COMPARATIVE ASSESSMENT OF OIL EXTRACTED FROM AVOCADO PERICARP (*PERSEA AMERICANA*) AND COCONUT ENDOSPERM (*COCOS NUCIFERA*) IN ILARO, OGUN STATE, NIGERIA

By

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ABSTRACT

The extraction and physicochemical properties of oil from Avocado Peel (pericarp) (Persea Americana) and coconut endosperm (Cocos Nucifera) were evaluated in this study using standard analytical techniques. The oil extracted using a steam distiller gave a yield of 27% for Avocado peel and 43.7% for coconut endosperm. Lipid induces of the oils revealed the free fatty acid (FFA) as 2.56 and 2.50%, Acid value (AV) as 5.2 and 5.0 mg NaoH g^{-1}, Saponification Value (SV) as 186.35 and 260.0 mg KOH g^{-1} Iodine Value (IV) as 78.0 and 9.0 mg of I_2 g^{-1} of oil and Peroxide Value (PV) as 5.0 and 0.40 mg O_2Kg^{-1} for the extracted Avocado Peel and Coconut Endosperm Oil respectively. The physical properties were also obtained; such as specific gravity which was found to be 0.927 and 0.925, and Refractive Index at 20 ^{0}c were 1.46 and 1.44 for Avocado peel and Coconut endosperm respectively. Both Oils were found to have applications in industries such as the cosmetics and food industries, though the yield of Avocado peel oil was lower than coconut endosperm oil. Avogadro peel oils is a sure alternative way of transforming these wastes with great potential for environmental pollution into a resource with great potential for economic wealth, and also for securing the public health impacts of safer and healthier environment.

INTRODUCTION

Persea Americana commonly known as Avocado Pear in Nigeria is a fruit that contains a high value of oil and chlorophyll concentration (Gatbontin et al., 2013). Avocado occupies a prominent place in the market due to its high nutritional value, especially fibers and lipids. It has soft flavour and low sugar content (above weight of pulp) and is generally recommended for the diabetic suffering people since it is as high-energy food (Galvao et al., 2014).The fruits composites by weight is averagely above 65% mesocarp (flesh), 20% endocarp (seed) and 15% pericarp (peels). (Adama and Edoga, 2011).

The oil content in the avocado mesocarp is indicative of maturity and fruit quality and is related to the firmness of the fruit. The fruits are inexpensive, extremely rich in vitamins and can be used in a wide range of food products (Pino et al., 2001). In addition to the oils, avocado contains a small amount of about 1.5% weight of oil of unsaponifiable matter, as a distinct fraction by itself is very valuable component useful in many creams and medicated ointments (Adama and Edoga, 2011).

The avocado oil is similar in composites to olive oil and is highly digestible. It consists of mainly unsaturated fatty acids predominantly olive acids (Gomez – Lopez, 1999) which contributes to its consistency and the special tasks of the fruits (Sinyinda and Gramshaw, 1998). The avocado oil content is used as a parameter to evaluate the maturity. Lots of research has been carried out on

the nutritional qualities of Avocado and the pericarp (i.e. peel) is usually discarded as waste into the environment. This study therefore explore the possibility of the use oil from this waste thereby reducing its discharge into the environment to give a cleaner atmosphere. The objective of this study is to extract oil from Avocado peel and coconut endosperm, determine its physicochemical properties and make a comparative study of the both oil.

METHODOLOGY

Collection and process of samples

Avocado and coconut fruits used for this study were purchased from Sayedero market, Ilaro, Ogun state. The fruits were thoroughly screened to remove spout fruits. The Avocado was peeled, and oven dried at 60^0C to a powdery form. The coconuts were dehauled mechanically with knife and the inner hard shells were removed. It was then carefully broken and the fruits collected and sun dried to reduce the moisture content. It was thereafter milled manually using a milling machine. The two processed powdered samples were wrapped in polythene bags and kept in a desiccator until needed.

Extraction method

The extraction method was carried out using a steam distiller.The solvent used was n-hexane at a temperature of 60^0C. The percentage oil yield was calculated for both oils.

Determination of percentage Oil yield

Oils yield were determined based on the weight of the sample used for their production and the weight of the respective oil. The weight of the oil produced was determined and used to calculate the oil yield using the following formula:

$$\%\ Yield = \text{Weight of extracted oil / Weight of sample X } 100$$

Physicochemical Chemical Analysis

The Free Fatty Acid, Acid Value, Saponification Value, Iodine Value, Peroxide Value and Specific gravity was determined using method described by Omotoso and Iro-Idoro, 2015 while the refractive index of the oils were determined using a refractormeter according to method described by Kyari, 2008.

