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RESEARCH ARTICLE

THE PHYSICOCHEMICAL INDICES AND MAJOR FATTY ACID COMPONENTS OF *Irvingia wombulu* OIL

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ABSTRACT

Oil from *Irvingia wombulu* was extracted, purified and characterized by Soxhlet Extractor. Standard methods were used for the determination of the physiological indices, while the Fatty acid components were determined using the Gas chromatographic technique. The percentage of pure fat after extraction was 60%. The physiochemical analysis revealed the following: Relative density (0.82), $_{P}$H (6.22), Saponification value (178.39mgKOH^{-1}), unsaponifiable matters (0.85%), Iodine value (2.54/100g Fat), Peroxide value (0.96mgEqKg^{-1}). Gas-Liquid Chromatography revealed that the major Fatty acids were: C14:O (48.93%), C12:O(32.37%), C16:0 (7.95%), C10:O (0.93%), C18:0 (0.75%) and C18:1(4.58%). The result of this study is indicative that the *Irvingia wombulu* oil contains high concentration of unsaturated fatty acids and thus may not be heart friendly.

INTRODUCTION

Irvnigia wombulu is a fruit of a non timber forest product made up of tree trunk, leaves and roots .The fruits comprises of a fleshy part which is sour in taste and thus not eaten as fruit and the nut which consist of a hard shell and the kernel seed (Ladipo, 1995). Their seeds have an outer brown testa (hull) and two white cotyledons. They belong to plant of irvingiaceae family and a subfamily simaraoubaceae. (Okafor,1978; Harris,1996). They are commonly called bush mango, Africa mango, wild mango or dikanut plant and also locally called Ogbono (Ibo), Ororgbije (Yoruba) and mangoron kurmi (Hausa) of Nigeria and Ewewe (Gabon). (Okafor 1978).

The edible kernel are used for culinary purposes and are traded widely. It is used as also thickener in west and central Africa particularly in Gabon. *Irvingia wombulu* flowers in October (Okafor, 1975), and fruits in the dry season around January-march (Ndoye *et al.,* 1998). Irvingia seeds constitute an important part of the rural diet in Nigeria. Usually the sun dried seeds are ground in flour and used as soup thickener (Ayuk *et al*, 1999).The kernels are highly valued for the slimy consistency they produce. Potentially, *Irvnigia wombulu* produces quality timber used locally for construction(Leaky,1999b).The wood is also for making poles and stakes (Ayuk *et al*.,1999). Fats extracted from the kernels are used for food applications such as in margarine or cooking oil and also suitable for soap, cosmetics and pharmaceuticals (Ejiofor *et al.,* 1987).Agbor,(1994) stated that the roots, leaves and bark of Irvingia Spp are used medically. *Irvnigia wombulu* bark is mixed with palm oil for use in the treatment of diarrhea and is taken by women to shorten their breast feeding period (Ngodi *et al.,* 2005).It is thus pleasantly surprising that almost all part of this plant is use full and hence our interest in investigating further the physiochemical and fatty acid profile of the oil extract from the so as to unravel more useful properties and possible application of the oil.

MATERIALS AND METHODS

Sample collection: *Irvnigia wombulu* seeds were collected from Late Musa Omeh's community farm in Olido Enugu-Ezike, Igbo-Eze Local Government Area of Enugu State of Nigeria. The seeds of the plant was identified by Mr. Nwogbaga Andrew, a botanist at Ebonyi State University, Abakiliki, Nigeria. Voucher specimen was deposited at the Herbarium of the same Department.

Sample preparation: The fruits were harvested manually from the tree and the seeds taken out fresh from the kernel after splitting it open with a knife. The fresh seeds are then collected, washed clean and air dried for 72 hours to remove moisture. The dried seeds were reduced into small sizes with Electric hopper and ground into powder using electric blender. The powdered seed were sieved using 2mm-steel and stored in a labeled plastic container until required for analysis.

Oil extraction procedure: The Franz von Soxhlet extractor method described by A.O.A.C,(2000).was used

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for the extraction and determination of the percentage oil yield.

Five grams(5.0g) of the powdered seeds was wrapped in a weighed filter paper and placed in the thimble and about 200ml of normal hexane was poured into a weighed round bottomed flask. The hexane was heated to boil with electro thermal heater for 4 hours continuous extraction. The defatted sample was removed and solvent recovered. The flask and it's oil content was further dried in the oven at 60ºC for 30 minutes and cooled in a desicator. The flask and its content was reweighed to determine the weight of the oil. The experiment was repeated two more times to get an average. The percentage oil yield was obtained by expressing the oil weight as a percentage of the weight of the sample.

