International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

Extraction and Physicochemical Characterization of Oil from the Seeds of *Chrysophyllumalbidum* for Pharmaceutical Applications

Ordu J I[1], Nwachi R C[2]

Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmaceutical Sciences, University of Port Harcourt, Nigeria
Correspondence author email address: *ordujohnik[at]yahoo.com*

Abstract: ***Natural materials from animals, plants, and soil are enriched with numerous chemical components including oils. Oilcan be derived from plant parts such as Chrysophyllumalbidum seeds, a typically edible fruit tree belonging to the family Sepotaceae. The oil was extracted from the plant seed by solvent extraction method using n-hexane. The yield of the oil was about 3.84%, and it appeared liquid and dark brown in color at atmospheric temperature (29 – 35^{O}C), with a pH5.5±0.09, viscosity 2.14±0.15Cp, and specific gravity 0.9±0.07g/cm^{3}. The oil has a percentage free fatty acid content of 0.137±0.10, saponification value 192±0.12MEq/KOH/g and acid value of 54.42±0.10mg/KOH/g. Proximate principles' reveals the oil to have high lipid content of 89.9% with low fiber and ash content of 0.3% and 0.4% respectively. Elemental analysis of the oil denotes high content of potassium but absence of lead and other deleterious materials. Exposure of the oil to some microbes shows susceptibility of the test organisms with inhibition effect onE. coli (23.8mm), P. vulgaris (26.5mm), P. aerugnosa (28.2mm), S. aureus (30.1) and K. pneumonia (19.5mm).***

Keywords: *Chrysophyllumalbidum*, oil, extraction, excipient

1. Introduction

Nature involving animals, plants, and mineral substances is saddled with numerous rich components including water, chemicals and oils.

The oil which could be sourced from these natural products, are found to be useful for industrial and technological applications especially as coating agents, lubricant, polymers, pesticides/herbicides, biofuel and pharmaceutically in the production of emulsions, laxatives, suppositories and others [1].
Plant source of oil

Chrysophyllumalbidum is a plant from which natural oils could be sourced. It is a medium buttressed tree up to 25 – 37m in height with a mature girth varying from 1.5 – 2.0m. The bark is thin, pale, brownish- green with stem exuding white gummy latex [2].

Figure 1: Tree and fruits of African star apple

Chysophyllumalbidum is a tropical edible fruit tree and belongs to the family Sepotaceae. The flowers are small (3-8mm) purplish white and have a sweet fragrant smell and often clustered together. They are haemophroditic (self-fertile) in nature.

The African star apple as it is otherwise called, produces fruit which appears as a large berry containing 4-6 flattened seeds or sometimes more due to abortion [3].

The seeds are about 1-1.5 x 2cm in size, bean like in shape, shiny when ripe compressed with one sharp edge and a star shaped arrangement in the front. The seed coats are hard, bony, shiny and dark brown and when broken reveals white cotyledons.

The seeds of this species are not particularly rich in lipids but linoleic and oleic acid are the main fatty acids present, the lipid content constitutes of mainly unsaturated fatty acids and hence desirable in the content of heart disease risk reduction [4].

The fruits have been reported to often deteriorate within a short period (5 days) starting with change of colour from uniform orange to one with patches followed by shrinkage [5].

The fleshy pulp of the fruit is eaten as snacks by old and young with 21.1g ascorbic acid content and 75mg of ascorbic content found in the skin per 100mg weight [6].

Proximate content of the fruits reveals presence of protein (8.8%) lipid (15.1%) ash (3.4%) carbohydrate (6.87%) and crude fiber (4.0%) with only minor difference between the pulp and skin [7].

The fruit is believed to be a good source of anti oxidants (β-carotene, ascorbic acid and α- tocopherol) needed by the body to prevent or combat the activities of free radicals. This high ascorbic acid contents, is a limitation for its consumption by individuals with ulcer. The low carbohydrate content also underscores its low content of simple sugar, hence safe for diabetic patients.

The low calorie sugar and high vitamin content recommends it as suitable for hypertensives although the high index of nutritional quality (INQ) makes its consumption as fruits acceptable for all [8].A liquid like Juice can also be produced from the fruit and this can, be fermented to wine useful for alcoholic production and it can also be made into value added products like jam and juice.

