Science Journal of Analytical Chemistry
2023; 11(1): 9-12
http://www.sciencepublishinggroup.com/j/sjac
doi: 10.11648/j.sjac.20231101.12
ISSN: 2376-8045 (Print); ISSN: 2376-8053 (Online)

Chemical Constituents, Proximate Composition, and Heavy Metals of the Oil Seed of *Guizotia scabra* Consumed in Plateau State-Nigeria

Pam Audu Chomo[1, *], Anya Ezekiel Gyang[2], Joyce Bahago Istifanus[3]

[1]Department of Applied Chemistry, Kaduna Polytechnic, Kaduna, Nigeria

[2]National Board for Technology Incubation Centre, Kaduna, Nigeria

[3]Department of Chemical Sciences, Federal University Wukari, Wukari, Nigeria

Email address:

chomopam@gmail.com (Pam Audu Chomo)

[*]Corresponding author

To cite this article:

Pam Audu Chomo, Anya Ezekiel Gyang, Joyce Bahago Istifanus. Chemical Constituents, Proximate Composition, and Heavy Metals of the Oil Seed of *Guizotia scabra* Consumed in Plateau State-Nigeria. *Science Journal of Analytical Chemistry*. Vol. 11, No. 1, 2023, pp. 9-12. doi: 10.11648/j.sjac.20231101.12

Received: October 8, 2022; **Accepted**: November 10, 2022; **Published**: March 31, 2023

Abstract: *Guizotia scabra* (L. F cass. composite) is an oil seed crop found wildly and in some areas cultivated at middle and higher geographical locations in Nigeria and other African countries. The objectives of this research were to among other things determine the physicochemical properties, proximate composition, and chemical constituents. Standard methods for physicochemical properties, proximate analysis and GC/MS was used to determine the chemical constituents. The physicochemical properties revealed acid value 0.455 mg/KOH/g. The percentage yield was 21.34%. The saponification value was 33.10 mg of KOH/kg. Peroxide value revealed 16.35 meq/KOH/kg. The iodine value was 66.83g/100g. The Specific gravity was 0.9246 and the viscosity was 25.3 mPa.s. A proximate composition 6.95% of moisture content, ash content was 3.05%, crude protein was 21.72%, crude fat was 24.4%, crude fibre was 29.5%, dry matter content was 93.50% and organic matter content was 96.95%. The chemical constituents revealed 9, 12-Octadecadienoic acid (31.80%) as the predominant unsaturated fatty acid in the seed oil while Dodecanoic acid (Lauric acid) (3.46%) is the predominant saturated fatty acid. The concentration of Zn in the samples was (1.146±0.00 µg/g), is higher than the other metals (Cu, Fe, Ni, and Pb), Ni and Pb were not detected in the sample. *Guizotia scabra* seed oil from Plateau state is therefore good for consumption due to it low acid value, good protein content, good amount of unsaturated fatty acid, low concentration of heavy metals and some phytochemicals.

Keywords: *Guizotia scabra,* Chemical Constituents, Heavy Metals, Phytochemicals, Proximate Composition, Plateau State

1. Introduction

Guizotia scabra (family Asteraceae) is an oil seed crop found wildly and in some areas cultivated at middle and higher elevations in Nigeria and other African countries. In Nigeria, places like Jos plateau and Kaduna states are seen to significantly harvest and consume this seed. Different tribes have cultural importance attached to this seed such as welcoming important guest, weddings and some other cultural festivities and have local names. People from Plateau state have local names. Every tribe have a special way in which the seed is prepared for the garnishing of such local delicacy [1].

2. Materials and Methods

2.1. Determination of Physicochemical Properties of the Oil

The Physico-Chemical properties for example, saponification value, peroxide number, iodine value, acid value, free fatty acid content, refractive index, percentage oil yield and specific gravity were determined according to standard analytical methods recommended by AOAC, 2003 [2].

