

Extraction and Characterization of *Lophira lanceolata* Seed Oil for Application on Leather**Habila, B^{*1}., Mamza, P.A.P²., Gimba, C.E³.**¹*Directorate of Research and Development, Nigerian Institute of Leather and Science Technology; P.M.B. 1034, Zaria.*^{2,3}*Department of Chemistry, Faculty of Physical Sciences, Ahmadu Bello University, Zaria.*

Abstract: Seed oil is a vegetable oil that is obtained from seed (endosperm) of some plants, rather than the fruit (pericarp). Generally, oil is a liquid, non-polar chemical substance at room temperature with hydrophobic and lipophilic characteristics. The seed oil of *Lophira lanceolata* (Namijin kade) was extracted using solvent (n-hexane) method of extraction which gave rise to 49.10±0.10% oil yield, and the physico-chemical properties of the oil were analysed using standard official methods. The iodine value was found to be 74.19±0.64mgI₂/100g, this suggest that the oil contain mainly saturated fatty acids. Moisture content and ash content of the seeds were found to be 0.73±0.26% and 0.897±0.03% respectively. The refractive index of the oil was 1.347 at 40C. The peroxide value is 2.87±0.12mol.peroxide/Kg. The low peroxide value is an indication of high stability of the oil against further oxidation. The acid value of the oil (1.20±0.13mg/KOH/g of oil) was within the range given by the standard for fatliquor production which is an indication that the *Lophira* seed oil cannot undergo rancidity easily. The saponification value of the oil was found to be 178.30±0.96mg KOHg⁻¹. The FT-IR spectrum of the oil at various peaks were observed. The carbonyl functional group: -C=O was observed at 1744.4cm⁻¹ frequency and at frequency 3011cm⁻¹, -C=C- in unsaturated hydrocarbon was observed. Finally, the fatty acid fractions of the oil as analysed by the use of GC-MS were found to be Palmitic acid of 62.88%, Linoleic acid of 9.66% and Oleic acid of 4.90% and these fatty acids are peculiar to the synthesis of fatliquor. This oil can have useful properties in the manufacturing of soap, cosmetics and lubricants.

Keywords: Fatliquor, FT-IR, GC-MS, *Lophira lanceolata* seeds oil, Namijin kade.

1.0 Introduction

In leather manufacturing, conversion of hide and skin into leather requires several chemical and mechanical steps to remove non-collagenous matter in pre-tanning operation [1]. After the tanning operation, in order to produce good leather of desirable quality, the tanned leather is lubricated in a fatliquoring step [2]. Fatliquoring is one of the critical steps for most types of leather especially in garment and upholstery leather manufacturing. The incorporation of fatty matter into leather fiber via fatliquoring process enhance leather full and soft handle, flexibility, pliability and at the same time improves its mechanical properties [3]. In

addition to separating the leather fibers from each other, oils and fats are introduced into the leather matrix in order to prevent the adhesion of fiber to promote good leather properties [4]. The most economical and environmentally friendly oil for sustainable production of fatliquor in the world oils market is the vegetable oil [5]. Nigeria is rich in vegetable oils such as Palm oil [6], Soya bean oil [7], ground nut oil [8], cottonseed oil and Sun flower oil to mention but few which can be used in fatliquor production. However, most of the fatliquors used in the Nigerian leather industry are imported from other countries and has invested huge foreign currency on imports

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[9]. *Lophira Lanceolata* seed oil can become imperatively one of the substitutes of vegetable oils used for fatliquor production because, it is mostly not consumed by humans. The oil has a potential properties for better fuel due to the presence of methyl ester derivative [10]. It also has good cosmetic and medicinal properties suitable for making soap. In traditional medicine the oil is used to treat dermatosis, toothache and muscular tiredness. Rubbing the skin with the oil prevents dryness [11]. *Lophira lanceolata* is known locally as “Namijin kande” in Hausa [12] Saktoje” in Ffulde and “Kofia” in Gbaya [13] is a common medicine plant in Sokoto State, Nigeria [14].

2.0 MATERIALS AND METHODS

2.1 Material

Lophira lanceolata seeds (Namijin-kade) was sourced from Asawe/Saminaka village, Katari in Kachia Local Government Area, Kaduna State, Nigeria, which was identified as *Lophira lanceolata*, belonging to Fabaceae family with in Department of Botany, Faculty of Life Science, Ahmadu Bello University, Zaria, Nigeria.

