurvedic medicine for dysentery, bilious, blood, and throat conditions while for aches and bruises can be treated externally using seeds. The seeds are sometimes ground and used as a protein supplement or added to traditional dishes [16,17]. Traditionally the plant is used as vegetable cousine and therefore given variety of names. The Hausas called it ‘RAMA’ and use a lot of it as supplement, and the Yorubas ’used to make soup which they called ‘EWEDU’. Infact, it is a common practice of using **Kenaf leaves** commonly as vegetables in some countries of West African such as Nigeria, Ghana, and Burkina Faso [18].

This study is therefore significant as it offers a comprehensive evaluation of Kenaf seed oil using phytochemical screening, physicochemical profiling, and spectroscopic characterisation, thereby contributing valuable insights toward its industrial utilisation and encouraging further bioprospecting of underutilized plant resources.

The various parts of the plant in its natural habitat is presented below.



a. Kenaf pod



b. Kenaf seed



c. Kenaf flower



d. Kenaf leaves and stalk

Figures 1a-d.

Methodology

Sample Collection and Preparation

Kenaf seeds were collected from a farm in Mariri town of Lere Local Government of Kaduna State on 15th January 2025. The plant was authenticated by Mallam A.B. Murtala a Botanist in the Department of Biological Sciences, Kaduna State University, Kaduna. A voucher number was given as KASU/BSH/322. The oil was extracted using Soxhlet extraction apparatus using PORIM Test (Palm Oil Research Institute of Malaysia Test) [6]. A 50 g portion of the seeds sample was weighed and plugged into the thimble. Extraction was conducted with 750 ml of hexane for 6hrs. The thimble was removed from the extraction apparatus and placed in an open place in order to evaporate the residual solvent. The extract was dried at room temperature for 2hrs. The oil and hexane collected in the flask were then fed to Rotary Evaporator to separate the oil and the hexane which lasted for about an hour in order to allow for complete separation. The collected oil was weighed and the percentage yield was calculated.

$$\%\ Oil\ content = \frac{weight\ of\ oil}{weight\ of\ sample} \times 100$$

Equation 1

Phytochemical Analysis

Phytochemical analysis was carried out on the extracted oil from the seeds of *Hibiscus cannabinus* according to the standard procedures of Pearson and others [19,20,21,22].

Test for carbohydrates

Molisch's test

To a small portion of the extract in a test tube, 3 drops of Molisch's reagent were added followed by concentrated sulfuric acid by the side of the test tube. The formation of a reddish colored ring at the interface indicated the presence of carbohydrates.

Test for saponins

Frothing test

About 10ml of distilled water was added to a portion of the extract and was shaken vigorously for 30seconds. The solution was allowed to stand for 5 minutes; the formation of a persistent froth indicated the presence of saponins.

Test for flavonoids

Ammonium test

About 0.5 g of the oil was heated with 10 ml of ethylacetate in boiling water for 3 minutes. The mixture was filtered differently and the filtrates were used for the following tests:

One portion of the filtrate was shaken with 1 ml of dilute ammonia solution (1%). A yellow coloration at the ammonia layer indicates the presence of flavonoids. The second portion was shaken with 1 ml of 1% aluminum chloride solution and observed for light yellow coloration. A yellow precipitate indicated the presence of flavonoids

Ferric chloride

About 0.5 g of the extract was boiled with distilled water and then filtered. To 2 ml of the filtrate, few drops of 10% ferric chloride solution were then added. A green-blue or violet colouration indicated the presence of a phenolic hydroxyl group.

