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PHYSICO-CHEMICAL, ANTIBACTERIAIL ACTIVITY AND FATTY ACID COMPOSITION OF OIL EXTRACTED FROM SPROUTED ACKEE APPLE (*BLIGHIA SAPIDA*)

[1]Aladekoyi G*, [1]Ajongbolo K.F. [1]Bada S. O.

[1]Science Laboratory Technology Department, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria.

ABSTRACT: *Blighia sapida* seed has been reported to have some levels of toxic substances when consumed. Most of these substances can be transferred to the oil during extraction thereby increasing the health risk of the oil. Sprouted *Blighia sapida* seed oil was evaluated to see if the reactions that take place during germination could reduce this toxic effect and increase its industrial values. These results were obtained for the physico-chemical properties: Oil Yield (%)(15.500±0.02), Refractive index (1.4615±0.01), Specific gravity (0.9140±0.01), Acid value(mg/g)(25.1000±0.10), Iodine value(g/100g)(27.5010±0.20), Saponification value(mg/g)(225.3000±0.20), Peroxide value(mmol/kg)(4.2400±0.20) and Free fatty acid(mg/g)(oleic)(7.0782±0.10) respectively. The Fatty acid composition of the oil were Palmitic Acid (C16:0)(32.3349), Stearic Acid (C18:0)(5.2555), Arachidic Acid(C20:0)(0.8528), Behenic Acid (C22:0)(0.6326) and Lignoceric acid(C24:0)(0.3061) as polysaturated fatty acid with abundance in Palmitic Acid respectively. The monounsaturated fatty acid were Oleic Acid (C18:1)(45.7362), Palmitoleic Acid (C16:1)(0.7655), Erucic Acid (C22:1)(0.4601) and Linoleic Acid (C18:2)(11.6010) and Lenolenic Acid (C18:3)(0.9773) as polyunsaturated fatty acid. The antibacterial activity of the oil from *Blighia sapida* seed indicated that the oil is susceptible to some pathogenic organism like *Escherichia Coli*(4.00 ± 0.01) and *Staphylococcus aureus* (2.00 ± 0.02), but had no effect on *Proteus, Pseudomonas Spp* and *Klebsiella pneumonia.* These results indicated that the oil from sprouted *Blighia sapida* seed had industrial and pharmaceutical value than the raw *Blighia sapida* seed oil.

KEY WORDS: Physico-chemical, fatty Acid, Antibacterial, Akee apple , Sprouted, oil

INTRODUCTION

Oil seed processing expands the use of crops and also brings value to waste products. Vegetable oils derived from plant seeds have been playing vital roles to provide comfort in human lives in various aspects. Outside the realm of food manufacture, vegetable oils feature in a variety of industrial uses ranging from the manufacture of soap to the production of paints, varnishes, lubricants and plastics. For instance, they have been used for illumination and lubricating purpose, production of detergents and cosmetics and for coatings and paint for many centuries before an abundant and cheap supply of mineral oil became available (Ibemesi, 1992). *Blighia sapida* K. D. Koenig is a member of the Sapindaceae family (Adams, 1972). Commonly known as “ackee”, it was introduced to the West Indies circa 1776 by Thomas Clark, and is cultivated in some islands such as Jamaica and Haiti. The plant, which is native to West Africa, is also found in Central America and South Florida (Barceloux, 2008; Ouattara *et al.*, 2010). A medium-sized to large, tropical evergreen tree, it has a short trunk, grows up to 10-15 m, is

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drought-resistant, and is capable of growing in most soil types (Parkinson, 2007; Morton, 1987).

According to Parkinson (2007), when the fruit is fully mature the reddish pod splits open to reveal two to four (but more commonly three) cream to yellow, fleshy and glossy arils, having smooth and shiny black seeds, some of which are very small. Only the mature fruits, with naturally opened pods are edible.

The unripe fruit is known to contain high levels of the toxic amino acid, hypoglycin A, consumption of which leads to a condition known as the "Jamaican Vomiting Sickness" (JVS) (Barceloux, 2008; Blake, 2003; Jordan and Burrows, 1937). The illness is caused by a dramatic reduction in blood glucose levels and can result in death (Barceloux, 2008; Moya, 2001). As the fruit matures, the concentration of hypoglycin A is substantially reduced (Chase *et al.*, 1990; Brown *et al*., 1992; Bowen-Forbes and Minott, 2011). Probably, the most important use of the *Blighia sapida* fruit is its use as a staple food (Rashford, 2001). **Medicinal Uses:** The medicinal use of the ackee tree is popular in West Africa. Ekué *et al*. (2010) identified 22 diseases which are treated with the use of different parts of the ackee tree in Benin; the roots, bark, leaves, capsules and seeds. Among the common diseases treated were fever, malaria, internal hemorrhage, dysentery, yellow fever and constipation. The bark and leaves of the ackee tree were most commonly used, being involved in the composition of drugs for the treatment of 13 and 8 different diseases respectively. However, only old people and traditional healers had such knowledge of the traditional medicinal use of the ackee tree parts and the knowledge varied among different ethnic groups in Benin.

