

# RESEARCH AND REVIEWS: JOURNAL OF FOOD AND DAIRY TECHNOLOGY

## Physicochemical Properties and Fatty Acid Composition of Oil Extracted From Akee Apple (*Blighia sapida*) Seeds.

Omosuli SV\*

Department of Food Science and Technology, Rufus Giwa Polytechnic, P.M.B 10190wo, Ondo State, Nigeria.

### Short Communication

Received: 22/10/2013  
Revised: 17/12/2013  
Accepted: 28/12/2013

#### \*For Correspondence

Department of Food Science and Technology, Rufus Giwa Polytechnic, P.M.B 10190wo, Ondo State, Nigeria.

**Keywords:** Fatty acid, Composition, Akee, Oil, Physicochemical, Extraction

#### ABSTRACT

The crude oil of Akee apple (*Blighia sapida*) seed was extracted by solvent extraction process. The oil was analysed for physical, chemical and fatty acid composition. The physical assessment gave the following results: yield(15.26%), specific gravity (0.85), colour (14units), moisture (0.48%), melt point (15°C), Smoke point (135°C), flash point (170°C), and Fire point (25°C).The chemical properties obtained were; acid value (57.22mgKOH/g), free fatty acid (28.61% Oleic), saponification value (245.43mgKOH/g), peroxide value (6.40Meq/kg) and iodine value (22.84Wijs). Fatty acids detected and their values were myristic acid (0.28%), palmitic acid (16.41%), margaric acid (0.36%), stearic acid (6.42%), arachidic acid (0.42%), behenic acid (0.13%), lignoceric acid (0.09%), palmitoleic acid(0.77%), oleic acid (39.43%), linoleic acid (35.04%), linolenic acid (0.38%) and erucic acid (0.45%). The total saturated fatty acids of 23.93% and the total unsaturated fatty acids of 76.07% of the oil is an indication that the oil may not congeal at ordinary room temperature. This study showed that the oil can be refined to improve the quality parameters.

#### INTRODUCTION

Akee (*Blighia sapida*, L.; Family: *Sapindaceaea*) is a perennial herbaceous plant to Jamaica in the 10<sup>th</sup> century mainly as a food for residents. It gained scientific recognition in 1793 when Captain William Bligh introduced it to England in honor of whom it was named 'Blighia sapida' [1]. It is an evergreen tree, which grows to a height of between 7 and 25m. Akee trees grow well in Jamaica with little cultural attention and cultivated mainly in the parishes of Clarendon and St. Elizabeth. It produces good yield of 7.5 to 10cm long, lipid-bearing fruits all the year round, with two peak fruiting season of January to March and June to August [1]. Akee is widely consumed in Jamaica as part of the national dish. It is also popular among the Jamaican in the United State and Canada, countries where it was previously prohibited [2]. The production of Akee apple varies from year to year and probably governed by prevailing climatic conditions. [3, 4] reported that a larger numbers of fats can be extracted in Akee arils which contains many important nutrients, especially fatty acids. Linoleic, palmitic and stearic are the primary fatty acids found in the fruit [5].It was reported in the literature that Akee oil makes important contribution to the diets of many Jamaicans[4][3]. The Akee must be allowed to open fully or at least partly it is detached from tree. When it is "yawned" the seeds are discarded and the arils, while still fresh and firm are best parboiled in salted water or milk and then lightly fried in butter. Then they are readily delicious. In Jamaica, they are often cooked with fish, onions and tomatoes. After parboiling, they are added to as stew of beef, salt-pork and scallions, thyme and other seasonings. Sometimes they are curried and eaten with rice. They are served, not only at home, but also in hotel dining rooms and other restaurants. In Africa, they are eaten raw or in soup, or after frying in oil [6]. The dried seeds, fruit bark and leaves are used medicinally. In Brazil, the seed aqueous extract has been administered to expel parasites. The treatment is followed by a saline or oily purative. Cubans blend the ripe arils with sugar and give the mixture as a febrifuge and as a treatment of dysentery. On the Ivory Coast, the bark is mixed with pungent species in an ointment applied to relieve pain. The crushed new foliage is applied on the forehead to relieve severe headache. The juice is employed as eye drops in ophthalmic and conjunctivitis. Various preparations are made for treatment of epilepsy and yellow fever [6]. Although, literature shows some chemical and biological studies on Akeemost especially in Jamaica [5,7]. Information on the quality parameters of oil extracted from Akee arils in Africa and mostly in Nigeria have not been fully investigated and documented. Hence this research work was aimed at