2.2 Oil Extraction

Lophira lanceolata seeds of 100.019g were crushed with mortar and pestle to powder form. Oil was extracted from the ground seeds with 350ml volume of n-Hexane for

1hour: 30minutes at 50°C by the use of soxhlet apparatus. The solvent (n-Hexane) was evaporated over water bath for 1hour and then kept overnight until completely evaporated.

2.3 FT-IR Analysis

The functional groups of the oils were determined using FT-IR Agilent Technologies, Cary 630 machine at ABU Multi-user Laboratory Zaria, Kaduna State; Nigeria with spectrophotometer resolution of 8 and ranging from 4000-650.

2.4 Physico – Chemical Characterization of the Seed Oil

The oil extracted directly from *Lophira lanceolata* seeds were been analysed for their Saponification value, Iodine value, Peroxide value, Ash content, Acid value, Moisture content, Refractive index and pH value using Official Standard Methods described by [15][16][17].

2.5 Fatty acid composition determination

The crude *Lophira lanceolata* seed oil was analyzed to determine the fatty acids composition using Agilent GCMS 7890A coupled with MSD 5975C machine in American University of Nigeria, Yola; Adamawa State. There was not sample preparation method, it was run directly at running time of 21mins at temperature of 20°C/min to 280°C for 9mins.

3.0 RESULT AND DISCUSSION

3.1 Physical Properties

Table 1: Physical Properties of *Lophira* Seeds/Oil

Parameter	<i>Lophira</i> seed/oil
Moisture content (%)	0.73±0.26
Ash content (%)	0.897±0.03
Oil yield (%)	49.10±0.10
pH	6.47
Refractive index (27°C)	1.347
Solubility of oil in water	Insoluble

The moisture content of *Lophira lanceolata* seeds is very low when compared to legumes with the required two years minimum storage moisture content of

11.0% [18][19]. This is indicative of high dry matter content, reduced antimicrobial activities, reduced redox reaction and high storage shelve life [20]. The percentage ash

content $0.897 \pm 0.03\%$ indicates low inorganic fraction. The percentage oil yield $49.10 \pm 0.10\%$ indicate that the seed contain much oil. The high percentage oil yield suggest commercial viability for Industries such as cosmetic [21], leather [22], soap, biodiesel [23] etc. The results obtained for the oil samples shown in Table 1 indicated that the pH value of *Lophira lanceolata* seed oil is 6.47. This shows that the *Lophira* seed oil is weakly acidic and almost neutral,

implying that it contain low amount of fatty acids making it fit for consumption as compared to groundnut seed oil with ranged of values between 6.59 - 6.79 [24]. This implies that they contain low amount of fatty acids making them fit for edible purposes. The refractive index of the *Lophira* seed oil was 1.346 indicating the purity of the oil and the value obtained was in agreement with the standard limits set by CODEX.

3.2 Chemical Properties

Table 2: Chemical Analysis Result of *Lophira* Seed Oil

Parameter	Values: Mean $\pm$ SD	Units
Acid Value	1.20 ± 0.13	mg/KOH/g
Iodine Value	74.19 ± 0.64	mgI ₂ /100g
Peroxide Value	2.87 ± 0.12	mol.peroxide/Kg
Saponification Value	178.30 ± 0.96	mg/KOH/g

The results in table 2 shows the chemical analysis of the *Lophira lanceolata* seed oil for fatliquor production. Acid value is a measure of rancidity. It was stated that, if the acid values are high, the fat or oil will become more rancid and vice versa. For an oil to be potentially suitable as a raw-material for fatliquor synthesis, the acid value should be below 8.6 mg/KOH/g of oil [25]. It is observed from the results in table 1 above, that the average acid value for the oil extracted from *Lophira lanceolata* seed was 1.20 ± 0.13 mg/KOH/g, therefore the oil becomes imperatively suitable for fatliquor production. Saponification value of oil measure the average molecular weight of the triacylglycerols in a sample. Saponification value is inversely proportional to the mean molecular weight of the fatty acids that is, the smaller the saponification values, the larger the average molecular weight of the triacylglycerols. The saponification value: 178.30 ± 0.96 mg/KOH/g of *Lophira lanceolata* seed oil was found within the range given by [26]. The higher the Saponification value of the oil (178.30 ± 0.96 mg/KOH/g *Lophira lanceolata* seed oil), the smaller the molecular weight and therefore; the higher