Physiochemical analysis

The physiochemical parameters were determined using standard methods of analysis. The parameters analysed include:

Specific gravity (Pycometer bottle method)

Melting point (Fisher-John melting Apparatus)

Setting Time (Pour point Refrigerator) Smoke, Flash and Fire point

$_P$H Determination ($_P$H meter method)

Acid value (AOAC, standard 969.17, 1997);

Saponification value: Saponification value was determined according to AOAC Official Method 920.160,1997.

Unsaponifiable matters (AOAC method,1997)

Iodine value (Iodine value of seed oil was determined according to AOAC Official Method 993.20,1997.

Peroxide value(AOAC method,1997)

Fatty Acid profile

The fatty acid profile was determined using Gas Chromatographic technique. After saponification,the methyl esters of constituent fatty acid was prepared using methanol and boron fluoride catalyst and then separated and indentified by Gas chromatography. Fatty acid separation, detection and identification were carried out in gas chromatographer model HP5890 series 11.Potassium hydroxide prepared in 2N of methanol was added to one gramme of the oil sample to saponify the oil. the oil was emulsified by addition of prepared conc.HCL with methanol(1:4) in a soap solution. This is followed by the addition of n-heptane to select the oil. Brine was added to salt out the outer composition.0.5µl micro syringe was used to measure out the sample extract and to inject into the chromatographer. After 10 minutes, the fatty acids were indentified in a graph, having peaks, area and carbon numbers. Fatty acid are indentified by comparing retention time (tr) of the methyl esters of the fatty acid with that of authentic fatty acids.

RESULTS AND DISCUSSION

The oil appeared butter-yellow in colour, showing that it contains some pigments that may be of biological importance and thus can be recommended for nutritional and medicinal purposes. Since the oil has no smell, any case of adulteration can be easily detected. The results obtained for the physiochemical and fatty acid analysis of the *Irvnigia wombulu* oil are shown in Table 1 & 2 below:

Table 1: Pyysiochemical properties of the*Irvnigia wombulu* oil.

Properties	*Value*
Specific gravity	0.88
Relative density	0.82
Refractive index	1.46
Melting point	13ºC
Setting point	19ºC
Smoke point	78ºC
Flash point	120ºC
Fire point	168ºC
$_P$H Value	6.22
Acid value	8.60mgKOHg^{-1}
Saponification value	178.39%FFA as Oleic
%Unsaponifiable	0.85
Iodine value	2.54/100g Fat
Peroxide value	0.96mEq/kg
%Yield	65

Table 2. The fatty acid profile of *Irvnigia wombulu* oil

Fatty acid fractions	*%Concentration*
C10:0	0.93
C12:0	32.37
C14:0	48.93
C16:0	12.44
C18:0	0.75
C18:1	4.58

The observed oil yield of 60% in *Irvnigia wombulu* is indicative that the seed is a good source of oil. The specific gravity of *Irvingia wombulu* oil of 0.88 and the values of the smoke, flash and fire points were probably as a result of increase in chain length and thus high molecular weight(Christie,1982).The $_P$H of 6.22 observed in the oil shows that the oil is acidic and thus highly recommended for soap making and other cosmetic application because these level of acidity are compatible with the skins acid mantle which is about 5.5(Reiger,1986).High acid value can also be indicative of poor storage methods. The saponification value of 178.39mgKOHg^{-1} for *Irvingia wombulu* oil is in agreement with the earlier finding by(Omogboi,1990).The iodine value of 2.54/100g fat indicates that the oil is highly saturated and falls into the class of lipid called non-drying oil(0-100).The peroxide value of 0.96 also shows that the oil is saturated and may not be so reactive as to go rancid. It may also indicate that the oil did not stay long before the analysis was carried out, thus the oil is stable(Pearson,1976).The low percentage(0.85) of unsaponifiable matters shows that the levels of sterols, carbohydrates and higher alcohols are very low, thereby classifying the oil as of normal purity. With a melting point of 13ºC the oil is expected to be liquid at room temperature but surprisingly the oil is solid, this variation may be due to its high molecular weight, increased chain length and thus high density. The analysis of the fatty acid profile also suggests that the oil is highly saturated as can be seen in Table 2.The most abundant fatty acid in the*Irvingia wombulu* oil are Myristic (C14:0), Lauric (C12:0) and Palmitic acid(C16:0) with myristic and lauric adding up to 86.97% (Womeni *et al.,*2006a;Womeni *et*

*al.,*2006b).This level of saturation may have resulted in the oil becoming solidified at less than room temperature(26-28ºC).Also due to their level of saturation it will not be advisable for cardiovascular patients to consume the oil or the seed in high quantity which unfortunately is widely consumed as soup thickner in Nigeria In Conclusion, the oil extracted from *Irvnigia wombulu* shows high level of saturation and the analysis revealed that it is rich in myristic and lauric acid which makes it very suitable for cosmetics and pharmaceuticals. Nutritionally it may not be recommendable to individuals with cardiovascular disposition.

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