2.2. Determination of Proximate Composition

After bringing the samples to uniform size, they were analyse for moisture, protein, fat, ash, and fibre contents by the methods of AOAC, 2006 [3].

2.3. Determination of Chemical Components

The GC and GC-MS analysis of the seed oil of *Guizotia scabra* was performed by injecting 1µL of the extracted oil to a multidimensional gas chromatography coupled with gas chromatography-mass spectrophotometer, (Agilent Technology) equipped with non-polar and polar double capillary columns (30.0m×250µm i.d., 0.25µm df). The vaporized with a flow rate of 0.8mL/min at the average velocity of 32.597cm/second. Various constituents were identified based on comparison of their mass spectra with those of Nist Library Mass Spectra data base and mass spectra from Literature.

2.4. Determination of Metals

0.5g of dried pulverized samples were transferred into a 100cm^3 round bottomed flask. To this, 8.5cm^3 of HNO_3 (69.5%) was added, followed by 5cm^3 $HClO_4$ (60%) and 3cm^3 of 30% H_2O_2 after which the mixture was heated at 120°C for 110minutes. The digest was allowed to cool to room temperature for 30 minutes and then filtered in 50cm^3 volumetric flask and made to the mark with distill water. Five working standard solutions for each metal under consideration (Cd, Cu, As, Pd and Ni) were prepared from respective stock solution (1000mg/L). 1000 ppm of Stock solutions of the metals (Cu, Fe, Ni, Pb and Zn) were prepared by dissolving the appropriate gram of salt of the metals under investigation in 1-liter volumetric flask and made up to the mark with distilled water. The working standards were prepare by diluting the stock solution using the dilution formula $C_1V_1 = C_2V_2$ for various concentrations in 50cm^3 volumetric flask and made up to the mark with distilled water [4].

3. Results and Discussion

Table 1 shows that the oil sample has an agreeable odour; the colour is cream-yellow. It has a percentage yield of 21.34% from 450g of the seed. The specific gravity was 0.9246 with a viscosity of 25.3 mPa. The refractive index was 1.467 and it is a transparent liquid at room temperature. The acid value was 0.455 mg/ $KOHg^{-1}$, iodine value was 66.83 (g/100g). The peroxide value was 16.35meq/KOH/kg and Saponification value was 33.10 mg of KOH/g. These values are in agreement with FAO/WHO, 2009 [5] except for saponification value and percentage yield that is lower while peroxide value is higher. [6] Also reported that Niger seed (*Guizotia abyssinica*) has a poor shelf life and becomes rancid when stored for a long period.

Table 1. *Physicochemical Properties of the Oil Seed of Guizotia scabra.*

Physicochemical Properties	Values	FOA/WHO
Odour	Agreeable	
Colour	Cream Yellow	
Specific Gravity	0.9246	0.9 - 1.16
Percentage Yield (%)	21.34	38-40
Refractive Index	1.469	1.4705
Viscosity (mPa.s)	25.3	
Appearance at room Temperature	Transparent Liquid	
Acid Value (mg/KOH/g)	0.455	4
Iodine value (g/100g)	66.83	80 – 106
Saponification Value (mg of KOH/g of oil)	33.1	181.4±2.60
Peroxide Value (meqkg^{-1})	16.35	2-10

Table 2. *Proximate Composition of the Seed of Guizotia scabra.*

Nutrients	% Composition
Moisture Content	6.95±0.50
Dry Matter	93.05±0.50
Ash Content	3.05±0.71
Organic Matter	96.95±0.07
Crude Protein	21.72±0.23
Crude Fat	24.40±0.67
Crude Fibre	29.50±1.48

Table 2 shows that the moisture contents was 6.95%, this value is lower than the AOAC, (1990) [7] standard of 7-11% for moisture content. It therefore indicate that there is less activities of microorganisms consequently increasing the shelf life of the seeds. Ash contents was 3.05% in agreement with the AOAC, 1990 [7] standard of 2-5% for ash content, this therefore showed that the seed sample have significant amount of ash, which is an important sources of minerals [8].

