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Physico - Chemical Properties of Pachystela Brevipes Seed Oil from Anambra State Southeastern Nigeria

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Abstract: **Oils of Pachstela brevipes seed kernels from different samples obtained from five local government areas of the state were extracted following literature methods and using normal hexane as solvent. Iodine value, saponification value, acid value and refractive index and oil content were determined. The seed kernels were found to contain varying levels of oils, mainly in the range of 40 – 48%. The level of unsaturation as suggested by the iodine value is of the range 76.63 – 100.00 and infrared absorption bands at 1650cm^{-1} and 1750cm^{-1} indicative of C=C and C=O of unsaturated carboxylic acid respectively. Judging by the high saponification values of the range 220 – 275, the oil may not be suitable for paint formulation but suitable for soap production.**

Keywords: Pachstela brevipes, Iodine value, Saponification value, Infrared absorption.

I. INTRODUCTION

Pachystela brevipes, tree is one of the most widely distributed trees in Africa, in areas like Gambia, Mali, Guinea, Togo, Benin, Niger, Guinea-Bissau, Nigeria and Cameroon. It is also found in the Middle East and South Asia (Hall *et al.,* 1991). Like most plant samples, there is enormous variation in the size, shape and colour of fruits and seeds. For instance the fruits of the species in the Wad Medani area of sudan are reported to be longish and yellow in contrast to the round and red fruits from Damazin (Jenseta 2002). Pachstela brevipes seed kernel porpularly known as "desert date" has many names of different languages. It is called Heglig (Arabic), Mjunju (Swahili) Datte (French), while some local names in Nigeria are Udara nwaenwe (Igbo), and Aduwa (Hausa). The saentific name is pachystela brevipes (Shanks 1991).

A report by panel of experts from various African countries, released in January 2008 included Pachystela among the 24 indigenous fruit trees (Okia 2007) chosen for their potential in nutritional values, environmental stability, and economic development if given the right scientific and agricultural support. Characteristics and compositional of Pachystela brevipes oil samples from the sudan have also been carried out by Hussain and Co- workers (Hussain et al., 1949) [5]. Some of the parameters determined were specific gravity, refractive index, acid value, iodine value, unsaponifiable matter etc. In recent study (Chapagain *et al.,* 2009) on Pachystela brevipes the kernel oil content was in agreement with that of sudan. The work of Mohammed (Mohammed *et al.,* 2000) was basically on the amino acid and saponin content of Pachystela brevipes.

The geographical conditions under which the tree thrives have been describe. It has been reported (Hall et al 1791) that the plant is one of the most drought resistant tree species in the arid regions due to its deep tap roots thus enabling it to thrive in deserts. Its thick back protects it from bush fires and it can with stand seasonal flooding, strong winds and shallow and compacted soils. Its seed kernel is used for oil extraction and for human consumption (Neuwinger 1996). It is known that the seed oil consists largely of triglycerides of linoleic and oleic acids, which are unsaturated, and most desirable in foods. Pachystela breupes extracts was shown to exhibit antidia-batic, antifecdant and contraceptive activities. (Jain et al., 1991, Kamel et al., 1991, Liu *et al.,* 1982, Ibrahnim, 1992 and Rao *et al.,* 1997). The leaves are valued for livestock feed, especially in the dry season, when grass has finished. Oil is extracted from the dried and crushed kernels of Pachystela brevipes and is used in various ways in the sudan for preparing food (Jen *et al.,* 2002). The pachystela tree is also of medicinal value (Liu *et al.,* 2005) such as in the treatment of malaria, yellow fever and toothaches. Diosgenin is found in seed kernel which can be absorbed through the gut and plays an important role in the control of cholesterol metabolism (Roman *et al.,* 1995). One of the earliest uses of seed oil from the plant known as Pachysno oil was used by the ancient Egyptians for perfumes as the tree was common in the Nile valley but now reported to be rare (Hall *et al.,* 1991). The fruit of Pachystela is known to consist of an-epicarp (5-7%), a mesocarp (28-35%), and endocarp (49-52%), and a kernel (8-12%) (Husain *et al.,* 1949, Rao *et al.,* 1997). Analysis were carried out on

