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Chemical compositions of the essential oils of *Plukenetia conophora* leaves

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Plukenetia conophora **fresh leaves were obtained from a farm in the Surulere Local Government Area of Oyo State, Nigeria. The plant is a climber which normally found support in kola nut or cocoa tree. Standard method was used for the extraction of the oil. The oil was analyzed using gas chromatographic and gas chromatography coupled with mass spectrometric methods. Fifteen compounds were identified in the leaves. The most abundant compounds in the oil were oleic (9-octadecenoic) acid (29.8%) and palmitic (hexadecanoic) acid (14.36%), while the less abundant compounds are 6-tridecenoic acid (9.05%) and 9-octadecenoic acid,1,2,3-propanetryl ester (6.24%). The characteristic of this oil is the presence of long chain fatty acids. This study seeks to evaluate the chemical constituents of the oils of *P. conophora* leaves and how to harmonize them in pharmaceutical and industrial uses.**

Key words: *Plukenetia conophora*, leaves, oil, gas chromatography (GC), gas chromatography coupled with mass spectrometric methods (GC-MS).

INTRODUCTION

Plukenetia conophora, which is also called *Tetracarpidium conophorum* belongs to the family Euphorbiaceae. It is a climbing plant; it is called *ukpa* by the Igbos in the southern part of Nigeria and as *awusa* or *asala* by the Yorubas in the southwestern part of Nigeria. This plant (Plate 1) is cultivated principally for sustainability and not for commercial purposes. The nuts could be consumed as snacks (Akpuaka and Nwankor, 2000). The bitter taste felt in the mouth after eating the nut upon drinking of water could be attributed to the presence of alkaloids. Ayodele (2003) reported the presence of oxalate, phylates and tannin in the raw nuts. Edem et al. (2009) also reported the proximate composition, ascorbic acid and heavy metal contents of the nut.

The methods of processing the nuts and waste in livestock feed formulation was reported by Okpero (2001). Ekpo and Eddy (2005) compared the level of

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

toxicant in the seeds of *Terminalia catappa* (Indian almond) and *Coula edulis* (African walnut). Ayoola et al. (2011) reported the phytochemical and nutrient evaluation of the *T. conophorum* root.

Though the nuts are generally eaten in Nigeria as snack (not minding is medicinal properties), yet little work has been reported on the essential oils of the *P. conophora* leaves. The objective of this work therefore is to evaluate the chemical compositions of the oils of *P. conophora* leaves in order to ascertain its possible usefulness as food, cosmetics and in formulation of drugs.

MATERIALS AND METHODS

Plant

The *P. conophora* fresh leaves (Plate 2) were collected at Oshu village in Surulere Local Government Area of Oyo State, Nigeria. The materials were 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. The plant was authenticated at the herbarium of the Forestry Research Institute of Nigeria (FRIN), Ibadan, Nigeria.

Isolation of the oils

The powdered leaves 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 present in the filtrate and the residue (oil) was weighed to calculate the percentage oil yield.

Gas chromatography

The oil was subjected to gas chromatography (GC) analyses on GC 2010 gas chromatograph. Column oven temperature is 60°C injection temperature of 250°C, split injection mode, at 100, 2 kPa; Column flow of 1.61 ml/min and total flow of 6.2 ml/min; 1.0 split

Plate 2. Leaves of *P. conophora* plant.
Source: Ayoola et al. (2011).

Table 1. Yields of the oil procured from the leaves of *P. conophora*.

Plant	% Yield of oil
P. conophora leaf	17.8

ratio; oven temperature programming is 60°C (for 5 min) and at the rate of 5°C min^{-1} till 140°C, 15°C min^{-1} till 280°C.

Gas chromatography-mass spectrometry (GC-MS)

The GC-MS analyses were performed on GC-MS QP2010 Plus ion, Source temperature 200°C; interface temperature 250°C; 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.