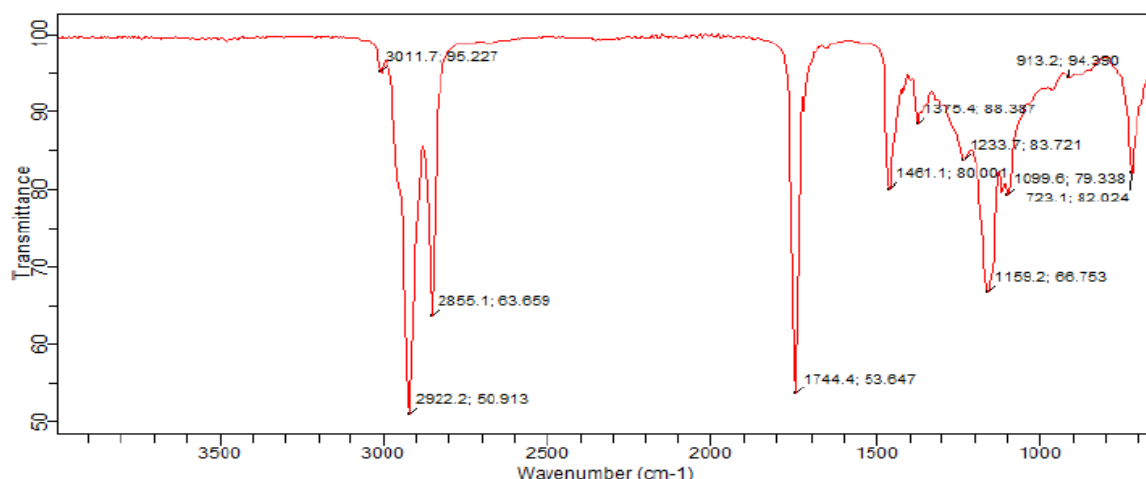
the penetrating powers of the oil into the leather, which gives it the softness properties after the fatliquoring processes. Iodine value is a measure of the degree of unsaturation. A low iodine value shows that the fat has a low quantity of unsaturated fatty acid [27]. The results in table 2 above indicated that *Lophira* seed oil has an Iodine value of 74.19 ± 0.64 mgI₂/100g that agrees with the Iodine value range reported [28]. *Lophira lanceolata* seed oils with iodine value of 76.59mgI₂/100g. Fats and Oils are usually classified on the basis of their iodine values as drying oil (130 – 190), semi – drying oil (100 – 130) and non – drying (100 below) [29]. Hence, based on the iodine value of *Lophira* seed oil, it can be referred to as non – drying oil which can be used for the production of fatliquor. Peroxide value is a measure of the extent to which an oil sample has undergone primary oxidation. The peroxide value 2.87 ± 0.12 mol.peroxide/Kg from table 2 above indicated the very low level of hydroperoxides which could initiate or propagate further oxidation of the oil. The value was compared with the 3.0mol.peroxide/Kg peroxide value of rapeseed oil as reported by [30].

Table 3: Fatty acid fractions of *Lophira lanceolata* seed oil

Fatty acid	Percentage (%)
Palmitic acid	62.88
Linoleic acid	9.66
Oleic acid	4.90
13-Octadecenoic acid	1.85
Cis-Nonadecenoic acid	0.87
Cis-Vaccenoic acid	0.10

Fatty acid compositions of the *Lophira lanceolata* seed oil extracted is shown in Table 3. As can be observed, Palmitic acid, Linoleic acid and Oleic acid were the main fractions and were found present with the following percentages respectively:

62.88%, 9.66% and 4.90%. These constituents account for above 75% of the fatty acids. The saturated fraction account for over 60% and the unsaturated fractions account for less than 16% of the total fractions.

**Figure 1: FT-IR Analysis of the Raw *Lophira lanceolata* Seed Oil**

The peaks at figure 1: 1744cm^{-1} and 3011.7cm^{-1} are due to the presence of C=O and C=C respectively. With the presence of the unsaturated functional group, indicated that the oil is capable of producing fatliquor [31].

4.0 Conclusion

The crude extract of *Lophira lanceolata* seed oil examined in this work by its saponification value, pH value, peroxide value, acid value, iodine value and refractive index. The infrared spectroscopic and GC-MS analysis shows the level of Unsaturated and Saturated fatty acids which are ingredients for the manufacturing of

fatliquor. Thus, the results indicated that, the *Lophira* seeds oil is imperatively viable for the synthesis of fatliquor. They may however be useful for other purposes such as soap, judging by their high saponification values in the range of 178-261 mg KOH-g-1.

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