



**EXTRACTION AND CHARACTERIZATION OF OIL FROM *ARTOCARPUS
HETEROPHYLLUS* SEED**

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ABSTRACT

This investigation was carried out to extract and characterize oil from *Artocarpus heterophyllus* seeds. The Extraction of oil from *Artocarpus heterophyllus* seed was done using soxhlet apparatus and it was characterized using standard methods; the fatty acid content was gotten through gas chromatography. The results indicated that the percentage oil yield, moisture and acid value were 25.5, 5.45 and 47.69 respectively. The viscosity, pH, iodine value, refractive index, specific gravity and density recorded 1.52, 4.20, 18.63, 1.46, 0.76 and 0.96 respectively with saponification value of 64.52mgKOH/kg while the smoke and cloud points were 60°C and 95°C respectively. The fire point is above 250°C and the free fatty acid is 23.84%. The fatty acids indicated were methyl stearate, magaric acid, lauric acid, palmitic acid, myristic acid and the oil was brownish in colour. The results indicated that the oil contained more of saturated fatty acids.

Key words: Extraction, characterization, oil, *Artocarpus heterophyllus* and seed.

INTRODUCTION

Oil is any neutral, nonpolar chemical substance that is a viscous liquid at ambient temperatures and is both hydrophobic and lipophilic. Oils have a high carbon and hydrogen content and are usually flammable

and slippery. Oils may be animal, vegetable, or petrochemical in origin, and may be volatile or non-volatile. Also oil can be organic or mineral in nature and oil can be used in cosmetics, painting, cooking,

biodiesel and cream production (Alberts *et al.*, 2012).

Artocarpus heterophyllus is a species of tree in the mulberry and fig family (Moraceae). This is a small-sized tree reaching 18 m tall. All parts of the plant have whitish latex. The leaves are simple, alternately arranged, about 5–22.5 × 1.8–11 cm, thinly leathery and glabrous. The apex is blunt and tapers to the base. The upper surface of the leaves is dark shiny green. Flowers are unisexual, small and grouped in elongated heads. Male heads are elongated, 3-8 x 1-3 cm while female heads are oblong and 5-15 x 3-4.5 cm. The fruits of *Artocarpus heterophyllus* are found on the trunk and main branches. The fruiting head is gigantic, measuring 30–90 × 25–50 cm, barrel or pear-shaped, and cream to golden yellow with conical warts. The seeds have golden yellow and waxy flesh which can be eaten (Chong *et al.*, 2010). The *Artocarpus heterophyllus* tree is well suited to tropical lowlands, and its fruit is the largest tree-borne fruit, reaching as much as 35 kg in weight, 90 cm in length, and 50 cm in diameter. Its tree is a widely cultivated and popular food item throughout the tropical regions of the world and can produce about 100 to 200 fruits in a year. The *Artocarpus heterophyllus* types differ among themselves in the shape and density

of spikes on the rind, bearing, size, shape, latex, flake size, flake colour, quality and period of maturity. Innumerable variations in sweetness, acidity, flavor and taste are observed among jackfruit-growing areas (Samaddar, 2011).

There are some qualities that are used to characterize oil. Refractive index of a material is a dimensionless number that describes how light propagates through that medium. Refractive index determines how much light is bent, or refracted, when entering a material. The density of a substance is its mass per unit volume (Bor *et al.*, 2010). Acid value is the mass of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance. Iodine value is the mass of iodine in grams that is consumed by 100 grams of a chemical substance. Iodine numbers are often used to determine the amount of unsaturation in fatty acids. The higher the iodine number, the more carbon to carbon bonds are present in the fat. Specific gravity is the ratio of the density of a substance to the density of a reference substance; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance for the same given volume (Firestone, 2011). Smoke point of an oil or fat is the temperature at which, under

defined conditions, enough volatile compounds emerge when a bluish smoke becomes clearly visible from the oil. At this temperature, volatile compounds, such as free fatty acids, and short-chain degradation products of oxidation come up from the oil. These volatile compounds degrade in air to give soot. The smoke point indicates the temperature limit up to which that cooking oil can be used. Saponification value the number in of milligrams of potassium hydroxide required to saponify 1g of fat under the conditions specified. It is a measure of the average molecular weight (or chain length) of all the fatty acids present it

allows for comparison of the average fatty acid chain length. The long chain fatty acids found in fats have a low saponification value because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat as compared to short chain fatty acids (Firestone, 2011).