Distribution and Ecology of *Chrysophyllumalbidum*

Chryphyllumalbidum is a dominant canopy tree of lowland mixed forest, sometimes riverine and is well distributed in the eastern, central and West African sub region and especially in the southern part of Nigeria with ideal habitat in low land tropical rain forest area. The tree bear fruits which appear in July ripen in between December and March although can extend to April [9].

Planting and Propagation

The star apple is most widely grown from seed, which retains viability for several months and germinates readily and the seedlings bear 5-10 years after.

Harvesting and Yield

African star apple, are generally harvested in seasons from late winter or early spring to early summer. They do fall when ripe but most are hand -picked by clipping the stem. If the fruits are not well matured, they tend to be gummy, astringent and inedible. When fully ripe the skin appear dull and slightly wrinkled while the fruit is soft to touch. The tree may bear about 150Ibs (60kg) of fruit in a short fruiting season of February to March [10].

Figure 2: Seeds of African star apple

Extraction of Oil From C*hrysophyllum* albidum SEEDS

Various techniques are adopted for the extraction of oil from the seeds of natural plants and such includes; mechannical pressing, pressurized solvent extracton, soxhlet extraction, aqueous/enjymatic oil extraction (AEOE) among others [11]. Amongst these, extraction using solvent is of high advantage due to higher yield, less turbidity as well as relatively low operating cost.

Oil extraction from *C. albibum* seeds has been by the application of solvent extraction method using the soxhlet apparatus although the yields of the extracted oils are dependent on the type and composition of solvents. Solvent blend of ethanol/n- hexanehave been found to demonstrate synergestic solvency power as indicated by their ability to produce the highest oil yield among all the solvent blend used.

The physicochemical properties of the oils however show no significant difference on the solvents of extraction [12].

Application of African Star Apple Seed Oil

Seed crops are vital sources of oils of nutritional, pharmaceutical and industrial importance. The characteristics of oils from different sources is dependent mainly on their composition and no oil from single soure can be suitable for all purposes. Need for further investigation of plant oils of under utilized seeds should be awakened in order to explore them in the production of pharmaceuticals such as ointments and creams for wound disinfection and mannagement.

Presently the quest for traditional vegetable oils have increased immensely due to the ever increasing world population and their use for industrial purposes. New low cost seed crops are needed to produce inexpensive oils suitable for food, pharmaceutical and industrial applications. One of the possible alternetive crop is *Chrysophyllum albidum* (African star apple) and its seeds could be harnessed for diverse purposes [13].

Aim and Objectives of the Study

The aim of the study is to extract and characterize the oil from the seeds of *Chrysophyllum albidum* and to evaluate the extracted oil for possible pharmaceutical applications.

The objectives therefore, is to extract oil from the seeds of chrysophyllum albidum using soxhlet extraction method with n- hexane and to determine some of the physical and chemical properties of the seed oil for possible use as excipient in pharmaceutical forrmulations.

2. Materials and Methods

Conc. Sulphuric acid (Sigma aldrich lot no. 83280, Germany), Perchloric acid, 0.5M HCl , n- henane (Sigma Aldrich England) pH meter (Helms reasin PHS England), Table centrifuge (PEC medicals USA), Conductometer (DDS- 22C England), Brook field viscometer (DVZT Germany), Fruits of *C.albidum* (Diobu, Port Harcourt, Nigeria)

Sample Collection

The African star apple (*Chrysophyllum albidum*) fruit were purchased at Dioubu area of Port Harcourt River State, Nigeria. The fruits were purchased when ripened and the seeds were removed from the pod by dehulling then sized and sun dried before milling with the aid of a milling machine (Corona Landers, India).

Extraction of Oil

The soxhlet extraction method was employed using n-hexane as solvent. A weighed amount of the milled seed cotyledons was packed in the timble of a soxhlet apparatus with a cotton wool at the top and bottom of the timble. The round bottom flask was filled with about 400ml of the solvent and fixed to the end of the apparatus with a

condenser tightly fixed at the bottom of the extractor. The whole set up was heated up in a heating mantle at a temperature of 50^{O}C. The n-hexane extract was concentrated using rotary evaporator. The dried extract appeared as a dark brownish viscous residue.

Determination of Oil Content
The quantity of oil was determined gravimetrically and evaluated while the yield was evaluated as the ratio of the weight of the extracted oil to the weight of the powdered *Chrsopyyllum albidum* seeds. The oil obtained, was placed in an airtight container, and stored in a cool dried place for further processing [14].