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determination of diosgenin level and oil percentage from the seed kernels of Pachystela brevipes collected from five Israel provinces (Bet-Shean, Eln-gedi, sapir, Samar and Eilat) and five International locations (Burkina Faso, Senegal, Mali, Niger and India). Results suggested that samples from Bet-shean valley, which is considered the northern – most latitude where Pachystegia brevipes naturally grows, contained the highest level of diosgenin as well as oil percentage; the Indians sample contained the lowest level of both diogenin and oil (Chapagain *et al.*, 2009). In Northern Nigeria the fruit provides a source of income for the rural people, and after licking or, sucking of the fruit juicy pericarp, the seed is thrown away. The importance of vegetable oil as food complement and as industrial raw material cannot be material it is expected to have some specific qualities. It is therefore always necessary to extract and characterize vegetable oils so as to know the industry in which it can be useful as raw material. The extraction and characterization of the oil from Pachystela brevipes that is growing in Anambra State cannot be said to be less important. This work is therefore concerned with the viability or otherwise of the seed oil from locally available Pachystela brevipes for domestic and industrial application through the determination of some physio-chemical parameters.

II. MATERIALS AND METHODS

Materials: ripe fruits of Pachystela brevipes were collected from five local government areas of Anambra State namely: Njikoka, Awka north, Awka South, Dunukofia and Idemili south. Pachystela trees with riped fruits were identified and the branches shaken and the ripe fruits that fell down picked into a bag for processing.

Preparation of Material: The epicarp (outer cover of the fruit) was removed by hand and 900.50 of each sample was taken and then weighed using an electronic balance. Then the mesocarps (pulp) were washed, and the nuts were air dried and weighed. The nuts were cracked using a stone and then the weight of the seed kernels was taken. After that the dried seed kernels were ground into powder form using a grinder. Each grounded sample was weight separately for each extraction. Extraction of the oil was done using soxhlet extractor and normal hexane as solvent.

III. CHARACTERIZATION OF THE EXTRACTED OIL

Determination of Acid value: Following a literature method (Lambert *et al.*, 1977). Determination of iodine value: using Wij's method (Dialond *et al.*, 1973). Determination of saponification value. Determination of Refractive Index by apparent depth method said to be overemphasized. For vegetable oil to be used as industrial raw material.

IV. PROCEDURE

A mark "X" was made with a marker at the inner bottom of the beaker. The beaker was placed under a travelling microscope. The mark was viewed directly from above with the microscope until a sharp clear image was formed in the microscope. The reading on the microscope was noted and recorded as M_1. The oil (Anambra Sample) was then poured into the beaker and the sharp clear image of the mark was formed in the microscope. The microscope was then adjusted until the chalk dusts were sharply focused in the microscope. The new reading was taken and recorded as M_3 Refractive Index =

$$\frac{\text{Real depth}}{\text{Apparent depth}} = \frac{M_3 - M_1}{M_3 - M_2}$$

V. DETERMINATION OF SPECIFIC GRAVITY (Lambet *et al.*, 1977)

A density bottle was used in determining the densities of the oil. A clean and dry bottle of 25ml capacity was weighed and assigned as W_o, and then filled with the oil, a stopper was inserted and reweighed to give a weight recorded as W_1. The oil was substituted with the water after washing and drying the bottle and weighed and was recorded as W_2. The expression for specific gravity (sp.gr) is as: Sp.gr. = Mass of the substance/Mass of an equal volume of water =

$$\frac{W_1 - W_0}{W_2 - W_0}$$

Infra red spectra of the oil extracts were obtained using FTIR Chimadzu 840OS at NARICTZaria.

VI. RESULTS AND DISCUSSION

The chemical and physical properties of Pachystela brevipes oil were evaluated and results are presented on Table 1.