investigating the physicochemical properties and fatty acid composition of oil extracted from Akee apple seeds collected from akee trees in Owo, Ondo State of Nigeria.

## MATERIAL AND METHODS

### Collection of Akee Apple Seeds

Matured open seeds of akee apple were collected from nearby farms from Rufus Giwa Polytechnic, Owo, Ondo State Nigeria.

### Extraction of oil from the Seeds

The whole seeds were sundried for 7 days to aid the cracking of the shell. The cracked seeds were milled and washed with hexane. It was shaken vigorously for 30 minutes after which the solution was filtered. The filtrate was heated for 2 hours in order to allow the total escape of hexane. The extracted oil was then cooled in the desiccator.

### Determination of Physicochemical Qualities of the Oil

The physicochemical qualities of the oil such as the specific gravity, smoke point, flash point, fire point, moisture content, melting point, peroxide values, iodine value, acid value, free fatty acid and saponification values were determined according to the methods of [8].

### Determination of fatty acid composition

The fatty acid composition was determined according to the method of [9].

## RESULTS AND DISCUSSION

The result of the physical properties of oil extracted from Akee apple arils were shown in Table 1. The yield of oil produced was 15.26%. This value is low and may not make oil from akee apple to be viable industrially. The yield of the oil obtained in this study was low to what was obtained from Akee apple obtained from Supare-Akoko of Ondo State as reported by [3]. The low yield of oil from untreated seeds has been reported to be probably due to the presence of moisture and undenatured protein molecule [10] as they are known to reduce efficiency of oil extraction [10]. The Akee apple oil had a specific gravity of 0.85. The value compared well with what was reported in the literature [3]. The low value could be because of the high Saponification and Iodine values of the sample since density of an oil increase with increase in Saponification value (molecular weight), Iodine value (unsaturated), temperature, free fatty acid and water content [11]. The moisture content of 0.48% obtained though high is not appreciably far from the recommended standard of 0.2% for fresh oils as specified by [10]. Low value of moisture means there will not be a great loss of mass if the oil is subjected to further processing or refining. Moreover, the colour unit of the extracted oil (14 units) was higher than the recommended value of 9 units [12]. This may be due to the fact that the oil did not undergo any processing or refining.

Fats are heterogeneous mixtures which do not have a sharp melting point [13]. Melting point is the temperature at which melting of a fat starts (The Akee apple oil had melting point of 15°C and remained liquid at room temperature. The result of the smoke test (135°C) showed that the oil is suitable for frying [14]. The flash point of the Akee oil was found to be 170°C, which is lower than the flash point range of 265°C-230°C in most oils [15]. A temperature (flash, smoke and fire points) usually varies with the amount of free fatty acids present in oil and decreases with increasing free fatty acids [16]. These values also showed that the oil has combustion characteristics [16].

The chemical properties of oil extracted from akee apple arils are shown in Table 2. Freshly extracted oil has the peroxide value less than 10 Meq/kg and that the rancid taste often begins to be noticed when the peroxide value is between 20 and 40 Meq/kg, which indicates that the oil is of high quality and not easily prone to rancidity. This value is lower than the maximum 15 Meq/kg for cold pressed and Virgin oils [17] showing that the oil will be good for consumption. Similarly, the Iodine value of 22.84 wjws obtained is low compared to other oils such as from almond seed [18] Tiger nut [19], Nutsedge oil and Shea fat [20]. Based on the Iodine value which is below 100 wjws, the oil could be classified as non-drying oil and not easily prone to rancidity [18].