Percentage Yield and Physicochemical Characterization of the Oil

Percentage Yield
Percentage Yield = $\frac{\text{Weight of extracted oil in grams}}{\text{Weight of } C.\ albidum \text{ seed powder}} \times 100$

Physicochemical Properties of the Oil

Determination of Fatty Acid
25ml diethyl ether was mixed with 25ml alcohol and 1ml phenolphthalein (1%) and carefully neutralized with 0.1 M NaOH then about 5g of oil was dissolved in the mixed neutral solvent and titrated with aqueous 0.1 M NaOH shaking constantly until pink color which persisted for 15 seconds was obtained.

Calculation:
Acid Value = $\frac{\text{Titer volume (ml)} \times 5.61}{\text{Weight of sample used}}$

The free fatty acid (FFA) is usually calculated as oleic acid (1 ml of 0.1M sodium hydroxide = 0.0282g oleic acid), in which case the acid value = 2 x FFA.

For most oils acidity begins to be noticeable to the palate when the FFA calculated as oleic acid is about 0.5 – 1.5 % [15].

Preparation of Wiji's solution
8g of iodine tetrachloride was dissolved in 200ml glacial acetic acid in a beaker

Into another beaker 9g of iodine tetrachloride was dissolved in carbon tetrachloride

Mixture of the solutions was done and diluted to 1000ml with glacial acetic acid to form the Wijis solution.

Determination of the Iodine Value
This is to determine the extent of unsaturation of the fatty acids and is measured as the number of grams of iodine consumed by 100g of fat.

Procedure
The oil sample was melted in a water bath then 2g of it was added into a 200ml beaker. 10ml cyclohexane was collected using a pipette and added into the beaker to dissolve the sample 2.5mlWijis' solution was collected using a pipette and added into the beaker and this was left in a dark place for about 30minutes with occasional agitation. Still left in such condition, 20ml of 10g/100ml potassium iodide (KI) solution was withdrawn and added to the beaker. Finally, about 100ml of distilled water was added to the beaker and shaken, properly. The solution was titrated with 0.1 mol/l – thiosulphate while under strong agitation. Blank measurement (titration) was also taken in the same way without the oil sample.

Iodine number (g/100g) = BL – A1 x F x $\frac{1.269}{S}$

BL = Titration volume of 0.1mol/l – sodium thiosulphate solution at blank measurement (ml)
A1 = Titration volume at sample titration, F = Factor of 0.1 mol/l – sodium thiosulphate solution
1.269 = 0.01269 (the number of grams of iodine corresponding to 1ml of 0.1mol/l – Sodiumthiosulphate solution) x 100 coverted into value per 100g, S = Sample volume (g)

Determination of the Peroxide Value

Procedure:
1.0g of oil sample was weighed into a clean dry boiling tube and while still liquid, 1.0g powdered potassium iodide and 20 ml of solvent mixture (2ml glacial acetic acid + 1ml chloroform) was added.

The test tube was placed in a water bath so that the liquid boils vigorously for 30 seconds or less.

The contents was quickly poured into a flask containing 20 ml of potassium iodide solution (5%) and the remaining content of the test tube washed twice with 25 ml water and titrated with 0.002 M sodium thiosulphate solution using starch as indicator.

The titer value obtained multiplied by 2 gives the peroxide value [15]

Determination of the Saponification Value
About 2g of the extracted oil was weighed into a conical flask and 25 ml of the alcoholic potassium hydroxide solution added. A reflux condenser was attached to the flask, which was heated in boiling water for 1hr, shaking frequently.1ml of phenolphthalein (1%) solution was added as indicator and titration carried out while hot using the excess alkali with 0.5 M hydrochloric acid (titer volume = a ml). Blank experiment was carried out at the same time (titer volume = b ml) [15].

Saponification value = $\frac{(b - a) \times 28.05}{\text{Weight (g) of sample}}$

Organoleptic Properties of the Oil
The physical characteristics (color, odors, texture, and appearance) of the oil extracted were observed and recorded.

pH of the Oil
1.0g of the sample was made into solution with 10ml of water, then 1ml of the solution introduced into a beaker and

the pH electrode inserted into the beaker and readings in triplicates were taken when stable.

Viscosity of the Oil

The sample (oil) evaluated was poured into a clean 600 ml beaker, temperature probe was attached to spindle guard leg and the viscometer lowered into the beaker until the spindle is fully immersed in the sample.