The use of ackee for treating dysentery, yellow fever as well as epilepsy in parts of Africa was also reported by Kean and Hare in 1980. In Nigerian traditional medicine, ackee leaves and pulp are used to treat eye conjunctivitis and the roots are used to manage diabetes (Atolani *et al*., 2009; Gbolade, 2009). Saidu *et al.* (2012) investigated the hypoglycemic effect of aqueous *ackee* root bark extract on normoglycemic albino rats. They observed that the consumption of ackee roots bark extract exerted significant hypoglycemic effect on the normoglycemic albino rats. This finding supported the traditional use of ackee roots in the treatment of diabetes in Nigeria. Although recorded among 160 medicinal plants in Jamaica, the ackee tree is not a popular medicinal plant in Jamaica (Rashford, 2001).

the aim of this project work is to determine the effect of natural sprouting at ambient temperature on the physico-chemical, antibacterial activity and fatty acid of oil extracted from sprouted ackee apple seeds and the objectives are; to determine the physical properties like oil yield, refractive index, specific gravity, viscosity of oil extracted from sprouted *Blighia sapida* oil, the chemical composition like acid value, peroxide value, saponification value, iodine value and the fatty acid composition from the oil from sprouted *Blighia sapida* seeds and compare the results obtained with the already existing work on raw(matured) *Blighia sapida* seed oil.

MATERIALS AND METHODS

Collection of plant material: Seeds of sprouted ackee (*Blighia sapida*) was obtained from the farm of local farmer in the suburb villages in Owo town, Owo local government area, in Ondo state.

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Preparation of seed samples: The samples were manually dehulled from different point source in the sites and kept inside clean buckets. It was sorted to remove the dirt and immature ones, sundried for two weeks and the samples were reduced to fine powder with the aid of a mechanical grinder to pass through 40 mesh sieves to increase the surface area for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for analysis

Characterization of the Extracted Oil

In evaluating the quality of the extracted oil, the percentage yield, refractive index, specific gravity, saponification values, acid value, iodine value, free fatty acid value, peroxide value, of the oil were determined using AOAC (2005). The Fatty Acid composition was obtained by Chromatographic method (fatty acid methyl ester method)

The oil extract was tested for their antibacterial properties using the agar – well technique (Pelczer and Black, 1993). The assay for antibacterial activities was carried out with *E. coli*, *Staphylococcus aureus*, *Proteus spp* , *Pseudomonas Spp* , *and Klebsiella pneumonia*. Triplicate plates of media for each organism were inoculated with the appropriate suspension of bacteria.

A B C

Figure 1: A= Matured Sprouted Akee Apple Seed, B= Peeled Akee Apple Seed, C= Oil from Sprouted Akee Apple Seed

RESULT AND DISSCUSION

RESULTS

Table 1: Physical Parameters of Oil from Sprouted Ackee Apple Seed (*Blighia sapida*)

Parameter (%)	Values
Oil Yield (%)	15.500 ±0.02
Refractive Index	1.4615±0.01
Specific Gravity	0.9140±0.01
Colour (Unit)	Light-yellow

±SDV of triplicate results

Table 2: Chemical Parameters of Oil from Sprouted Ackee Apple Seed (*Blighia sapida*)

Parameters	Values
Acid Value (mg/g)	25.1000±0.10
Free Fatty Acid (% oleic	7.0782±0.10

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Saponification Value (mg/g)	225.3000±0.20
Iodine Value (mg/g	27.5010±0.20
Peroxide Value (mmol/kg)	4.2400±0.20

± SDV of triplicate results

Table3: fatty acid composition of oil from Sprouted Ackee Apple Seed (*Blighia sapida*)

Parameter (%)	Values
Arachidic Acid(C20:0)	0.8528
Palmitic Acid (C16:0)	32.3349
Palmitoleic Acid (C16:1)	0.7655
Margaric Acid (C17:1)	0.0673
Myristic Acid(C14:0)	1.0106
Stearic Acid (C18:0)	5.2555
Oleic Acid (C18:1)	45.7362
Linoleic Acid (C18:2)	11.6010
Linolenic Acid (C18:3)	0.9773
Erucic Acid (C22:1)	0.4601
Behenic Acid (C22:1)	0.6326
Lignoceric acid(C24:0)	0.3061

Note: C:0= Number of Carbon atoms and level of saturation or unsaturation

Table 4: Result of the antibacterial activity of oil from Sprouted Ackee Apple Seed (*Blighia sapida*)

Sample	Organisms	Zone of Inhibition(mm)
Sprouted Ackee Apple Seed Oil	*Proteus*	No Zone
	Escherichia Coli	4.00 ± 0.01
	Staphylococcus aureus	2.00 ± 0.02
	Pseudomonas Spp	No Zone
	Klebsiella pneumonia	No Zone

± SDV of triplicate results

DISCUSSION

The result of the physical composition of oil extracted from sprouted Ackee apple seed were shown in table 1. The yield was 15.500%. This value was very low compared with the value obtained by Anderson-Foster et al., 2011(37.0 ± 4.9%) for raw sample, and may not make oil from sprouted Akee Apple to be viable industrially. The sprouted Blighia sapida oil had a specific gravity and refractive index of 0.9140 and1.4615±0.01 respectively. The values were very close to the value reported by Anderson-Foster et al., 2011(0.905±0.008 and 1.4532) for raw Blighia sapida oil.