An acid value of 57.22 mgKOH/g was obtained for the Akee apple oil. High acid value has been reported to be due to lipase action on oils prior to processing and high moisture content. Result from this study showed that the oil would need to be refined, as this will improve the quality of the oil as it is done in other vegetable oils [18]. Also, a high free fatty acid value of 28.61% oleic was obtained. [21] reported that high value of free fatty acids in oil gives rise to off-flavours and odours, increased susceptibility to rancidity and loss in the yield of the oil during

refining when free fatty acids are removed. The saponification value (SV) of 245.43mgKOH/g obtained in this study was higher than the recommended range (188-198mgKOH/g) for edible oils [22]. This is an indication that the oil is composed of short chain fatty acids since the SV is higher than 200. [22] reported that oils with SV above 200 contain short chain fatty acids (low molecule weight fatty acid). This was further proved by the fact that the oil remained liquid at room temperature. Short chain fatty acids are known for their quick supply of dietary energy especially under emergency conditions [23] and are usually used as sources of energy where there is difficulty in the digestion of long chain fatty acids.

Results from this study showed ( table 3) that oil from akee apple contains 76.07% of unsaturated fatty acids of which 39.43% is oleic acid (C18:1), 35.04% Linoleic acid (C18:2), 0.77% Palmitoleic acid (C16:1) and 0.45% Erucic (C22:1) while the saturated fraction of 23.93% is predominantly Palmitic acid (C16:0) with 16.14% and stearic acid (C18:0) constituting only 6.42%, Margaric acid (C17:0), Myristic acid (C14:0), Arachidic acid (C20:0), Behenic acid (C22:0) and Lignoceric acid (C24:0) were present only in almost undetectable amount of 0.36%, 0.28%, 0.24%, 0.13% and 0.09% respectively. However, Caprylic acid (C8:0), Capric acid (C10:0) and lauric acid (C12:0) were undetectable. Linoleic and Linolenic acids are the most important essential fatty acids required for growth, physiological functions and body maintenance [24]. Stearic acid has been reported to lower blood cholesterol [25]. Since the saturated fatty acids have the lowest percentage (23.93%): it implies that oil may not congeal at ordinary temperature. It is however reported that saturated fatty acids plays an important role in the structure of tissue.

**Table 1: Physical Properties of Akee Apple oil**

Properties	Akee Apple oil
Yield (%)	15.26
Specific gravity	0.85
Smoke Point (°C)	135
Flash Point (°C)	170
Fire Point (°C)	265
Moisture Content (°C)	0.48
Colour (unit)	14
Soft / Melt Point (°C)	15

**Table 2: Chemical Properties of Akee Apple oil**

Properties	Akee Apple oil
Peroxide value (Meq/kg)	6.40
Iodine value (wijs)	22.84
Acid value (mgKOH/g)	57.22
Free fatty acid (% oleic)	28.61
Saponification value (mgKOH/g)	245.43

**Table 3: Fatty acid composition of Akee Apple oil**

Fatty Acid methyl Ester	Fatty Acids	Carbon Number	Result(%)
Methyl Caprylate	Caprylic	8:0	0.00
Methyl Caprate	Capric	10:0	0.00
Methyl Laurate	Lauric	12:0	0.00
Methyl Myristate	Myristic	14:0	0.28
Methyl Palmitate	Palmitic	16:0	16.41
Methyl Margarate	Margaric	17:0	0.36
Methyl Stearate	Stearic	18:0	6.42
Methyl Arachidate	Arachidic	20:0	0.24
Methyl Behenate	Behenic	22:0	0.13
Methyl Lignocerate	lignoceric	24:0	0.09
Methyl Palmitolate	Palmitoleic	16:1	0.77
Methyl Oleate	Oleic	18:1	39.43
Methyl Linoleate	linoleic	18:2	35.04
Methyl Linolenate	Linolenic	18:3	0.38
Methyl Arachidonate	Arachidonic	20:4	0.00
Methyl Erucate	Erucic	22:1	0.45