This procedure was repeated at different temperature and carried out using the Brook field viscometer, DV 2T was turned on to obtain a stable % Torque between 10% and 100%.

The displayed viscosity was recorded in Centipoise (Cp), revolutions per minute (rpm) and %Torque on the viscosity data sheet [16].

Density of the Oil

An empty measuring cylinder was weighed then a known volume of oil was put into the measuring cylinder and weighed. The procedure was repeated thrice.

The density was calculated using the formula

Mass of Oil = weight of cylinder and oil – weight of empty cylinder

$$\text{Density} = \frac{\text{Mass (g)}}{\text{Volume (ml)}}$$

Conductivity of the Oil

This was done using the Probe –Conductometer connected to a power source

The electrode was inserted into a beaker containing the sample and the reading taken when stable and in triplicate

Refractive Index of the Oil

This was carried out using the refractometer (Abbe, England). In this process the light was turned on and check was made to ensure the proper flow of cold water as the water temperature is recorded on the precision temperature to $0.1^{O}C$.

The incident prism (with the Prism Lock Knob) was opened and the prism face cleaned with acetone and carefully blotted dry with a Kim Wipe.

A few drop of the sample solution to be tested was placed on the polished surface of the lower Refracting Prism then the hinged upper Incident Prism was closed and locked into place with the knob, so that the liquid is evenly distributed on the face of the Refracting Prism.

The lower adjustment knob was scanned until a light and dark divided image was seen.

The dispersion was adjusted using the upper smaller dispersion correction knob, until a sharp light/dark boundary is seen. The boundary was centered on the crossbars of the telescope using the lower large adjustment knob and the refractive index read from the green scale below the boundary.

Specific Gravity of Oil

This involves taking the weight of empty specific gravity bottle with stopper

Transfer of about 50 ml of water into specific gravity bottle and weight taken with stopper

The specific gravity (SG) is calculated using the formula

$$S.G = \frac{\text{Wt of X ml of Oil } (M_2 - M_1)}{\text{Wt of X ml of water } (W_2 - W_1)}$$

Where M_1 = Mass of Specific Gravity Bottle with Stopper, M_2 = Mass of Specific gravity bottle + Oil, W_2 = Mass of Specific Gravity Bottle with Stopper, W_2 = Mass of Specific gravity bottle + distilled water

Proximate Analysis of the Oil

The proximate content of the extracted oil involves:

Determination of Carbohydrate Content by ClegAnthrone method

Calculation:

$$\% \text{ CHO as glucose} = \frac{25 \text{ x absorbance of sample X } 100}{\text{Absorbance of standard glucose}}$$

Determination of Protein Content by Kjeldahl Method involving

Stage 1 (Digestion), Stage 2 (Distillation) and Stage 3 (Titration) in which case, the distillate was titrated with standard 0.1 M hydrochloric acid solution back to purple from greenish. The volume of hydrochloric acid added to effect this change was recorded as titre value.[17].

Calculation:

$$\% \text{ Organic nitrogen} = \frac{\text{Titre value x 1.4 x 100 x 100}}{1000 \text{ x } 20 \text{ x } 0.1}$$

Where; Titre value = the volume of HCl used in titrating the ammonium distillate.

1.4 = Nitrogen equivalent to the normality of Hl used in the titration 0.1 M

100 = the total volume of digestion, 100 = percentage factor, 20 = conversion factor from gram to milligram, 0.1 = the weight of sample in gram digested.

Determination of Moisture Content: This is carried out by Air Oven Method

$$\%\text{Moisture} = \frac{\text{Weight of fresh sample – weight of dried sample X } 100}{\text{Weight of fresh sample used}}$$

Determination of Lipid Content: This is carried out using the Soxhlet Extraction Method
[17].

Calculation:

$$\% \text{ Lipid} = \frac{\text{Weight of flask and extract - weight of empty flask X100}}{\text{Weight of sample extracted}}$$

Determination of Ash Value: This was investigated by adopting the Furnace Method

1g of the dried sample was weighed into a porcelain crucible which was previously preheated and weighed. The crucible was inserted into a muffle furnace, regulated to a temperature of 630^{0}C for three hours then allowed to cool to room temperature and reweighed [17].

