

**COMPARATIVE STUDY OF OILS FROM GROUNDNUT
(*Arachis hypogaea*) AND CASHEW NUT
(*Anacardium occidentale*)**

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Abstract

Groundnut (Arachis hypogaea) and Cashew nut (Anacardium occidentale) plays an important role in the diet of many people in the world. They serve as supplements in diets and also have nutritional and medicinal values. The results of physiochemical characteristics of the oils from groundnut and cashew nut showed that they have similar values for the parameters analysed: -percentage oil content 47.3% and 42.5%, percentage moisture content 10% and 10%, specific gravity 0.9 and 0.9, acid value 9mg/g and 10mg/g, saponification value 196mg/kg and 163mg/kg, iodine value 88g/100g and 53g/100g, peroxide value 10meq/kg and 20meq/kg and percentage fatty acid value of 4.5 and 5.0 respectively, indicating that they are non-drying and edible oils. The oils extracted from these nuts are used domestically for candies, cakes, cookies and industrially for the production of paint, margarine and soap.

Groundnut (*Arachis hypogaea*) is a specie in the legume or bean family (Fabaceae). The cultivated groundnut was probably first domesticated in the valleys of Peru. Groundnut is an animal herbaceous plant growing 30cm to 50cm tall. The leaves

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are opposite, pinnate with four leaflets (two opposite pairs, no terminal leaflet), each leaflet 1cm to 7cm long and 1cm to 3cm broad (Steele, 2004). The flowers are typical pea flower in shape, 2cm to 4cm across, yellow with reddish veining. After pollination, the fruit develops into a legume 3cm to 7cm long containing 1 to 4 seeds which forces its way underground to nature (hypogaea means “under the earth”).

The domesticated groundnut is an amphidiploids or allotetraploid meaning that it has two sets of chromosomes from two different species, *A.duranensis* and *A.ipaensis*. These likely combines in the wild to form the tetraploid species, *A.minticola*, which gave rise to the domesticated groundnuts (Hafij-Al-Kader, 2008). Groundnut grows best in light sandy, loamy soil. They require five months of warm weather and an annual rainfall of 500 to 1000mm or the equivalent in irrigation water. The pods ripen 120 to 150 days after the seeds are planted. Harvesting can either be done mechanically or by hand (Achu and Daives, 2005). If the crop is harvested too early, the pods will be unripe. If they are harvested late, the pods will snap off at the stalk and will remain in soil (Jack, 2008). Groundnuts are rich in carbohydrates, dietary fibre, fat, proteins, vitamins A, C, E and B-complex groups (such as riboflavin, niacin, thiamin, pantothenic acid, vitamin B6 and folates), anti-oxidants (especially resveratrol, a chemical which reduces the risk of cardiovascular diseases, cancer and ageing) and minerals (Richard, 2007).

Cashew (*Anacardium occidentale*) belongs to the family Anacardiaceae, with about 75 general and 700 species. Cashew are tropical tree species cultivated in many tropical countries of the world from its center of origin in Brazil before spreading to south and central America then Africa, Asia and tropical Australia (Ayodele and Gray, 2001). Cashew trees grow well on most soil types, tolerating poor fertility levels and wide pH range. It needs a lot climate and is drought resistant requiring dry conditions for flowering and fruit settings (Ihekoronye and Ngoddy, 2004). Most cashew trees are raised from seeds although it is possible to propagate vegetatively by layering or grafting. Yields are greatly improved by vegetative propagation using carefully selected stock. Young cashew plants are very sensitive to root damage and must be raised in containers prior to transplanting. For direct field planting, 2-3 seeds are placed in each hole and the weaker plants subsequently removed. A final plant spacing of about 18m x 18m is required (Alias and Linda, 1999).

Most cashew trees start bearing fruit in the third or fourth year and are likely to reach their mature yield by the seventh year if conditions are favourable. The cashew nut is 2.5 – 4.0cm (1.0 -1.5 inches) long and kidney shaped. Its shell is about 5mm thick, with a soft leathery outer skin and a thin hard inner skin. When fully ripe, it falls to the ground (Ogunwolu and Akinwale, 2003).