Crude protein was 21.72%, a report by [9] reveals that plant food that provide more than 12% of its calorific value from protein is considered good source of protein. This therefore suggests that the seed of *Guizotia scabra* is a good source of protein. Crude fat was 24.4, fats allow humans and animals to consume fat-soluble vitamins and provide them with essential fatty acids, that is, those indispensable fatty acids that their bodies are unable to synthesize themselves AOAC, 1998 [10]. Crude fibre contents was 29.5% which is higher than the one reported by AOAC, 1999 [11] standard of ≤ 12%. Adequate intake of dietary fibre can lower cholesterol level, risk of coronary heart diseases, constipation, hypertension, diabetes, colon and breast cancer [12]. Dry matter content was 93.50% and organic matter content was 96.95%.

Table 3. *Chemical Constituents of the Oil Seed of Guizotia scabra.*

SN	Constituents	MF	MW	% Composition
1	Erucic acid	$C_{22}H_{42}O_2$	338.6	0.03
2	Oleic Acid	$C_{18}H_{34}O_2$	282.5	0.1
3	Pentadecanoic acid	$C_{15}H_{30}O_2$	242.39	0.16

SN	Constituents	MF	MW	% Composition
4	Octanoic acid	$C_8H_{16}O_2$	144.21	0.16
5	Hexanoic acid	$C_6H_{12}O_2$	116.16	0.65
6	9-Hexadecenoic Acid	$C_{16}H_{30}O_2$	254.41	0.67
7	Cyclohexanone	$C_6H_{10}O$	98.15	1.34
8	2,4-Decadienal	$C_{10}H_{16}O$	152.24	2.8
9	Octacosanoic Acid	$C_{28}H_{56}O_2$	424.76	3.04
10	Dodecanoic Acid	$C_{12}H_{24}O_2$	200.32	3.46
11	Fumaric Acid	$C_4H_4O_4$	116.07	3.55
12	Trichloroacetic Acid	CCl_3COOH	163.38	12.26
13	8-Azabicyclo{3.2.1}Octane-2-carboxylic acid	$C_9H_{14}NO_4$		21.19
14	Linoleic Acid	$C_{18}H_3O_2$	280.4	31.89