The chemical composition of sprouted Blighia sapida seed oil in table2 indicated that the oil had Acid value of 25.1000±0.10(mg/g).This was higher than the value obtained by Anderson-Foster et al.,2011(11.8326±0.006) in Jamaica, but lower than value obtained by Omosuli, 2014(57.22) for raw Blighia sapida seed oil from the same geographical location. However, the acid value of the oil must not be too high, as this denotes an excessively high content of free fatty acids, which causes the oil to turn sour. The iodine value of sprouted Blighia sapida seed oil was 27.5010±0.20g/100g. This was

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lower than the value obtained by Anderson-Foster et al.,2011 (64.520□00.18), but a little higher than value obtained by Omosuli,2014(22.84). , the iodine value of the oil is in correlation with the standard, since their iodine value are less than 100 , the oil could be classified as non-drying oil. The saponification value of sprouted Blighia sapida seed oil was 225.3000±0.20(mg/g) compared to 197±0.19 obtained by Anderson-Foster et al.,2011, but lower than value obtained by Omosuli, 2014(245.43). According to Ezeagu et al., (1998), a saponification value of 200 mg/KOH/g and above indicates high Proportion of fatty acids of low molecular weight. This indicates that the oil had potential for soap making. The Peroxide Value (mmol/kg) of the oil was 4.2400±0.20. This was very low compared to the value obtained by Anderson-Foster et al., 2011(28.0100±0.037) and closer to the value obtained by Omosuli, 2014(6.40). The low peroxide values are indicators of the ability of the oil to resist lypolitic hydrolysis and oxidative deterioration (Akinhanmi et al 2008), It shows that the oil cannot easily oxidize and therefore will be generally acceptable for the absence of odor and flavor in its content. The free fatty acid was7.0782±0.10mglg

The fatty and composition of oil extracted from sprouted Ackee Apple seed are shown in table3 showed monounsaturated fatty acid of which oleic acid (C18.1) 45.7362%, palmitoleic acid (16:1) 0.7655%, and Erucid acid (C22:1) 0.4601% while Linoleic acid (C18:2) 11.6010% and Lenolenic Acid (C18:3) 0.9773% as the polyunsaturated fatty acid. Only the oleic acid of the Srouted Blighia sapida seed oil was higher than value onbained by Omosuli, 2014 for raw Blighia sapida seed oi l(39.43%) while other monounsaturated fatty acids were in the same range. The linoleic acid was lower than the raw oil sample (53.04) but linolenic was still in the same range (0.38) obtained by Omosuli, 2014.The saturated fraction is predominantly palmitic acid (C16:0) 32.3349% and stearic acid (C18:0) 5.2555%. Germination increased the palmitic acid when compared with the raw sample oil (16.41), but reduced the stearic acid present (6.42) reported by Omosuli, 2014, and stearic acid has been observed to lowering blood cholesterol. Margaric acid (C17:1)., 0.0673, Myristic acid (C14:0) 1.0106%. Arachidic acid (20:0)0.8528%, Behenic acid (C22:0)0.6326% and Lignoceric acid (C24:0)0.3061% were present only in low quantity but higher than values obtained by Omosuli, 2014 for raw oil sample of Blighia sapida seed. Linoleic and linolenic acid are important essential fatty acids required for growth, physiological functions and body maintenance. It is however reported that saturated fatty acids plays an important role in the structure of tissue.

The antibacterial activity of the oil from Blighia sapida seed indicated that the oil is susceptible to some pathogenic organism like Escherichia Coli (4.00 ± 0.01) and Staphylococcus aureus (2.00 ± 0.02) as indicated in table4, but had no effect on Proteus, Pseudomonas Spp and Klebsiella pneumonia.

CONCLUSSION

The results obtained for the physico-chemical properties of oil from sprouted Blighia sapida revealed that it is safer for human consumption than the raw Blighia sapida seed oil due to decrease in the level of the toxicity without limiting or reducing its industrial application. The results of the fatty acid composition equally showed that the values obtained for sprouted Blighia sapida seed oil were better than the raw oil sample for pharmaceutical purposes. It could be used for curative purposes when the pathogenic organisms detected were Escherichia Coli and Staphylococcus aureus, but the dose required for its curative purpose are not stipulated in this research work.

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