The cashew fruit is an edible food rich in vitamin C used in manufacturing jams, soft and alcoholic drinks. It is also rich in sugars, fat, protein, tannins and minerals mainly calcium, iron and phosphorus. Furthermore, the fruit has medicinal properties – used for curing scurvy and diarrhoea and it is effective in preventing cholera. The bark and leaves are commonly used to relieve toothache and sore gums, and the boiled water extract of the leaf or bark is used as a mouth wash. A paste of the bark ground in water is used in tropical application for the cure of ringworm. The root has been used as a purgative. It is applied for the cure of neurological pain and rheumatism. It is also regarded as a first-class source of energy (Ogunwolu and Akinwale, 2003).

Oil

Oil is one of the essential constituents of all forms of plant and animal life. Every species of plant and animal produces some quantity of oil during their life cycle. However, only relatively few plants and animals produces fats and oil in sufficient quantity.

Fats and oils obtained from the seeds of plants are called vegetable oils; among the important edible vegetable oils are soya bean oil, groundnut oil, coconut oil, cashew nut oil and cotton seed oil.

Oil is defined as an organic substance that is liquid at room temperature and that will not dissolve in water (Sheely, 2004). Depending on the nature of carbon chain, vegetable oil can be classified as non-drying, semi-drying, and drying oil. Oil may be extracted from seed by the use of expression, solvent extraction and steam distillation method (Steele, 2004).

According to Ihekoronye and Ngoddy (2004), parameters such as acid value, iodine value, peroxide value, saponification value, specific gravity and moisture content etc are used to characterize oils. These give the proper identification of oil and ascertain whether it is edible or not. Oil can be used domestically or industrially for the production of many products. Domestically, it can be used in frying, cooking and baking. Industrially, it can be used in paint, margarine and soap production (Okafor, 2005).

Types of Oils

Depending on the nature of carbon chain, vegetable oil can be classified as non-drying, semi-drying and drying oils.

Drying oil

They can absorb oxygen rapidly on exposure to air to form thin elastic film. They react in this way because they contain a large proportion of unsaturated fatty acid

like linolenic acid (with three double bonds in its molecule), linoleic etc. Drying oils have higher iodine value or number greater than 130 eg linseed oil, soya bean oil etc and are used in paint production (Steele, 2004).

Semi - drying oil

This forms a soft surface film after a long exposure to air. They contain a large proportion of linoleic acids with little linolenic acid. The iodine value of semi – drying oil ranges from 100 to 130 and are used as cooking oil eg rape seed, cotton seed etc.

Non – drying oil

Non – drying oil are those oils that remains liquid and do not form film on exposure to air. This implies that it reacts slowly or not at all with oxygen and so has low iodine value of less than 100. They are used as edible oil for salad preparation, soap making and for lubrication purposes (Sharma, 2006).

Materials and Method

The samples of groundnut (*Arachis hypogaea*) and cashew nut (*Anacardium occidentale*) were bought from the cocoa market in Onitsha, Ogbaru LGA of Anambra State. The samples were then transported to the Chemistry Laboratory, Science Technology Department of Federal Polytechnic, Oko in a polyethene bag. The pods of the samples were removed and the seeds sun-dried to have a constant weight. Furthermore, the dried seeds were ground into powder using grinding machine and weighed. The parameters analyzed for were done in the laboratory by adopting standard laboratory techniques. The analytical procedures adopted are shown in Table 1.

Table 1: The Analytical Methods Used for the Comparative Study of the Oils of Groundnut and Cashew Nut

Parameters	Analytical Method
Extraction of oil	Soxhlet solvent extraction using petroleum ether (40°C – 60°C).
Specific gravity	It was done using specific gravity bottle.
% oil content	Differential in weights before and after the extraction.
Moisture content	
Acid value	Titrimetry using 0.1M alcoholic potassium hydroxide and phenolphthalein indicator.
Saponification value	Titrimetry using 0.1M alcoholic potassium hydroxide with phenolphthalein indicator.