Calculation:

$$\%Ash = \frac{\text{Weight of crucible + Ash sample - weight of crucible X 100}}{\text{Weight of sample}}$$

Determination of Fibre Content: The fiber content can be obtained by difference as shown below

Fiber content = 100 - ∑ (other parameters)

Elemental Analysis of the Oil

Sample was ashed in a muffle furnace at a temperature of 630^{0}C for 3 hours. The ashed sample was dissolved in 10 ml concentrated hydrochloric acid and heated on an electro-thermal heater hotplate. The solution of the ash was diluted to 50 ml with distilled water. The solution were analyzed for metal ion using Atomic Absorption Spectrophotometer [18] based on the respective wavelengths various elements including lead (283.2 nm), (magnesium 285.2 nm), (sodium 589 nm), (calcium 422.7 nm), and (potassium 766 nm) were analyzed.

Susceptibility testing of the extracted oil

Antimicrobial activity of the oil was assessed on both gram positive and gram negative organisms (Staphylococcus aureus, proteus vulgaris, pseudomonas aerugnosa, Escherichia coli and Klabsiela pneumonia obtained as isolates from the University of Port Harcourt teaching hospital, Nigeria. The antimicrobial assessment was done in triplicates using Meuler Hilton agar. The agar plates were inoculated with 0.1 ml broth culture of test organisms, then spread with an L- shaped glass rod. Sterile cork borer was used to make agar wells on the media and 2 drops of the oil was introduced into the well. The plates were allowed to stand for 1 hr for pre diffusion of the oil to occur and incubated at 37^{O}C for 24 h. The inhibition zone diameters were measured in millimeters (mm) [19].

3. Results

Figure 3: DE hulled African Star Apple Seed Cotyledon

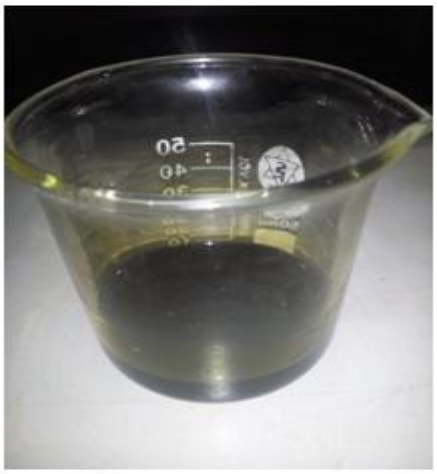

Figure 4: African Star Apple Seed oil

Percentage yield of the extracted C. albidum oil is 3.84

Physicochemical Characterization of the African Star Apple seed Oil

Table 1: Physical Characterization of the African Star Apple seed Oil and Olive Oil

Characteristics	*Chrysopyllumalbidum* seed oil
Colour	Dark Brown
Odour	Agreeable
State at Room Temperature (29.38^{O}C)	Liquid
pH	5.50±0.09
Viscosity (cP)	2.14±0.15 at 31.10^{o}C
Density (g/ml)	1.02092
Specific Gravity	0.94±0.07
Refractive Index	1.469±0.001
Conductivity µS/cm	0.23±0.11 at 27.7^{o}C

Table 2: Chemical characterization of the African Star Apple seed Oil

Characteristics	Extracted *C. albidum* Oil
Percentage (%) Free Fatty acid (mgKOH/g)	0.137±0.10
Iodine Value (mg/100g)	75.92±0.82
Peroxide Value (meq/kg)	20.00±0.38
Saponification Value (meq/KOH/gram)	192.71±0.21
Acid Value (mgKOH/g)	54.42±0.10