There is high demand of vegetable oil and mineral oils in the growing population of the world, and plants are the major sources of these oils. Plant seeds also contain high amounts of oil; hence the need to extract and characterize the oil from *Artocarpus heterophyllus* seeds.



Figure 1: *Artocarpus heterophyllus* (Jules and Roberts, 2010)

MATERIALS AND METHODS

MATERIALS

The seeds were gotten from Umuoji, Idemmili North LGA, Anambra State in the month of April.

CHEMICALS AND REAGENTS

The chemicals and reagents were of analytical standard.

METHODS

EXTRACTION OF OIL FROM THE SAMPLE (AOAC, 1994).

The oil from the jackfruit seed was extracted by using the soxhlet extractor. The soxhlet extractor was connected to electrical power source and the homogenized sample was gotten and was mixed with anhydrous

sodium sulphate after that it was agitated in a mortar to absorb moisture. The homogenate was placed into the extraction chamber of the soxhlet unit. Extraction was then carried out with ethanol for 48hrs.

The acid value, free fatty acid, peroxide value, saponification value, smoke point,

flash point, cloud point, refractive index, density, specific gravity, viscosity were determined by the methods of AOAC (1994). The fatty acid profile was done using gas chromatography.



Figure 2: *Artocarpus heterophyllus* seeds

RESULTS

TABLE 1: Characterization of Oil from *Artocarpus Heterophyllus* Seeds

CHARACTERIZATION	VALUES
ACID VALUE	47.69%
VISCOSITY	1.52pa.
PH	4.20
IODINE VALUE	18.61
PEROXIDE VALUE	14.2mgKOH/Kg
SAPONIFICATION VALUE	64.52mgKOH/Kg
DENSITY	0.96
SPECIFIC GRAVITY	0.76
REFRACTIVE INDEX	1.46
MOISTURE CONTENT	5.45%
SMOKE POINT	60°C
CLOUD POINT	95°C
FIRE POINT	250°C and above
FREE FATTY ACID (FFA)	23.84%

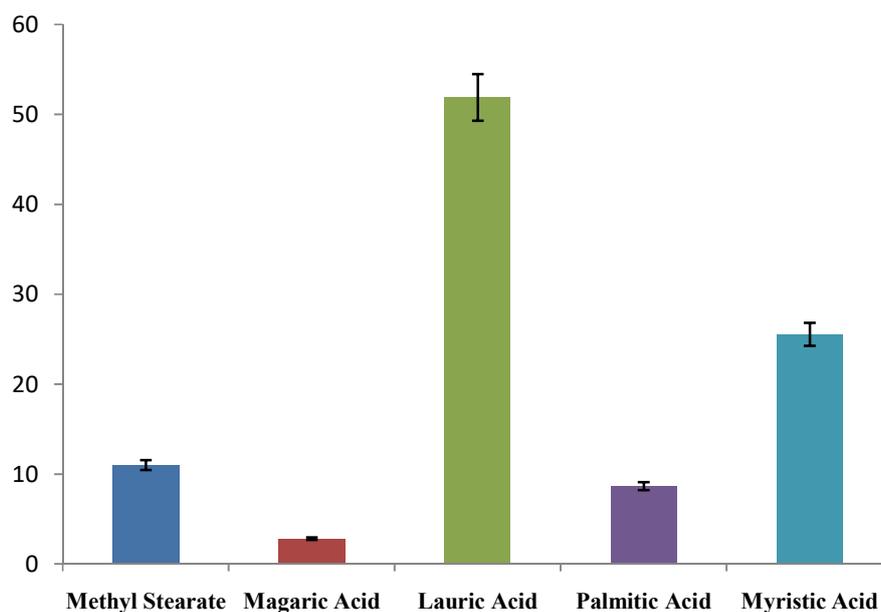


Figure 3: Bar chart representation of fatty acid contents of *Artocarpus heterophyllum* Seeds.

DISCUSSION

The *Artocarpus heterophyllum* seeds recorded 25.56% of oil yield, which is different from 0.24% as recorded by Redemptor *et al.* (2015) and 48% oil yield which was also recorded by Abitogun *et al.* (2008); more so, Orhevba *et al.* (2012) recorded 15.05%, Adebayo *et al.* (2012) reported 10.71% oil yield and the differences in the percentage oil yield may have been caused by the type of solvent used for extraction or the environment in which the plants grew.

The acid value of *Artocarpus heterophyllum* gave 46.69%. Adebayo *et al.* (2012) recorded 5.20% acid value while 14.8% acid value was recorded by Abitogun *et al.* (2008).