Test for steroids and terpenoids

Concentrated Sulphuric Acid Test

About 9 ml of ethanol was added to 1 ml of the extract and then refluxed for a few minutes and filtered. Each of the filtrates was concentrated to 2.5 ml in a boiling water bath. Distilled water, 5 ml was added to the concentrated solution, the mixture was allowed to stand for 1 h and the waxy matter filtered off. The filtrate was extracted with 2.5 ml of chloroform using a separating funnel. To 0.5 ml of the chloroform extract in a test tube, 1 ml of concentrated sulphuric acid was carefully added to form a lower layer. A reddish-brown interface showed the presence of steroids. To another 0.5 ml of the chloroform extract was evaporated to dryness on a water bath and heated with 3 ml of concentrated sulphuric acid for 10 min on a water bath. A grey colour indicated the presence of terpenoids. In addition, Salkowski test for the presence of terpenoids was also carried out as follows.

Salkowski test

A small portion of the extract was dissolved in 2ml of chloroform, 3 drops of concentrated sulphuric acid were added at the side of the test tube. A red brown coloration at the interface indicated the presence of terpenoids.

Test for tannins

About 0.5 g of the oil was boiled with 5 ml of 45% ethanol for 5 minutes. The mixture was cooled and filtered. The filtrate was subjected to the following tests:

Ferric chloride test

1 ml of the filtrate was diluted with distilled water and added 2 drops of ferric chloride. A transient greenish to black color indicated the presence of tannins

Lead sub-acetate test

To a small portion of the extract, 4 drops of lead sub-acetate solution was added, the formation of a cream colored precipitate indicated the presence of tannins.

Test for alkaloids

About 0.5 g of the extract sample was boiled with 5 ml of 2% HCl on a steam bath. The mixture was filtered and 1 ml portion of the filtrate was measured into three test tubes. Each of the 1 ml filtrate was treated with 2 drops of the following reagents:

Dragendorff's reagent. Appearance of red precipitate indicated the presence of alkaloids.

Mayer's reagent. Appearance of creamy-white colored precipitate indicated the presence of alkaloids.

Wagner's reagent, Appearance of a reddish-brown precipitate indicated the presence of alkaloids.

Test for Reducing Sugar

About 0.5 ml portion of the extract was shaken vigorously with 5 ml of distilled water and filtered. To the filtrate was added equal volumes of Fehling solutions A and B and shaken vigorously. A brick red precipitate indicated the presence of reducing sugars.

Test of Anthraquinones

Bontrager's test

A small portion of the extract was dissolved in 5ml chloroform, shaken and filtered. To the filtrate, an equal volume of 10% ammonium solution was added with continuous shaking. A bright pink colour in the aqueous upper layer indicated the presence of anthraquinone.

Test for Cardiac Glycosides

Sulphuric acid test

5 ml of the dilute sulphuric acid was added to 0.5 ml of the test extract in a test tube and boiled for 15 min in a water bath. It was then cooled and neutralized with 20% potassium hydroxide solution. A mixture, 10 ml of equal parts of Fehling's solution A and B was added and boiled for 5 min. A more dense red precipitate indicated the presence of glycoside.

Keller-Kiliani test

A small portion of the extract was dissolved in 1ml glacial acetic acid containing traces of ferric chloride solution. The solution was then transferred into a dry test tube to which an equal volume of sulphuric acid was added; a brown ring obtained at the interface indicated the presence of deoxy-sugars(digitoxose).

Physicochemical Analysis

Physicochemical analysis was carried out on extracted oil from of *Hibiscus cannabinus* seeds according to the modified procedures of [23, 24,25,26, 27,28].

Density Measurement

Densities of oil samples were measured by a Relative Density (R.D) bottle with a capacity of 10 ml according to the following formula;

$$Density\ (\rho)(g/ml) = \frac{Mass\ of\ the\ oil\ sample\ (M)}{Volume\ of\ the\ RD\ bottle\ (V)}$$

Equation 2

Moisture Content

Three crucibles were weighed and into each 10 g of the oil sample were added. The samples were dried to constant weights in an oven at 105°C, cooled in desiccators and weighed. The procedure was repeated thrice for each sample and the average value was determined.

$$Moisture\ content\ (\%) = \frac{Initial\ weight\ of\ the\ sample(W1) - Dry\ weight\ tof\ he\ sample(W2)}{Initial\ weight\ of\ the\ sanple\ (W1)} X\ 100$$

