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Chemical Compositions of *Plukenetia conophora* Mull. Arg. Root Bark Crude Oil Extract

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Abstract The crude oil extract from the root bark of *Plukenetia conophora* Mull.arg plant was analyzed for their constituents by means of gas chromatography and gas chromatography coupled with mass spectrometry. Fourteen compounds were identified in the root bark oil. The most abundant compounds in the oil were 11, 14-octadecadienoic acid (41.20%) and palmitic acid (26.46%), while the less abundant compounds were; stearic acid (8.07%) and triacontanoic acid (3.42%). The characteristic of this oil is the presence of long chain fatty acids.

Keywords *Plukenetia conophora*, Root bark, Crude oil, Extract, GC and GC-MS

1. Introduction

Many people are now turning to natural products in order to prevent, treat diseases or maintain good health. Recent research reports had shown the potential of health benefits of essential fatty acids (EFAs). As a result of this, consumers should be aware of the role EFAs play in nutrition, health and disease, in order to take good care of their health. Essential fatty acids, or EFAs, are fatty acids that humans and other animals must ingest because the body requires them for good health but cannot synthesize them (*Robert and Maurice, 1980*). These EFAs are part of vegetable oil constituents examples of EFAs are alpha-linolenic acid (an omega-3 fatty acid) and linoleic acid (an omega-6 fatty acid), while essential oils are concentrated hydrophobic liquid containing volatile aroma compounds from plants. The essentiality of the oil does not indicate indispensable as in essential amino acids or essential fatty acids which indicates nutritional requirement by a living organism (Reeds, 2000).

Essential oils are generally extracted by solvent extraction (maceration), absolute oil extraction, distillation and cold pressing; they are used in perfumes, cosmetics, soaps, food and drinks as flavour. Also used in the treatment of skin diseases and as remedy for cancer (Thorpe's, 1947).

Plukenetia conophora, is a woody perennial climber belongs to the family of *Euphorbiaceae*. Its common name is African walnut and it is widely distributed in the Southern part of Nigeria. It is known in the Southern Nigeria as *ukpa* (Igbo), Western Nigeria as *awusa* or *asala* (Yoruba). This plant is cultivated principally for the nuts which are cooked and consumed as snacks (Oke, 1995). The work done by Oyenuga (1997) revealed the presence of amino acid and fatty acid components of the nut and the use of its leaf juice for the treatment of prolonged and constant hiccups.

Ayoola *et al.*, (2011) reported the phytochemical and nutrient evaluation of the African walnut root.

The root bark of this plant has been in use for many years to treat and prevent different ailment but little work or no work has been reported on the essential oils of the *Plukenetia conophora* root bark. Therefore, the objective of this research work is to evaluate the chemical compositions of the crude oil extract of *Plukenetia conophora* root bark in order to ascertain its possible usefulness as cosmetics and in formulation of drugs.

Plate 1. *Plukenetia conophora* plant shows as a climber tree (**Source:** Ayoola *et al.*, 2011)

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Plate 2. Root Plukenetia conophora (**Source:** Onawumi *et al*., 2015)

2. Materials and Methods

2.1. Plant Material

The *Plukenetia conophora* fresh root bark (Plate 2) was collected at Oshu village in Oko area, Alagbayen farm, Surulere Local Government Area of Oyo State, Nigeria. The root bark was washed, cut into small pieces to facilitate dryness, and air-dried for 14 days. The dried sample was ground into fine powder and stored in an air tight bottle put in the desiccators prior to analysis.

2.2. Isolation of Essential Oils

The powdered root bark sample was weighed (50 g) into a 2.5 L bottle where 1.5 L of n-hexane was introduced and the mixture was left for 72 h with intermittent shaking (extraction by maceration). The mixture was filtered using glass wool in funnel and the filtrate was left to evaporate all the n-hexane.