Determination of acid value

5g of the sample was weighed accurately into a 500-ml Erlenmeyer flask; 75ml of hot neutral ethanol was added. 0.5 ml of phenolphthalein indicator was added and titrated immediately, while shaking, with 0.5 N alcoholic KOH until the pink color persists for at least 30 sec.

$$Acid\ value = 56.1 \times T \times N W$$

Where T is the titer (ml), N is the normality of potassium hydroxide solution; and
W is the weight of sample (g).

Determination of saponification value

2g of the oil was weighed into a 250-ml flask with a ground-glass joint; 25ml of alcoholic potassium hydroxide was added. A reflux condenser was attached to the flask and the content of the flask was heated on a steam bath for one hour with occasional shaking, and while the solution is hot, phenolphthalein indicator was added and the solution was titrated with 0.5M hydrochloric acid. The titer value was recorded, and a blank determination as control was carried out using the same quantity of reagents but omitting the sample.

$$Saponification\ Value = 56.1 \text{ x M S } (A-B) \text{ W}$$

Where A and B are the quantity in ml of HCl required for the titration of the blank and for the titration of the sample respectively. W is the weight of sample in g and M is molarity of the HCl.

Determination of peroxide value

5.00g of the oil was weighed in a 250 ml conical flask fitted with a ground-glass stopper. 30ml (a mixture of 2 volumes of chloroform and 3 volumes of glacial acetic acid) was added to the oil. It was shaken to dissolve the substance and 0.5 ml of potassium iodide solution was added to the content in the flask. It was shaken for exactly 1 min then left in a dark place for five minutes, 30 ml of water was added to it. It was titrated with 0.01 M sodium thiosulfate with continuous vigorous shaking, until the yellow color is almost discharged. 5 ml of starch solution indicator is then added and the titration continues with vigorous shaking until the color is discharged. A blank determination was carried out simultaneously test. The Peroxide value was calculated as follows:

$$Peroxide\ value = 1000\ x\ M\ x\ (B-A)\ \text{W}$$

Where M is the molarity of thiosulfate, A is volume of thiosulfate used in the blank, B is the volume of thiosulfate used in the test. W is the weight of the sample.

Determination of iodine value

0.2g of the oil sample was weighed into a conical flask, 25ml of Wij's solution was added using a pipette with swirling to the flask. The flask was stoppered and the content was stored in the dark for 30 minutes. 20ml of potassium iodide followed by 100ml of distilled water was added to the flask. The solution was titrated with 0.1N thiosulfate solution gradually and with constant stirring. The titration is continued until the yellow color had almost disappeared. 2ml of starch indicator solution was then added and the titration was continued until the blue color had disappeared. A blank titration was done simultaneously omitting the oil. Iodine value was expressed as grams of iodine absorbed per 100g of sample are calculated thus;

$$Iodine\ value = (A-B) \text{ x N x } 12.69\text{W}$$

Where A is the titer value of blank in ml, B is the titer value of sample in ml, N is the normality of sodium thiosulfate solution, W is the weight of sample in grams.

Determination of specific gravity

A 10ml specific gravity bottle was used and the analysis was carried out at room temperature. The weight of water was then determined using the weight difference between the weight of empty bottle and the weight of the bottle when it was filled with water. The bottle was then washed, rinsed with acetone and allowed to dry in the desiccator. It was reweighed alone and 10ml of the

oil sample was poured into it. The bottle filled with the oil was weighed also. The relative density was the calculated thus;

$$\text{Relative density of oil} = \frac{A-B}{C-B}$$

Where A is the weight of the bottle with oil sample, B is the weight of the relative density bottle and C is the weight of bottle with water.

Determination of refractive index

A refractometer was used in this determination. The sample were transferred into the glass slide of the refractometer. In order to carry out determination of the refractive index of oils, the prism box was opened and a few drops of the oil were placed on the ground surface of the lower prism. It was then closed and the box flattened again, making sure that the oil did not flow away. The cross wires of the telescope was focused by rotating the eye piece and adjusting the mirror so as to get good illumination. By means of the lower knob, the prism box was turned slowly backwards and forwards until the field of view became coloured fringe. By means of the upper knob the compensator was rotated until the coloured fringe disappeared and the lighted image showed a sharp edge. The prism box was rotated until the sharp edge was in coincidence with the intersection of the cross-wires in the telescope. The index of refraction was then read off on the scale through the eye piece. The third decimal place in the refractive index could be read directly and the fourth was estimated with an accuracy of about ± 0.0002.