Equation 3

Where;

W_1 = Weight of the sample before drying (wet weight)

W_2 = Weight of the sample after drying (usually in an oven at 105°C until constant weight)

Saponification Value

The saponification value was determined by taking 0.5 g of oil sample in to a conical flask to which was added 25 ml 0.5 N alcoholic KOH heated under a reserved condenser for 30–40 min to ensure that the sample was fully dissolved. After cooling the sample, phenolphthalein then added and titrated with 0.2 N HCl until a pink end point was reached. A blank was determined with the same time conditions.

$$Saponification\ value = \frac{(B-T)xN\ x\ 56.1}{W}$$

Equation 4.

Where;

B= ml of HCl required by blank

T= ml of HCl required by oil sample

N= Normality of HCl

W=Weight of oil in gm

Acid Value

The acid value of the oil was determined by titrimetric method. Therefore, about 0.5 g of oils was taken into 250 ml conical flask. To this was added 10 ml of neutral ethyl alcohol and then boiled on water bath. Phenolphthalein indicator solution (1-2 drop) was added and the hot mixture was titrated against standard potassium hydroxide

solution with shaking. The end point was noted to the first pink color which persisted for 30 seconds. The Acid value was calculated as mg of KOH per gm of Oil from the equation below;

$$Acid\ value = \frac{MasVx\ Nx\ 56.1}{W}$$

Equation 5.

Where,

V= Volume of standard KOH solution in ml

N=Normality of standard KOH solution.

W=Weight of oil sample in grams.

Peroxide Value

A 0.5 g amount of the sample was weighed into a conical flask. 25 mL of solvent mixture was added, that is, 2 volume of glacial acetic acid and 1 volume of chloroform. 1mL of 10% potassium iodide was added and shaken vigorously. The solution was covered with a stopper and kept in the dark for 30 minutes. 35mL of starch indicator was added, and titrated (V1) with 0.02 M sodium thiosulphate until solution turned colourless. The blank was done starting with 25mL of solvent mixture.

$$Peroxide\ value\ (meqO_2/\text{kg oil}) = (S - B)x\ W\ x\ N$$

Equation 6.

Where:

S = Volume of sodium thiosulphate consumed by the sample oil

B = Volume of sodium thiosulphate used for blank

W = Weight of oil sample

N = the normality of sodium thiosulphate

Iodine value

0.1g of oil was taken in a 250 ml of conical flask and then 10ml chloroform was added followed by 25ml of iodine solution. And incubate the tubes in dark for about 30minutes. After incubation, add 10ml of potassium iodide (KI) followed by adding 100ml distilled water along with few drops of starch indicator. And finally, the oil sample was titrated against 0.1N sodium thiosulphate to get the clear solution. Treat The blank was similarly in the absence of oil.

$$Iodine\ value = (B - S)x\ Nx126{,}9/gm$$

Equation 7.

Where:

B- ml of sodium thiosulphate used in titration of blank,

S- ml of sodium thiosulphate used in titration of sample,

N- Normality of sodium thiosulphate solution.

Chromatographic Procedure

UV Spectrophotometer

2 ml of the oil sample was placed in beaker of 50 ml and then 5 ml of n-hexane were added and shaken thoroughly to reach solution consistency. The cuvette was filled with the sample solution and inserted in to the device and the results were recorded. The cell was emptied and the result was recorded at the wave length range of 200 - 800 nm. The absorptions results were recorded [29].

FT-IR Analysis

Fourier-transform infrared spectroscopy (FT-IR) analysis was performed using a Perkin Elmer Spectrophotometer system (PerkinElmer, Waltham, MA, USA) over a frequency range 400–4000 cm, which was used to detect the characteristic peaks [30].