Iodine value	Titrimetry using 0.1M sodium thiosulphate.
Peroxide value	Titrimetry using 0.1M sodium thiosulphate.
Free fatty acid	Titrimetry using 0.1M potassium hydroxide.

Results and Discussion

The results of the physicochemical analyses on the oil extract from groundnut and cashew nut are shown in Table 2.

Table 2: Results of the Comparative Study of the Oils of Groundnut and Cashew Nut

Parameter	Groundnut Oil	Cashew Nut Oil
% Oil content	47.3	42.5
% Moisture content	10	10
Specific gravity	0.9	0.9
Acid Value (mg/g)	9	10
Saponification Value (mg/kg)	196	163
Iodine Value (g/100g)	88	53
Peroxide Value (meq/kg)	10	20
Free fatty Acid Value (%)	4.5	5.0

The oil from groundnut (*Arachis hypogaea*) is pale – yellow in colour while that of cashew nut is golden – yellow. Both oils are liquid at room temperature.

The percentage oil content of groundnut is 47.3% while that of cashew nut is 42.5%. This indicates that groundnut yields more oil compared to cashew though both equally have high percentage oil content. Therefore, these oils can be commercialized just as seed of olive and soya bean which have approximately 45% oil.

The moisture content of the oils of groundnut and cashew nut averages 10%, therefore the oils can be stored for average duration before deterioration (Okafor, 2005).

The acid value of the groundnut oil is 9mg/g while that of cashew nut is 10mg/g. These are low compared to oil from *Treculia africana*. The lower acid value of oil from groundnut indicates that free oil is less susceptible to oxidative rancidity than that of cashew nut oil. According to Sharma (2006), the low acid value indicates that both oils are still fresh and have not deteriorated since high value above 20mg/g shows aging of the oil. Therefore, both oils are good for human consumption because of low acid value. The saponification value of oil from groundnut is 196mg/g while that of cashew nut is 163mmg/g. The saponification value of both oils falls within the range of cotton seed and coffee oils (160 – 199mg/g). The saponification value of both oils are high when compared to *Treculia africana* oil (152mg/g). The high saponification value of both oils indicates free fatty acid content of higher carbon content, therefore they can be used in the production of shampoo and soaps.

The iodine value of oil from groundnut is 88g/100g while that of cashew nut is 53g/100g. The iodine values of both oils are at the lower range below 100/100g, therefore they are grouped under non-drying oil. Both are good in perfumery, soap, lubrication and food purposes (Sharma, 2006).

The peroxide value of oil from groundnut is 10meq/kg and that of cashew nut is 20meq/kg. When compared to that of olive oil (30meq/kg), it is low. According to Hafij-Al-Kader (2008), the peroxide value of fresh oils must not be above 20meq/kg. If the peroxide value is between 30 and above, rancid taste is noticeable. Therefore, the low peroxide value indicates that the oil is consumable and has no rancid taste.

The fatty acid value of these oils are low ie groundnut oil has 4.5% while cashew nut oil is 5.0%. Both oils have close fatty acid value and can be used for industrial purposes and for edibility purposes. Finally, the oils from groundnut and cashew nut have similar physical and chemical properties as such they can be substituted for each other.

Conclusion

From the results of this research work, it can be seen that both groundnut and cashew nut have qualities that makes them suitable for domestic and industrial uses. Also, their similar values means that they can be substituted for each other ie in the absence/scarcity of one, the other can be used comfortably.

Recommendation

As a result of the nutritional values of groundnut, it is highly recommended for consumption because of the following:

1. It is a good source of niacin which contributes to brain health and blood flow (Richard, 2007).

2. It is also a good source of resveratrol, a chemical studied for its potential anti – aging effect. It is equally associated with reduced cardiovascular disease and reduced cancer risk (Richard, 2007).

Cashew nut on the other hand, because of the numerous minerals contained therein, it is recommended for the production of beverages and spirits. It is also useful for the transportation of vitamin (fat soluble vitamins) and enzymes in the body. The oils from both groundnut and cashew nut can be used for cooking, frying and baking of foods.

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