## CONCLUSION

The akee apple oil studied in this work shows the presence of great physicochemical values and quality fatty acid composition. This study showed that the oil can be refined to improve the quality parameters as done in vegetable oils to increase its consumption tendency.

## REFERENCES

1. Lancashire RJ. The Jamaican national fruit. www.chem.uwimona. Edu. J M. Retrieved December 2005, pg45.
2. Foster EN, Adebayo AS, Smith NJ. Physico-chemical properties of *Blighia sapida* (ackee) oil extracted and its potential application as emulsion base. African J Pharm Pharmacol. 2012;6(3):200-210.
3. Omosuli SV, Ibrahim TA, Dada IBO, Adesina KA. Qualitative Assessment of Oil Extract from Akee apple (*Blighia sapida*). Proceeding of the 32nd Annual conference of Nigeria Institute of Food and Science and Technology held in Ogbomosho, 13<sup>th</sup>-17<sup>th</sup> October,2008, pp 239-240.
4. Markle M. Tropical Plant, a textbook of Botany, Macmillan Publishers, Ltd, India, 1<sup>st</sup> edition, London and Basingstoke, 1998;pp.171-173.
5. Ogutuga AA, Asemota HN, Musac I. Fatty acid composition of the aril of akee fruit (*Blighia sapida*). Jamaica J Sci Technol. 1992;3:30-32.
6. Andrea R. The akee issue JAGRIST Processing Jamaica society for Agricultural Science. Jamaica J Sci Technol. 1997;4:25-27.
7. Singh P, Garden M, Poddar S, Choo-kang E, Coard K, Richards E. The Effects of Ackee oil (*Blighia sapida*) following subacute administration to rats. West Ind J Med. 1992;41:23-26.
8. AOAC .Official Methods of Analysis of Association of Analytical Chemist (AOAC)International, 17<sup>th</sup> ed. Horowitz, W. (ed) Vol. 1 Maryland, OS. A, Ch 45, 2005, pp:112-120.
9. Ibitoye AA. Laboratory Manual on Basic Methods in plant Analysis, 1<sup>st</sup> Ed., Concept IT and Educational consults, Akure, Nigeria. 2005, pp:17-25.
10. Onyeka EJ ,Onuegbu N, Onoha NU, Ochonogor F. Effect of Extraction Pretreatment on the composition and characteristics of seed and pulp Oil of African Black Pear (*Dacryodes edulis*). Nigeria Food J. 2005;23:13-20.
11. NIS . Standard for edible Vegetable Oil. Nigerian Industrial Standard. 1992, pp: 5-12.
12. Weiss TJ. Food arils and their uses 4<sup>th</sup> Edition Avi Publishing Company , 1980, pp:135-137.
13. Onwuka GI. Food Analysis and Instrumentation Theory and Practice. Naphthali Prints, Lagos Nigeria. 2005, pp: 23-93.
14. Kirk RS, Sawyer R. Pearson's Composition and Analysis of Foods. International Students Edition, Longman Publisher, London.1999, pp.610-634.
15. Pearson D. The Chemical Analysis of Food 7<sup>th</sup> Edition, Church Hill Livingstone Publishers. 1979, pp: 522-529.
16. Giwa N. Waste oil management and environment. A report by charman Raw Material Research and Development Council in News watch Magazine, 1992.
17. Aremu MO, Olanisakin A, Bako DA, Madu PC. Compositional studies and physicochemical characteristics of cashew nut (*Anarcadium occidentale*) flour. Parkistan J Nutr. 2006;5:328-333.
18. Falola AO, Adesola SO, Aremu TO. Extraction and Evaluation of oil from Almond seed (*Terminaria Catappa*). Processing of the Annual Conference of Nigeria Institute of Food Science and Technology held in Ogbomosho, 13<sup>th</sup>-17<sup>th</sup> October,. 2008, pp:225-226.
19. Arubi PA. Comparison of the physical and chemical properties of the Nut and Oil of two varieties of Tiger nut (*Cyperus esculentus* L.) proceeding of the 32<sup>nd</sup> Annual Conference of Nigerian Institute of Food Science and Technology held in Ogbomosho. 13<sup>th</sup>-17<sup>th</sup> October, 2008, pp:235-236,
20. Ezebor F, Igwe CC, Owolabi FAT, Okoh SO. Comparison of the physico-chemical Characteristics, Oxidative and Hydrolytic Stabilities of Oil and Fat of *Cyperus Esculentus* L. (Yellow nut edge) and *Butyrosper Mumparrkii* (Sher nut) from Middle-Belt State of Nigeria. Food J. 2005;23:33-39.
21. Markovic VV, Bastic LV. Characteristics of Pumpkin Seed Oil. J American Oil Chem Soc. 1974;53:42-44.
22. FAO/WHO. Fats, Oil and Related Products, Food Standard Program. Codex Alimentarius Commission. Vol. 8. Food and Agriculture Organization of United Nations. World Health Organization, Rome. 1993, pp:33-35.
23. Charles A, Guy L. Food Biochemistry. Chapman and hall foods Science Book. Aspen publisher Inc. Cartherburg, Maryland. 1999,pp: 78-95.
24. Salunkle DK, Chaven RN, Kadan SS. World Oil seeds Chemistry, Technology and Utilization, Van Nostrand Reinhold New York, 1992, pp: 55.
25. Omosuli SV, Ibrahim TA, Oloye D Jude – Ojei BS, Agbaje RB. Proximate and mineral composition of Roasted as defatted cashew nut (*Anarcadium Occidentale*) flour. Pakistan J Nutr. 2009;8(10):1649-1651.