Identification of components

Identification of the essential oil components was 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 as well as in-house “Baser Library of Essential oil constituents” built up by genuine compounds and components of known oils (Olawore et al., 2005; Usman et al., 2017).

RESULTS AND DISCUSSION

The percentage of the oil yield is shown in Table 1. The percentages of the leave constituents as determined by means of gas chromatography (GC) and gas chromatography coupled with mass spectrometry (GC-MS) is shown in Figure 1. Fifteen compounds were identified in the leaves and these are, respectively responsible for the percentage oil yield of the leaves (17.8%) (Table 2). The oil is dominated by oleic (9-octadecenoic) acid (29.78%) and palmitic (hexadecanoic) acid (14.36%).

Oleic acid is important in restoring the heart's ability to be properly used as fat storage organ. This singular act allows a diseased heart to function effectively as a

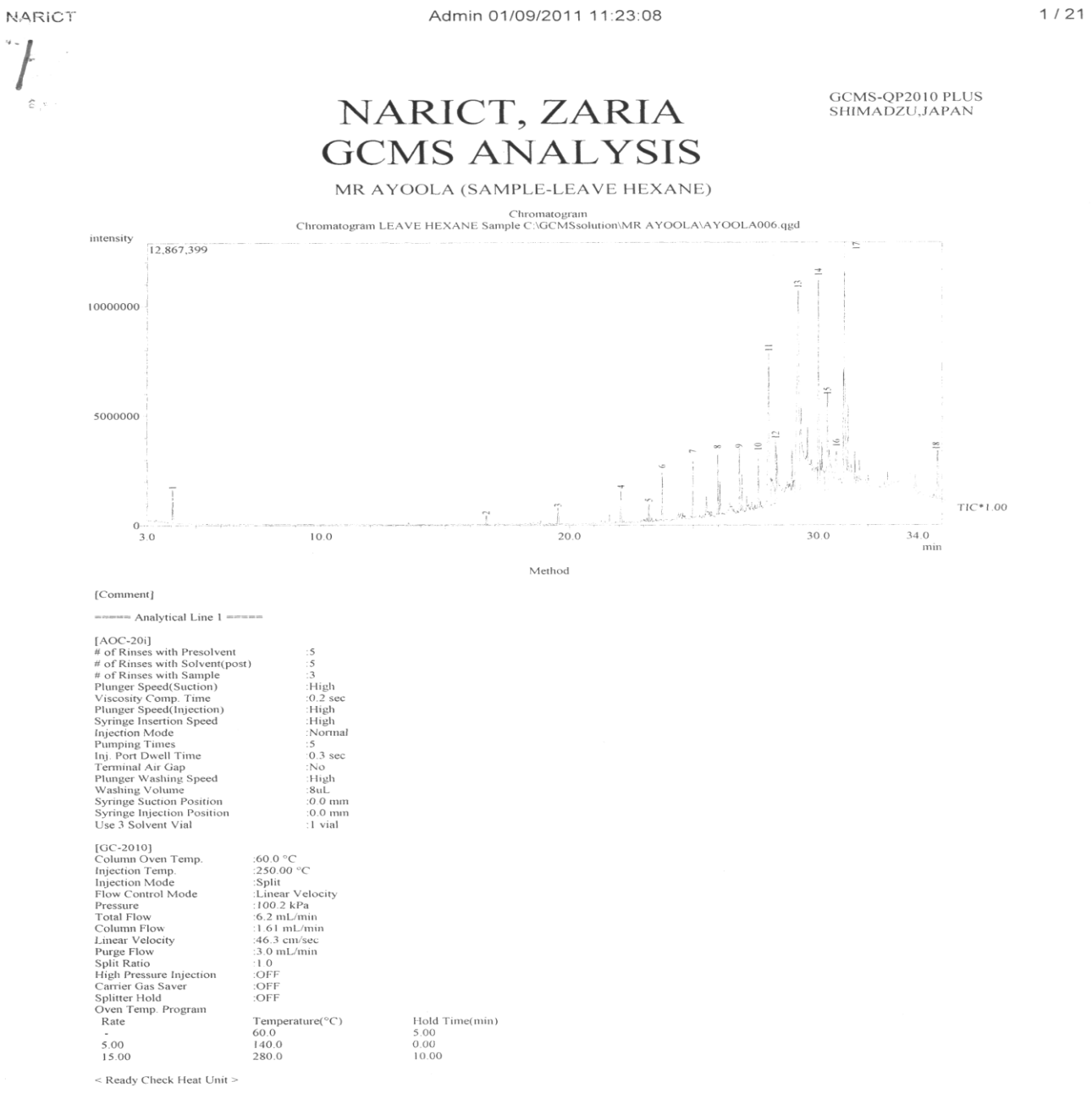

Figure 1. Gas chromatogram of the essential oil of *P. conophora* leaves.

healthy heart (Lahey et al., 2014). Oleic acid could be used to replace other omega fatty acids in cell membranes, since oleic acid is less susceptible to oxidation damage than omega-6 and omega-3 fatty acids, replacing these fatty acids with oleic acid protects the cell membranes from free radicals and other oxidative stressors (Haug et al., 2007).

High content of oleic acid in a diet may reduce the inflammation present in obesity (Vassilious et al., 2009). People consuming high amounts of oleic acid were likely to have ulcerative colitis than those consuming least amount of oleic acid (De Silva et al., 2014).

Conclusion