Table 1: Physical and Chemical Properties of Pachystela brevipes oil extracted from various seed kernel and compared with the literature values.

	Present samples					Literature values (Hussain *et al.*, 1949)		
Parameters	Njikoka	Awka North	Awka South	Dunukofia	Idemili South	Northern Nigeria	Ugana	Sudden
Oil content %	40	44	42	48	42	-	-	44
Specific gravity	0.701	0.704	0.722	0.673	0.698	0.717	0.720	0.7185
Refractive Index at room temperature	1.00	1.548	1.118	1.123	1.22	-	1.2638	-
Colour	Light yellow W	Brown	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow w
Acid value (mg NaOH/g of oil)	0.024 ±0.01	0.0714 ±0.01	0.015 ±0.01	0.022 ±0.01	0.022 ±0.01	3.00	0.70	1.30
Iodine value	99.57	100.00	76.63	99.15	78.61	92.48	98.02	78.0
(I_2g/100g of oil)	±0.300	±0.294	±0.454	±0.475	±0.304			
Saponification value	209.58	230.50	256.03	238.36	247.19	186.5	181.4	184.0
(Mgkoit/g of oil)	±0.430	±0.719	±0.693	±0.692	±0.694			

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In previous studies, oil content and refractive index were not done for oil samples from Southern Nigeria, but in this study we found the percentage oil content of the seed kernels in the range of 40-48% and is fairly in good agreement with that reported for the Sudan samples (Husain *et al.,* 1949). The specific gravity and refractive index values obtained were also within the range of the literature values. But only the refractive index of 1.548 for the Awka North sample was much higher. This was further supported by its dark brown colour. The refractive index of 1.42 from Idemili South is in good agreement with that of Uganda sample (Hussain *et al.,* 1949). The colour of the oils obtained were light yellow with the exception of that from Awka North. The light yellow oils comply with the reported literature.

The colour of the oil is known to be due to the pigment mainly α - carotene (Hussain *et al.,* 1949). The acid values were generally found to be much lower and not consistent with that reported for the Northern Nigeria samples or that from Uganda (Okia 2007 and Hussain *et al.,* 1949). These lower level of acid values imply lower corresponding free fatty acid content. It is interesting to note that the saponification values (209-256) were rather high as compared with those from the literature (Donkor 1997). The range however, confirm to those reported for common oils used for soap production (Donkor 1997). For example, the saponification values for palm oil, coconut oil and paalm kernel are in the range 200-205, 251-264 and 248 respectively. From the results of this study therefore the oil extracts may be said to be suitable for soap making.

The iodine values for all seed kernels oils were in the range of 76.63- 100.00. Only that for Idemili south and Awka south tallied exactly with that from Sudan and Uganda (Hussain *et al.,* 1949). The levels of the iodine values indicate the presence of un-saturation. The iodine values fall within that for groundnut oil (10-103) that is used for soap production (Donkor 1997). But oils with iodine value less than 180 therefore are not considered drying oils and cannot be used in the paint industry. All the seed kernels examined in this work have been shown to contain oils in reasonable levels which are in the range of 40-48% like the seeds from Uganda. The findings suggest that they contain unsaturated fatty acid judging but their iodine value (70-103). The strong IR absorption bands at 1750cm^{-1} and above 3000cm^{-1} are indicative of OH and C=O groups for carboxylic acid. There is a medium band at 1650cm^{-1} that could be assigned to C=C stretch of unsaturated double bonds. (Nwokonkwo 2008) in characterizing mustard seed oil assigned similar bands at 2500-3300cm^{-1}, 1760cm^{-1} and 164cm^{-1} to OH, C=O and C=C respectively. The oil from the seed kernels of Pachystela brevipes obtained from different locations in Anambra State, are however not good drying oils, because of their low iodine values. It has been suggested that a good drying oil should have iodine value of 180 and above (Kyari 2008). All the oil extracts from the samples from the five Local Government Areas are not suitable for paint formation. They may be however useful for other purposes such as soap production judging by their high saponification values in the range of 209-256.

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