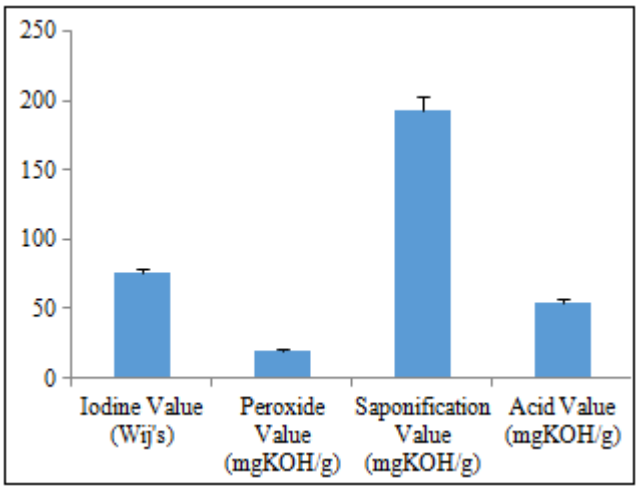

Figure 5: Chemical Characterization of the African Star Apple seed Oil

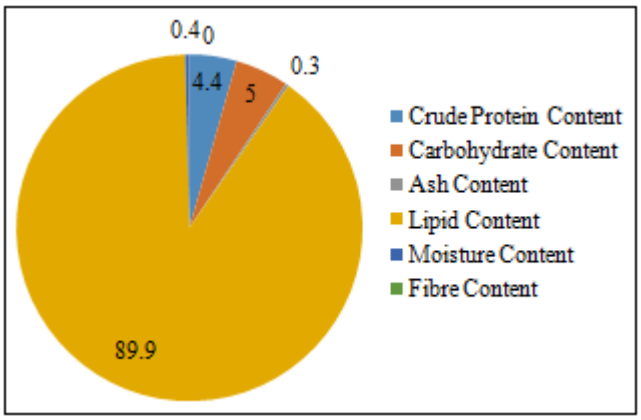

Figure 6: Proximate Analysis of African Star Apple seed Oil

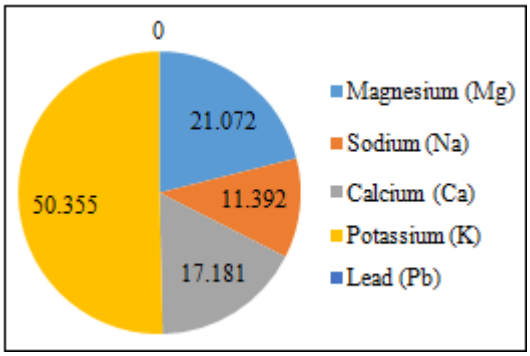

Figure 7: Elemental Analysis of African Star Apple seed Oil

Table 3: Susceptibility Testing

Isolate	Inhibitory Zone diameter (mm)
Escherichia coli	23.8
Proteus vulgaris	26.5
Pseudomonas aerugnosa	28.2
Staphylococcus aureus	30.1
Klabsiellapneumonea	19.5

4. Discussion

The percentage yield of the oil obtained from the seeds was 3.84%. The yield from the calculation is low and this indicates that the seed might not be an economic source of abundant oil.

The specific gravity range was 0.94±0.07 indicating that it is less dense than water and this is in line with those obtained from other authors [20]. The refractive index obtained was 1.469±0.001 confirming that the oil is liquid at room temperature as shown in Table 1 and figure 4 and that it is also a non-drying oil. The color of the oil is dark brown with a non-offensive odor while its viscosity value of 2.14±0.15 at 31.10^{o}C gives an insight that it is of low viscosity hence its suitability as ingredient in pharmaceutical cream formulations.

The conductivity at 27^{o}C was 0.23±0.11µS/cm, which is low and this explains the safety of the oil as it is believed to contain less electrovalent ions hence suitable for human and animal physiological system, as it will not permit high electrical conductivity. Based on this property the oil if incorporated as excipient in skin cream formulation, such formulated cream would likely not have any deleterious impact or negative interaction effect with the human skin as a result of the low ionic composition and low electrical conductivity.

The results as given in Fig.5 showed that the peroxides value obtained was 20.00 Meq/Kg. The peroxide value serves as an indicator of the nature of oils in terms of their deterioration. However based on research carried out, some authors has acknowledged that oils with peroxide values less than 10Meq/Kg are regarded as fresh and not degraded but otherwise, if the values fall between 20 and 40 Meq/Kg, hence the result obtained could be caused by the improper storage condition influenced by temperature and humidity [21].

Acid value is a direct measure of the percentage content of free fatty acid in a given amount of oil. It is a measure of the extent to which the triglyceride in the oil has been decomposed by lipase action (enzymatic) into fatty acids and itis also dependent on the degree of rancidity and edibility of the oil [20]. The acid value obtained in this work was of high value compared to those obtained from other researchers. Low level of acid value has been assumed to indicate the freshness of the oil identifying that the oil has not been degraded from the processing stage [21]. The high acid value obtained from this study (54.4 mgKOH/g), might be as a result of the drying method employed and the effect of environmental condition thus fermentation might probably have taken place thereby leading to the hydrolysis of the triglyceride content of the oil to free fatty acids.