Chemical compositions of the essential oil of *P. conophora* leaves could be compared to other seeds oil which mostly contain unsaturated fatty acids that are health friendly and are medicinally important to human

Table 2. Chemical constituents of the oil of *Plukenetia conophora* leaves using Gas chromatography-Mass spectrometry techniques.

Peak No.[a]	MS [Base peak +most abundant peaks][b]	Identified compound[c]	%TIC[d]	Retention time [min][e]	RI[f]
1	43,41,57,85,71	C_8H_{18} - Octane[114]	1.70	4.1	816
2	57,43,41,71,85	$C_{11}H_{24}$ - undecane[156]	0.56	16.6	1115
3	57,43,71,85,41	$C_{13}H_{28}$ - Tridecane[184]	1.01	19.5	1313
4	57,43,71,85,41	$C_{14}H_{30}$ - Tetradecane[198]	1.62	22.1	1413
5	57,43,71,85,41	$C_{15}H_{32}$ - Pentadecane[212]	2.28	23.7	1512
6	57,71,43,85,41	$C_{16}H_{34}$ - Hexadecane[226]	0.88	23.2	1612
7	57,43,71,85,41	$C_{16}H_{36}$ - Heptadecane[240]	2.41	25.9	1711
8	57,43,71,85,41	$C_{19}H_{40}$ - Nonadecane[268]	2.47	26.8	1910
9	57,43,71,85,41	$C_{20}H_{42}$ - Eico sane [282]	2.27	27.6	2009
10	73,43,60,41,256,129,213	$C_{16}H_{32}O_2$ - Hexadecanoic acid (palmitic acid [256])	14.36	28.0	1968
11	55,69,41,83,97,98,264	$C_{18}H_{34}O_2$, 9 - Octadecenoic acid (oleic acid [282])	29.78	29.2	2175
12	57,43,70	$C_{16}H_{30}O_2$, 11 - Tridecenyl propionate [254]	11.97	30.0	17.87
13	67,80,41,93,55	$C_{19}H_{32}O_2$, 6 - Tridecenoic acid, 13-(2-cyclopenten-1-yl), methyl ester	9.05	30.4	2110
14	57,43,71,85,41	$C_{27}H_{56}$ - Heptacosane [380]	4.75	30.7	2705
15	55,69,83,98,97,41	$C_{57}H_{104}O_6$, 9 - Octadecenoic acid,1,2,3-propanetriyl ester [884]	6.24	31.1	6149

beings. This leaf of *P. conophora* is a confirmed source of oleic acid, therefore could be extracted and package as essential oil of *P. conophora.*

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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