Gas Chromatography-Mass Spectrometry Analysis

GC-MS analysis was carried out on a GC system comprising a Gas Chromatograph interfaced to a Mass Spectrometer (GC-MS) instrument; Schimadzu GCMS-QP2010, employing the following conditions: Column Elite-1 fused silica capillary column (30×0.25 mm ID×1EM df, composed of 100% Dimethyl poly siloxane), operating in electron impact mode at 70 eV; helium (99.999%) as carrier gas at a constant flow of 1ml/ minute and a sample injection volume of 1 µl which was employed (split ratio of 10:1) injector temperature 250°C; ion-source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 minutes), with an increase of 10°C/minute, to 200°C, then 5°C/minute to 280°C, ending with a 9 minutes isothermal at 280°C. Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da. Total run time was 30 min. The compounds were then identified from the GC-MS peaks, using library data of the corresponding compounds. GC-MS was analyzed using electron impact ionization at 70 eV and data was evaluated using total ion count (TIC) for compound identification and quantification. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS library using NISP Search. The relative % amount of each component was calculated by comparing its average peak area to the total areas. Measurement of peak areas and data processing were carried out by Turbo-Mass-OCPTVS-Demo SPL software [31].

Results and Discussion

The % yield of the oil was 22 % and this is a demonstration of the viability of the seed of Kenaf and its colour was slightly light yellowish green [32,33,37].

The result of the phytochemical screening of the extracted oil from the seeds of *Hibiscus cannabinus* revealed the presence of some important bioactive compounds of medicinal value as indicated in table 1 below. The absence of Anthraquinone means the plant is not poisonous and therefore safe for human consumption. For instance, the Saponins have antimicrobial, anticancer and antifungal properties same thing with Flavonoids except for their antibacterial activity. Tannins on the other hand have both antioxidant, antimicrobial, anti-inflammatory and wound healing property. The Alkaloids apart from having some of these properties they have Antihypertensive**,** bronchodilatory and antiarrhythmic. All these suggest the rampant use of the plant locally [34,35].

Identification of similar phytocompounds was reported for both the seeds and leaves of the plant

and in both cases anthraquinones were not identified [36].

Table 1: Phytochemicals found in oil extracted from *Hibiscus cannabinus*

Phytochemical	Test	Observation	Inference
Carbohydrates	Molish reagent	Reddish colored ring at the interface	+
Reducing sugars	Fehlings A &B	Brickred precipitate	+
Saponins	Frothing's test	Persistent froth	+
Flavonoids	Ferric chloride test	Green-blue coloration	+
	Ammonium test	Yellow colouration	+
Tannins	Lead sub-acetate test	Cream colored precipitate	+
	Ferric Chloride	Greenish to black colouration	+
Steriods	Salkowski' test	Red brown coloration at the interface	+
Alkaloid	Dranendoff's test	Reddish-brown precipitate	+
	Mayer's reagent	Creamy white precipitate	+
	Wagner's reagent	Reddish brown precipitate	+
Antraquinone	Bontrager's test	Bright pink color in the aqueous upper layer	-
Cardiac glycoside	Keller-killiani test	Brown ring at the interface	+

Key: + = present
- = absent

Physico-chemical studies

Physiochemical analysis, show cased its nutritional value, stability, shelf life, and potential industrial or pharmaceutical applications (Table 2). The average density (0.810g/ml) is within the range of oils and useful in both packaging and handling of the oil . Lower value density is highly appreciable to consume [38,39]. The moisture content (14.5%) is appreciable as it is within the average for oils. Thus the higher the moisture content of the oil, the more it is used for food texturing, baking, and frying, as well as in the industrial production of soaps, detergents, cosmetics, and oil paints [40,41]. The saponification value obtained suggests a reflection of average molecular weight of fatty acids and since the value is within the acceptable