Determination of Free fatty Acid

0.1g of oil was weighed (according to the expected acid value) in glass vial and dissolved in 50ml of the solvent mixture. It was titrated, with shaking, with the KOH solution (in a 25 ml burette graduated in 0.1 ml) to the end point of the indicator (5 drops of indicator) until the pink color persisted for at least 10s. The acid value was calculated by the formula: 56.1 x N x V / M where V is the number of ml of KOH solution used and N is exact normality, M is the mass in g of the sample.

Statistical Analysis: All extractions and analysis were performed in triplicates. Results expressed as mean.

RESULT AND DISCUSSION

The result attained for the physicochemical analysis of Avocado peel and coconut endosperm oil are outlined in Table 1.0. The percentage oil yields of Avocado peel was low compared to Coconut but may be considered to be of reasonable yield level.

The Free Fatty Acid (FFA) have significant effect on the transterification of glycerides with alcohol using catalyst (Patel et al, 2011), the high FFA content of both oils (2.6% for Avocado peel and 2.5% for Coconut) will cause soap formation and the separation of products will be exceedingly difficult therefore these oils will give a low yield of biodiesel because for biodiesel products, the amount of FFA in the oil should be less than 1%, if not these FFAs react with the alkaline catalyst during transesterification to produce soaps instead of esters (Omotoso and Iro-Idoro, 2015).-In addition, the free fatty acids in oils can be used as a parameter which gives an indication about the age and extent of deteriorations of oil (Eromosele et al., 1994) and the observed values for these oils show no indication of deterioration.

The specific gravity of the oils 0.925 and 0.927 for Avocado peel and coconut endosperm respectively was low compared to 0.964 for cashew nut seed oil reported by Aremu et al., 2006 and 0.7563 for Avocado fruit pulp reported by Gatbontron et al., 2013 and 0.96 – 1.04 for coconut oil reported by Adeyanju et al., 2016 but this showed that the oil is less than water and can therefore be used in cream production as it will enable the oil flow and spread evenly in the skin. The specific gravity of 0.927 is relatively similar to what was reported by Galvao et al., 2014 for Avocado peel oil.

Iodine value is a measure of unsaturation of Fatty Acid in fats and Oils, the higher the iodine value, the more unsaturated fatty acid bonds are present in a fat which is in form of double bonds that reacts with the Iodine compound (Omotoso and Iro-Idoro, 2015). It can be seen that the Iodine Value of 9.0 for Coconut oil makes it a good oil for soap production while 78 for Avocado Peel oil makes the oil suitable for cream production.

Refractive index of aqueous solutions and oils is of crucial importance in applications of adulteration of oils and purity (Yanus et al., 2009). The refractive index 20 ^{0}C of avocado peel oil is relatively higher than coconut Oil as shown in table 1 and is in accordance with observed values by Yanus et al., 2009).

The saponification number is the number of milligrams of potassium hydroxide required to neutralize the fatty acid resulting from the complete hydrolysis of 1g of fat. It is a measure of the average molecular weight (or chain length) of all the fatty acids present. The observed saponification values of both oils showed their potential in both large scale and local manufacturing of soap although coconut oils is of better option due to its high value.

Peroxide value measures the amount of oxygen bond in unsaturated fatty acid molecules in mg O_2/kg oil. It gives the evidence of rancidity in unsaturated fat and oils. The low peroxide value of the oil show they are not susceptible to oxidation though the value observed in this study is slightly lower than 0.56 observed by Dayrit et al., 2011.

Table 1.0. Results of the Physicochemical Properties of Coconut endosperm and Avocado peel oil.

Properties	**Coconut endosperm oil**	**Avocado peel oil**
Specific gravity	0.925	0.927
Refractive index @20^{o}C	1.44	1.46
Colour	Light yellow	Emerald green
Saponification values (mg KOH/g oil)	260	186.35
Acid values (mg NaOH/g oil)	5.0	5.2
Peroxide value (mg O_2/Kg oil)	0.40	5.0
Iodine value	9.0	18.0
% Yield	43.7	27
FFA	2.5	2.6

CONCLUSION

Since both oils have proven to be a good source of oil, with very wide industrial applications, and given that the Avogadro pear is extractable from its ever superabundantly available peel wastes needing urgent disposal to deter health hazards from environmental disruptions/ degradations, it was concluded that the extraction of oil from this source will not only provide a cheap source of this plenipotential industrial raw material but also a complimentary method for the management of wastes generated from Avogadro pear consumption. Added to these are the public health impacts of securing safer and healthier environment from this indirect waste management option.

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