Saponification value is used to measure the level of adulteration of oils, it comprises of both free and chain-bound fatty acids [21]. Oils with saponification values as high as/or approaching 200mg/KOH/g have been reported to have potential for use in the soap and cosmetics industry. From the results obtained for *C. albidum* oil, the Saponification value was 192.71±0.21 mg/KOH/g as seen in Fig 5 and this can be classed among such potentially useful group of oils.

Free fatty acid content is one of the parameters checked when estimating the stability, quality, and functionality of oils. It stimulates oxidative deterioration of oils by enzymatic and chemical oxidation to form off-flavor components. The percentage free fatty acid value obtained was 0.137±0.10mgKOH/g, hence with this result the oil has not gone rancid as it is observed to maintains its quality.

Iodine values of oils is always rated per 100g of the oil. The iodine value obtained in this study was 75.92 mg/100g. The iodine value is also an index for assessing the ability of an oil to go rancid [21] it is a measure of the amount of iodine in grams, consumed by 100g of a chemical substance. Oils with iodine values less than 100 indicate that they contain a low amount of unsaturated fatty acids and thus classified as non-drying. This property makes the *C. albidum*oil to have the resemblance of olive and groundnut oils and therefore can be employed in the cosmetic, soap and lighting candles industries, as it would cause the reduction on the dependence of the other known edible oils for such purposes.

The elemental analysis carried out on the extracted oil, Fig. 7, showed that lead (Pb) was absent which is an indication of a non-toxic nature of the oil in its pure form. Potassium (K) had the highest proportion and it is beneficial, as it is known to be a major cation in animal cells as it functions in the maintenance of fluid and electrolyte balance. This composition can influence the oil to serve for that purpose when incorporated as excipients in creams to be applied in weeping lesions. Calcium was also present in an appreciable amount which is also important for many cellular processes such as metabolism and cell development.

The proximate analysis as in figure 6, depicts that the oil has high content of lipids followed by carbohydrate. The moisture content indicates the extent of the drying process of the seeds before milling and the ash content was the least in this analysis hence absence of organic matters and this will favorable in the retardation of microbial growth thus making the oil a potential anti-microbial agent [22].

In the antimicrobial screening of the extracted oil, it was tested against both Gram negative and Gram positive bacteria which included *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aueruginosa*, *Proteus vulgaris* and *Klebsellapneumoniae* as seen in Table 3. The activity of the extracted oil against the bacterial isolates show that the oil imparted more inhibitory effect on *Staph aureus* isolate as compared to other organisms hence *Staph aureus* could be more susceptible to the presence of *C.albidum* though generally the anti-microbial activity of the oil is obvious in all the isolates tested. The antibacterial activity of the *C. albidum* oil as demonstrated can be a base for its use in the formulation of pharmaceutical creams possible for wound disinfection and management [23].

5. Conclusion

Oils could, successfully be extracted from the seed of *C.albidum* by soxhlet extraction method although the oil was of low yield about 3.84%. The extracted oil was of high lipid content but low in fiber and ash and also slightly acidic with a pH of about 5.5.

Though the yield was low, the inhibitory effect on most susceptible organisms was high; hence, the oil could be useful as an ingredient in pharmaceutical cream formulation for its emollient and antimicrobial effect. Reference to these activities therefore it is suggested that more research be undertaken towards enhancing the production of *C. albidum* fruits on a large scale and all through the seasons of the year, then modification geared towards having a high yield of the oil with better seed preservation to boost its quality, economic and industrial values.

References

[1] Ajewole, K., Adeyeye, A. Seed oil of African star apple (ChrysophyllumAlbidium) Physicochemical characteristics and fatty acid Composition. *J. Sci. FoofAgric*, 1991; 54: 313-315

[2] Edem DO, Eka ON, Ifon ET. Chemical Evaluation of the value of the fruit of African Star Apple (*ChrysophyllumAlbidum*). *Food Chem*.1984; 14: 303-311.

[3] Jayeoba, O.J., Ige, M.M., Omolaiye, J.A., Gbadamosi, S.O., Ogunbanjo, R.O. and Abiola, IO. Chemical Composition and Physical properties of African star apple (*ChrysophyllumAlbidum*). *Asset*, 2007; 7 (1): 37-42.