range for oils it therefore means that the oil is suitable for making [38].The iodine value obtained indicates high degree of unsaturation and are very useful for drying oils [37,42]. The acid value obtained is within stipulated range and therefore, indicates higher amounts of free fatty acids ([45]. On the other hand, the peroxide value is also within the range for oils as such it reflects the extent of primary oxidation. Hence the oil cannot undergo rancidity immediately [38,42]. The peroxide value can be used to determine the quality and stability of fats and oils. A progressive increase in peroxide value indicates oil rancidity due to relative higher oxidation in oils. Peroxide value ranges are closely related to the specified standard value of 10 meq O_2/kg [41,42]. The acid value of oils determines their purity. The higher the values, the less likely the oils are to be used for cooking. The acid value obtained for *Hibiscus cannabinus* oil was 2.004 mg KOH /g. Higher values indicate that oil triglycerides are being converted into fatty acids and glycerol, which cause rancidity [40, 41, 43].

Table 2: Physicochemical properties of oil extracted from *Hibiscus cannabinus* Seed

Properties	Value/unit
% yield of oil	22.%
Density	0.810g/ml
Moisture content	14.5%
Saponification value	136.2mgKOH/g
Acid value	2.004mg/g
Peroxide value	2.7×10^{-3}meqO_2/kg
Iodine value	115 g I_2/100 g

Spectrometric Analysis

The results of the UV Spectrometric analysis indicated absorption maxima at 319 nm. thus, the UV analysis was used to detect the presence of chromophores in the extract. These absorbance peaks further confirm the antioxidant nature of the oil.

The UV Spectrophotometer maximum wavelength of 319nm was obtained from the sample (Table 3). Organic compounds, particularly those with a high degree of conjugation, absorb light in the UV region of the electromagnetic spectrum based on the measurements of the electronic transition of σ-bonds, π-bonds and lone pair of electrons. The absorptions at 232 - 270 nm is an indication that the kenaf oil has good oxidative stability and low peroxide formation while the absorbance maximum within 212 – 319 nm thus indicating the colourless nature of the oil [47].

Table 3: UV Result of the extracted oil of *Hibiscus cannabinus*

Wavelength(nm)	Absorbance	Interpretation
212.00	Low	π→π* transitions in esters (triglycerides)
224.00	Low	‘’
242.00	Moderate	Presence of conjugated dienes
254.00	High	‘’
319.00	Strong	Phenolic compounds, flavonoids, oxidative degradation products

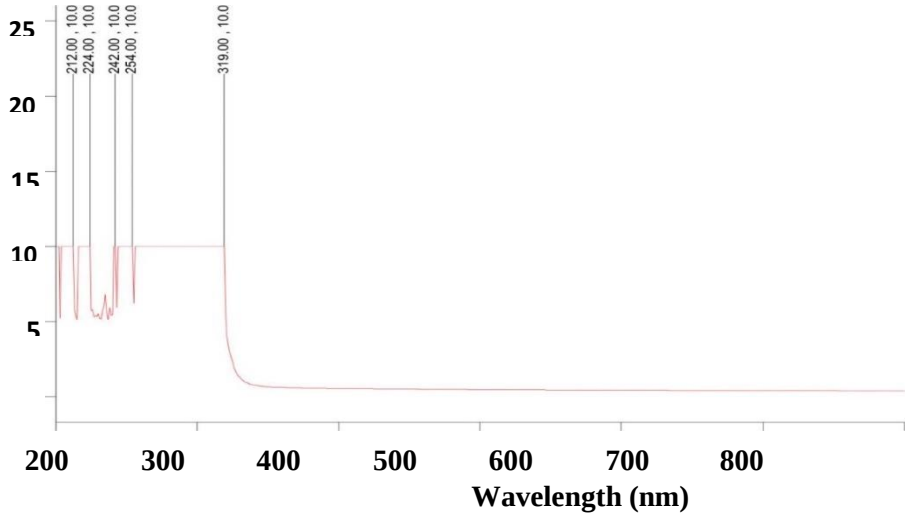


Figure 2: UV spectra of sample

FTIR Result

The FTIR spectrum exhibited characteristic absorption bands (3585 – 1651 cm^{-1}) thus confirming the likelihood that the oil is composed predominantly of triglycerides with long-chain fatty acids, with no unusual contamination or degradation. The FTIR spectrum of kenaf seed oil exhibits several characteristic absorption bands corresponding to various functional groups as indicated in the table below.