The Journal of Dairy Research is an international Journal of high-standing that publishes original scientific research on all aspects of the biology, wellbeing and technology of lactating animals and the foods they produce. The Journal's ability to cover the entire dairy foods chain is a major strength. Cross-disciplinary research is particularly welcomed, as is comparative lactation research in different dairy and non-dairy species and research dealing with consumer health aspects of dairy products. Journal of Dairy Research: an international Journal of the lactation sciences. Latest articles. View all. Article. Physical properties of UHT light cream: impact of the high-pressure homogenization and addition of hydrocolloids. [www.scholarscentral.org/submissions/research-reviews-food-processing-dairy-technology.html](http://www.scholarscentral.org/submissions/research-reviews-food-processing-dairy-technology.html) or send as an e-mail attachment to the Editorial Office at [email protected]. Article Processing Charges: 519 Euros (Research and Review), 319 Euros (Other Articles). Milk or milk products etc. The Journal of Food and Dairy Technology is an open access, peer reviewed, quarterly publishing journal. Articles are welcome in the form of a research article, review article, short communication, perspective and commentary. This periodical emphasizes on various food processing and dairy technology studies, thereby providing an insight to the current developments in this fields and allied subjects. Approved by publishing and review experts on Typeset, this template is built as per for Research and Reviews: Journal of Food and Dairy Technology formatting guidelines as mentioned in OMICS Publishing Group author instructions. The current version was created on and has been used by 647 authors to write and format their manuscripts to this journal. After uploading your paper on Typeset, you would see a button to request a journal submission service for Research and Reviews: Journal of Food and Dairy Technology. Each submission service is completed within 4 - 5 working days. 16. Can I download Research and Reviews: Journal of Food and Dairy Technology Endnote Style? Yes. Typeset provides this functionality.