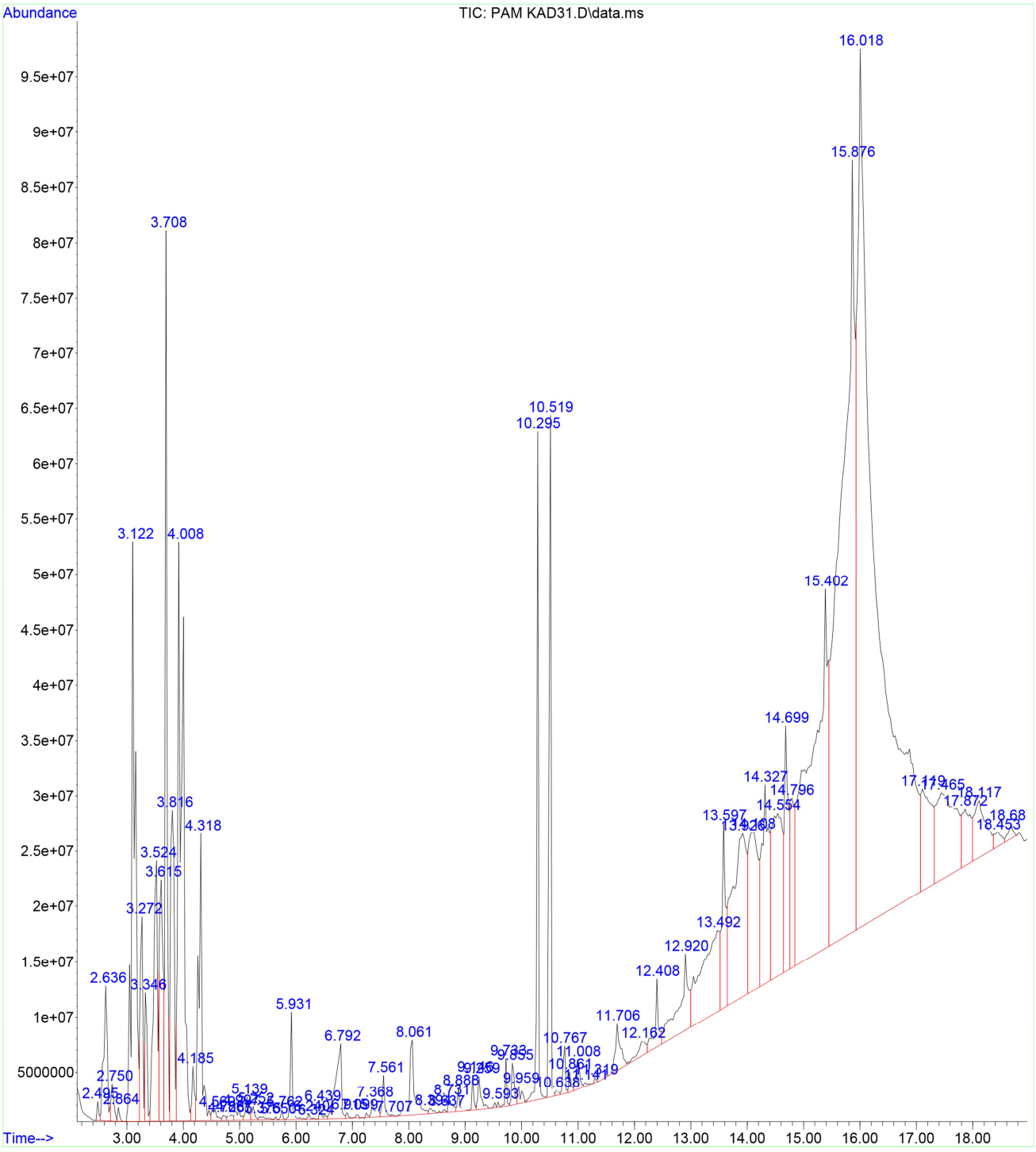

Figure 1. *The GCMS Chromatogram of the Oil Seed of Guizotia scabra.*

Table 3 and Figure 1 shows that the sample has 31.80% 9, 12-Octadecadienoic acid (Linoleic acid), it is the most predominant unsaturated fatty acid that is mostly needed in humans for biological processes [13]. 8-Azabicyclo{3.2.1}Octane-2-carboxylic acid 21.19%, trichloroacetic acid 12.26%, Dodecanoic acid 3.46%, Fumaric acid 3.55%, Octacosanoic acid (Montanic Acid) 3.04% Cyclohexanone 1.34%, 2,4-Decadienal 2.80%. Other noticeable constituents found in the oil were Octanoic acid 0.16%. Hexanoic acid 0.65%, Erucic acid 0.03%, Oleic acid 0.01%, 9-Hexadecenoic acid 0.668%, Limonene 0.02%, 3-Eicosene 0.71%, 9, 12-Octadecadienoyl chloride 0.73%. A similar was report by [14] on *Guizotia abyssinica* seed oil in India.

Table 4. *Concentration of Heavy Metals in the oil seed of Guizotia scabra.*

Metals	Mean Concentration
Cu	0.097±0.00
Fe	0.503±0.00
Ni	BDL
Pb	BDL
Zn	1.146±0.00
	*BDL = Below Detectable Limit

Table 4 shows the levels of some heavy metals in the seed of *Guizotia scabra* in the sample. The concentration of Zn (1.146 µg/g) is higher than Fe (0.503 µg/g), Cu (0.161 µg/g), while Ni, Pb were below detection limit in the sample. Zinc concentration are more than other metals in the samples and are below the recommended intake of 7-15mg/day. There values are lower than the one reported by [15] 35.6 µg/g in Niger seed, [16] 88.7 µg/g in sesame seed. Zinc is an essential element for activation of enzymes, present in trace amount. It is present in all body tissues and fluids. The recommended intake for human is 7–15 mg/day [17].