[4] Amusa, N.A., Ashaye, O.A. and Oladapo, M.O. "Bio deterioration of the African Star Apple (*ChrysophyllumAlbidum*) In Storage and the effect on its food value". *African. Jour. Of Biotechnol*. 2003;. 2 (3):56-59.

[5] Adepoju, O T and Adeniji, P O. Nutrient Composition and Micronutrient Potential of three wildly grown varieties of African Star Apple (*ChrysophyllumAlbidum*) From Nigeria. *African Journal of Food Science*, 2012; 6 (12): 344-351, 29

[6] Ewansiha, C.I. Asia I O, Ekebafe L O Jatto O E; and Okodugha G. Proximate and mineral composition of seed shell pericap of *ChrysophyllumAlbidum*. *The Pacific journal of Science and Technology* 2011, 12 (1): 363-366

[7] Amusa N A. Ashaye O A. Oladapo M O. Bio deterioration of the African star apple C*hrysophyllumalbidum*) in storage and the effect on its food value. *Afr. J. Biotechnol*. 2003; 2: 56 - 57.

[8] Bada S O. Preliminary Information On The Ecology Of *Chrysophyllumlbidum*Done In The West And Central Africa; In Proceedings Of A National Workshop On The Potentials of Star Apple In Nigeria (Denton OA, Ladipo AO, Adetoro MA, Sarumi MB 1997. Pp. 16 - 25.

[9] Ugwu J.A and Umeh V.C. Assessment of African star apple (chrysophyllumalbidum) fruit due to insect pest in Ibadan south west Nigeria, *Research journal of Forestry*; 2015; 9 (3): 87 – 92.

[10] Adebayo, S E., Orhevba, B A., Adeoye, P A., Musa, J J., Fase, O J. Solvent extraction and characterization of oil from African Star Apple (*Chrysophyllumalbidum)* Seeds. *Academic Research International*, 2012; 3 (2): 178-183

[11] Paul M. Osamudiamen, L and Afolabi O. Physicochemical characteristics, proximate and mineral compositions of the underutilized seed and oil of *Chrysophyllumalbidum*from Ibadan, Nigeria. *Ejeafche, , 2012; 11 (4),* .[351-357]

[12] Ejiofor M A, Okafor JC. Prospects for commercial exploration of Nigeria indigenous trees, vegetables, fruits and seeds through food and industrial product formulation .*Tree Crops J*. 1997; 9: 119-129.

[13] Adepoju T F, Ojediran, J O andOkunola, A.A. An optimization approach to oil extraction from *ChrysophyllumAlbidium*oilseeds and its quality characterization.*International Journal of innovative research and studies*, 2013; 2 (10): 56-71

[14] Ramadan M.F and Morsel J.T. Determination of the lipid classes and fatty acid profile of Niger seed (*guizotiaabyssinica*cass). *Phyto-chemical analysis*, 2003; 14: 366-370

[15] Robert S M. Institute for Basic Standards, National Bureau of Standards, Washington D.C. 20234. The accuracy of measurements of viscosity of liquids.Journal of Research At the national bureau of

standards-a. Physicist and chemistry, November – December 1971; 75a (60):, 225-171
[16] AOAC International 1984.Official method of Analysis
[17] Adebayo S.E, Orhevbu B A, Adeoye P.E, Musa J.J and Fase O.J. Solvent extraction and characterization of oil from African star apple (Chrysophyllumalbidum) seeds. *Academic research international journal*, 2012; 3 (2): 123-145.
[18] Sousa E.O, Silva N.F, Rodrigues F.F, Campos A.R, Lima S.G and Costa J.G. Chemical composition and resistance-modifying effect of the essential oil of lantana *Camaralinn. Pharmacogn. mag*. 2010; 6, 79–82
[19] Myles J. Methods for the determination of Specific Gravity.MacDonough Chandler Engineering Company 2001 N. Indian wood Avenue Broken Arrow, Oklahoma 74012
[20] Pearson, D..*Chemical Analysis of Foods. 1976; 7th Edition*. Churchill Livingstone: London, UK.
[21] Balouiri M. Sadiki, M. Ibnsouda S.A. Methods for *in vitro* evaluating anti -microbial activity: a review.*J pharm. bio-med. anal*., 2016; 6:1–79.
[22] Ebere, C U. Antibacterial effects of *ChrysophyllumAlbidum*extracts on bacterial isolates from urinary catheters. Msc Thesis. 2013 Department Of Microbiology University Of Nigeria, Nsukka