Orhevba *et al.* (2012) reported 11.50% acid value and Nangbes *et al.* (2013) recorded 14.8%

Artocarpus heterophyllum seed indicated viscosity to be 1.52p.a. Abitogun *et al.* (2008) and Nangbes *et al.* (2013) reported 0.43p.a. while Orhevba *et al.* (2012) reported 74p.a.

pH was gotten to be 4.20 in *Artocarpus heterophyllum* seed. The value is different from 5.80 reported by Abitogun *et al.* (2008), also Moses *et al.* (2008) indicated pH as 6.03 and Nangbes *et al.* (2013) indicated 5.8

Artocarpus heterophyllum seed has the saponification value of 64.52mgKOH/kg. Redemptor *et al.* (2015) reported

353.65mgKOH/Kg. Nangbes *et al.* (2013) reported 180.77mgKOH/kg, Moses *et al.* (2008) indicated 134mgKOH/g, Abitogun *et al.* (2008) reported 178mgKOH/mg oil and Orhevba *et al.* (2012) showed 189mgKOH/g oil. The saponification value indicated in *Artocarpus heterophyllus* seed showed that the oil has long chain fatty acids.

Peroxide value was gotten to be 14.2mgKOH/Kg in *Artocarpus heterophyllus* seed. Orhevba *et al.* (2012) got 9.25mEq/kg and Abitogun *et al.* (2008) gave 158.64Meq/Kg, Nangbes *et al.* (2013) also recorded 158.64Meq/Kg.

In *Artocarpus heterophyllus* seed iodine value gave 18.61 wiji's value, Moses *et al.*, (2008) reported 7.44g, Nangbes *et al.*(2013) indicated 58.64 wiji's value, Orhevba *et al.*, (2012) reported 94.7g, Redemptor *et al.* (2015) showed 60.75 wiji's value and Abitogun *et al.* (2008) reported 58.39 wiji's value.

Moisture content was indicated to be 5.45% oil in *Artocarpus heterophyllus* seed, while Abitogun *et al.* (2008) reported 0.3% in moisture content of the oil. Adebayo *et al.* (2012) indicated 3.12% and Nangbes *et al.* (2013) reported 0.3%.

Density of oil from *Artocarpus heterophyllus* seed showed 0.96, Adabayo *et al.* (2012) reported 0.89; however the value gotten in

Artocarpus heterophyllus seed is close to 0.95 reported by Nangbes *et al.* (2013).

The specific gravity in *Artocarpus heterophyllus* indicated 0.76. 0.95 was reported by Abitogun *et al.* (2008); however, Orhevba *et al.* (2012) recorded 0.92 and all the values reported are closely related to each other.

Refractive index indicated in *Artocarpus heterophyllus* is 1.46 as it is different from 1.57 as reported by Moses *et al.* (2008) while Nangbes *et al.* (2013) reported 1.80. Consequently, the value gotten from *Artocarpus heterophyllus* is related to 1.47 reported by Adabayo *et al.* (2012).

Smoke, cloud and fire points in *Artocarpus heterophyllus* indicated 60°C, 95°C and above 250°C respectively. Abitogun *et al.* (2008) reported smoke and fire points as 215 and 256 respectively. Nangbes *et al.* (2013) reported smoke point of 215, cloud point of 225 and fire point of 256.

Free fatty acid indicated in *Artocarpus heterophyllus* oil was 24.84%. The value is different from the 2.60% recorded by Adebayo *et al.* (2012), 7.4% was reported by Abitogun *et al.* (2008), Orhevba *et al.* (2012) indicated 5.75%.

The saturated fatty acids indicated in *Artocarpus heterophyllus* include: Methyl stearate, lauric acid palmitic acid and

myristic, and the following saturated acids: palmitic, stearic and hydroxylstearic acids was recorded by Abitogun *et al.* (2008), while the unsaturated fatty acid in *Artocarpus heterophyllus* is magaric acid. Abitogun *et al.*, (2008) recorded oleic acid and ricinoleic acid as unsaturated fatty acids. However Nangbes *et al.* (2013) recorded saturated fatty acid of stearic acid, dihydroxylstearic acid and palmitic acid and unsaturated fatty acids of oleic, linoleic, linolenic and ricinoleic acids.

In conclusion, the results have shown that *Artocarpus heterophyllus* seed had a significant amount of oil which is mainly composed of saturated fatty acids.

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