4. Conclusion

The physicochemical properties of the oil has revealed its palatability for consumption compared with other edible oils. The proximate composition further expresses the suitability of the seed oil, having good amount of protein, crude fibre, and a low moisture content. The flour from these seeds can therefore, be used to fortify low protein diets for better nutrients in the body. The chemical composition revealed that the presence of unsaturated constituents are consider beneficial because they can improve blood cholesterol levels, ease inflammation, stabilize heart rhythms, and play a number of beneficial roles [13]. The seed oil might not be used for saponification purposes due to the low saponification value and reduced shelf life.

References

[1] Chomo, P. A., Okunola, R. M., and Suleiman, S. S. (2022). Amino acid profile of the oil seed of *Guizotia scabra* harvested from Plateau and Kaduna States- Nigeria. Nigerian journal of chemical research. 27 (1) 054-060.

[2] AOAC, (2003). Official methods of analysis of the association of official's analytical chemists, 17th ed. Association of official analytical chemists, Arlington, Virginia.

[3] AOAC (2006). Official Method of Analysis of AOAC International. 18th Ed., Gaithersburg, USA.

[4] Singh, B. C and Matiwes, S (2015). Ntrient composition of niger seed cultivated in different parts of Ethiopia, Bull chemical society Ethiopia, 29 (3), 341-355.

[5] FAO/WHO (2009). Report on the 21st session of the Codex Alimentarius Committee on fats and oils. Kola Kinabalu, Malaysia.

[6] Baerts, M. & Lehmann, J. (2002). *Guizotia scabra*. Prelude Medicinal Plants Database, Metafro-Infosys, Royal Museum for Central Africa, Tervuren, Belgium.

[7] AOAC, (1990). Official methods of Analysis 15th Ed, Association of Official Analytical Chemist, Washington DC. 777-796.

[8] Haris, G. K., and Marshall, M. R. (2017). Ash analysis, In: Nielson ss (ed) Food Analysis, 5th edn. New York, Springer.

[9] Pearson, D. (1976). The Chemical Analysis of Foods. 7th Ed, Edinburgh, UK Churchill Livingstone.

[10] AOACS, (1998). Fats and oils Handbook 1-55. Retrieved 10 June 2021 from http://doi:org/10.1016/B978-09818936.0.50006-8

[11] AOAC (1999). Official Method of Analysis by the Association of Official AnalyticalChemist, Washington D. C., USA: Association of Official Analytical Chemists, Inc.

[12] Ishida, H. H., Suzono, N., Sugiyama, S., Innam, I. T., Tadokoro, & Maekawa, A (2000). Nutritive Evaluation on chemical components of leaves, stalks, stems of sweet potatoes. (Ipomoea batatas poir). Food Chemistry, 68, 359-367.

[13] Mozaffarian, D. R., Micha, R., & Wallace, S. (2010). Effects on coronary heart disease of increasing polyunsaturated fat in place of saturated fat; a systematic review and meta- analysis of randomized-controlled trials. Nutrition Source, 7 (3).

[14] Bhavsar, G. J., Sayed H. M. M and Andhale, R. R. (2017). Characterization and quality assessment of mechanically and solvent extraction of *Guizotia abyssinica* seed oil.

[15] Matiwes, S., & Bhagwan, S. C. (2015). Nutrient composition of niger seed (*Guizotia abyssinica* (l. f.) cass.) cultivated in different parts of Ethiopia. Bull chemical society, 29 (3), 341-355.

[16] Elleuch, M., Besbes, S., Roiseux, O., Blecker, C., & Attia, H. (2007). Food Chemistry, 103, 641.

[17] (Scientific Committee on Food (SCF), 2003). Greenfact. Facts on Health and the environment.