FTIR spectrum of the extract revealed numerous bands (Table 4), indicating the presence of numerous functional groups. Peaks 3585.7cm^{-1}to3008cm^{-1} relate to strong stretching of hydroxyl and amine groups (O-H and N-H), band 2922.2cm^{-1}to2855cm^{-1}indicates the presence of a methyl group(C-H), 2310cm^{-1} to 1744.5cm^{-1}indicates the

presence of (C=O) stretching characteristics of carbonyl groups in triglycerides which is a major component of vegetable oils and band 1651cm^{-1} indicates the presence of cyclic alkene (C=C). This vibration indicates the unsaturation in fatty acids. The absorptions at less than 1500cm^{-1} are called fingerprint region and are due to the stretching vibrations of C–O bonds in esters and other oxygenated functional groups [40,41,48,49,50].

Table 4: FT-IR Result for the extracted oil of *Hibiscus cannabinus*

Peaks/Bands (cm^{-1})	Functional Group & Mode Of Vibration
3585-3008	O-H and N-H stretching
2922-2855	C-H stretching
2310-1744	C=H stretching
1651	C=C stretching
< 1500	"Fingerprint" region

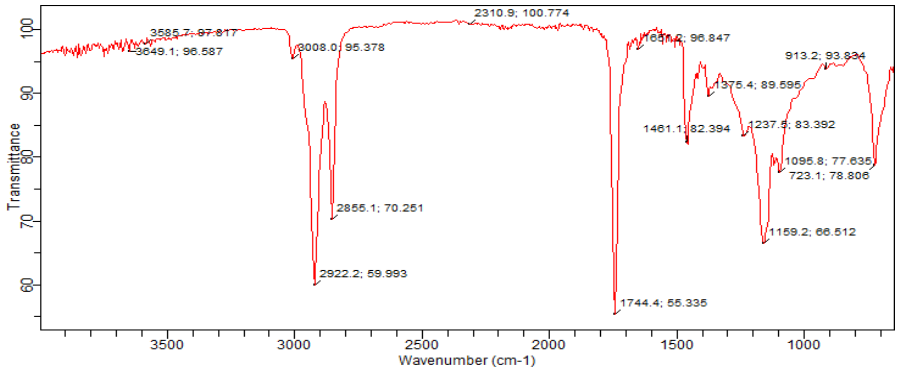


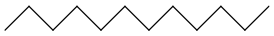
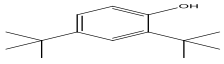
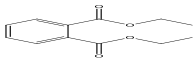
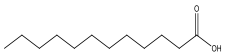
Figure 3: FT- IR spectra of sample of the extracted kenaf oil

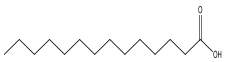
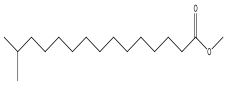
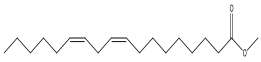
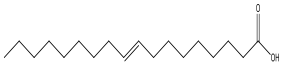
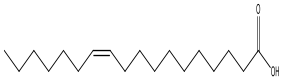
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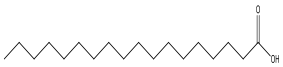
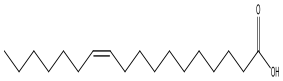
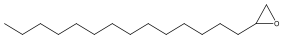
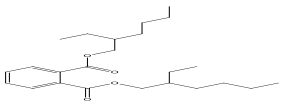
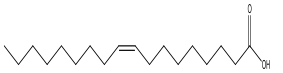
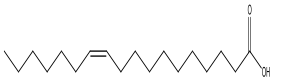
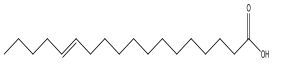
The GC-MS analysis of for *Hibiscus cannabinus* oil revealed the presence of thirty one (31) compounds (Table 5) which comprised of a complex mixture of compounds, predominantly fatty acids, which are crucial for determining the nutritional and industrial value of the oil. Some of these compounds have medicinal values ranging from antimicrobial, antiviral, anti-inflammatory and antioxidant properties thus the usage of the plant in vegetable soup or in cousins [44,46, 48,51,52,53]. The major components were Dodecane, Cyclotetradecane, Tetradecane, 2,4-Di-tert-butylphenol, Pentadecane, Diethyl Phthalate, Dodecanoic acid and