2.3. Gas Chromatography

The crude oil extract was subjected to GC analyses on GC 2010 gas chromatograph. Column oven temperature is 60℃ injection temperature of 250℃, split injection mode, at 100, 2k Pa; Column flow of 1.61 ml/min and total flow of 6.2 ml/min; 1.0 split ratio; oven temperature programming is 60℃ (for 5 mins.) and at the rate of 5℃ / min till 140℃, 15 °/min till 280℃.

2.4. Gas Chromatography-Mass Spectrometry

The GC-MS analyses were performed on GC-MS QP2010 Plus ion, Source temperature 200℃; interface temperature 250℃; solvent cut time 2.5 min; with relative detector gain mode and threshold 3000; scan MS ACQ mode; detector FTD; mass range of m/z 40-400.

2.5. Identification of Components

Identification of the extracted oil components were based on their retention indices (determined with a reference to a homologous series of n-alkanes), along with comparison of their mass spectral fragmentation patterns in computer matching against in built data and commercials such as Joulain and Koenia (1998), Adams (1995) and massada (1976) Libraries as well as in-house “Baser Library of Essential oil constituents” built up by genuine compounds and components of known oils.

Table 1. Yields of the extracted oil procured from the root bark of *Plukenetia conophora*

Plant	Part	Weight of Sample (g)	Weight of volatile oil procured (g)	% yield of oil
Plukenetia conophora	Root bark	50	5.7	11.4

Table 2. Chemical compositions of the *Plukenetia conophora* Root bark extracted oil using Gas chromatography-Mass spectrometry techniques

Peak No[a]	MS[Base peak+most abundant peaks][b]	Identified Compound[c]	% TIC[d]	Retention time [mins][e]	RI[f]
1	57,43,71,85,41	$C_{14}H_{30}$-Tetradecane [198]	1.48	9.6	1413
2	57,43,71,85,41	$C_{15}H_{32}$-Pentadecane [212]	1.91	10.8	1512
3	57,43,71,83,41	$C_{16}H_{34}$-Hexadecane [226]	2.21	12.0	1612
4	57,71,43,85,41	$C_{17}H_{36}$-Heptadecane [240]	2.29	13.1	1711
5	74,43,87,57,41,143	$C_{31}H_{62}O_2$-Triacontanoic acid, methyl ester (methyl triacontanoate) [466]	3.42	13.3	3270
6	57,43,71,85,41	$C_{18}H_{38}$-Octadecane [254]	2.48	14.2	1810
7	74,87,41	$C_{17}H_{34}O_2$-Palmitic acid, methyl ester [270]	26.46	15.4	1878
8	57,43,71,85,41	$C_{20}H_{42}$-Eicosane [282]	2.25	16.2	2009
9	67,81,55,41,95,109,294	$C_{19}H_{34}O_2$-11,14-Octadecadienoic acid, methyl ester [294]	41.20	16.9	2093
10	74,87,43,41,57	$C_{19}H_{38}O_2$-Stearic acid, methyl ester [298]	8.07	17.3	2077
11	57,71,43,85,41	$C_{22}H_{46}$-Docosane [310]	1.82	18.1	2208
12	57,43,71,85,41	$C_{24}H_{50}$-Tetracosane [338]	1.43	18.9	2407
13	74,87,43,57,41, 143,354	$C_{23}H_{46}O_2$-Docosanoic acid, methyl ester [354]	1.39	20.6	2475
14	74,87,43,57,41, 143	$C_{22}H_{44}O_2$-Heneicosanoic acid, methyl ester [340]	1.54	22.3	2375

3. Results and Discussion

The root bark crude oil extrac was analyzed for its constituents by means of gas chromatography (GC) and gas chromatography coupled with mass spectrometry (GC-MS).

Fourteen compounds were identified in the root bark which is respectively responsible for the root bark 11.4% oil yielded (Table 1).

The root bark oil is dominated by 11, 14-octadecadienoic acid or conjugated linoleic acid (41.20%) and hexadecanoic (palmitic) acid (26.46%).

4. Conclusions

Chemical composition of the crude oil extract of *P.conophora* fresh root bark which is normally known for it's used in some traditional healing homes as medicaments consists of compounds that are health friendly.

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