Tetradecanoic acid. However, n-hexadecanoic acid has the highest percentage of 23.0881 % while 9.12-Octadecadienoic acid (Z,Z)-methyester was found to have the lowest percentage of 0.1055 %.

Table 5: GC-MS analysis of chemicals constituents in the extracted oil of *Hibiscus cannabinus* seed

S/NO	RT	Area%	Name	Mol. Wt	Structure
1	9.6002	0.256	Dodecane	170.0	
2	14.6191	0.224	Cyclotetradecane	196.0	
3	14.9011	0.8111	Tetradecane	198.0	
4	17.2648	0.3518	2,4-Di-tertbutylphenol	206.0	
5	17.3911	0.6481	Pentadecane	212.0	
6	18.5116	0.3756	Diethyl Phthalate	222.0	
7	18.9599	9.5038	Dodecanoic acid	200.0	
8	19.7676	0.2078	Hexadecane	226.0	

9	23.5674	2.5139	Tetradecanoic acid	228.0	
10	23.9525	0.3384	E-15-Heptadecenal	252.0	
11	24.1679	0.351	Octadecane	254.0	
12	26.4066	0.2111	Pentadecanoic acid, 14-methyl-,methyl ester	270.0	
13	27.5991	23.0881	n-Hexadecanoic acid	256.0	
14	27.9863	0.2993	1-Octadecene	256.0	
15	28.1601	0.1304	Eicosane	282.0	
16	29.0952	0.1055	9,12-Octadecadienoic acid(Z,Z)-, methyl ester	294.0	
17	29.2087	0.1138	trans-13-Octadecenoic acid, methyl ester	296.0	
18	29.8691	17.1743	9-Octadecenoic acid	282.0	
19	29.9335	5.7762	cis-Vaccenic acid	284.0	

20	30.0158	16.7366	Octadecanoic acid	284.0	
21	30.2161	2.894	1-Octadecene	252.0	
22	30.2814	1.3669	cis-Vaccenic acid	284.0	
23	30.7606	1.0757	Dodecane,4-cyclohexyl-	209.0	
24	31.4554	0.8136	1-Docosene	308.0	
25	31.4984	0.3493	Tridecane,1-bromo-	262.0	
26	31.6883	0.5211	Oxirane, tetradecyl-	222.0	
27	32.0304	1.3786	Bis(2-ethylhexyl) phthalate	279.0	
28	32.1586	4.5735	Oleic Acid	284.0	
29	32.4404	1.1247	cis-Vaccenic acid	384.0	
30	32.5909	6.203	trans-13-Octadecenoic acid	384.0	

31	32.8876	0.1877	1-Bromodocosane	309.0	

Conclusion

The oil extracted from the seeds of *Hibiscus cannabinus* L. (Kenaf) contained some important phytochemicals which are associated with antioxidant, antimicrobial, and anti-inflammatory activities, highlighting its potential medicinal value. The Physico-chemical analysis revealed that the oil possesses good stability, moderate acidity, and a high level of unsaturation, making it suitable for food, therapeutic, cosmetic, and industrial applications. The Spectroscopic analysis confirmed the presence of characteristic functional groups of fatty acids and triglycerides, supporting its chemical composition and quality. Overall, this study demonstrates that Kenaf seed oil is a valuable natural resource with promising nutritional, medicinal, and economic potential.

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