

# Determination of proximal attributes and Physico-chemical properties of Cashew nut (*Anacardium occidentale* L.) oil and Cashew nut shell liquid

Pragnya Priyadarshini Padhi<sup>1</sup>, Samapika Dash<sup>2</sup>

Bachelor of Sciences, Model Degree College, Sonepur, India<sup>1</sup>

Lecturer in Botany, Department of Botany, Model Degree College, Sonepur, India<sup>2</sup>

\*Corresponding Author

**Abstract:** Cashew nut (*Anacardium occidentale* L.) Is an evergreen perennial crop highly cultivated at tropical regions across the world. In Asian and African countries cashew was introduced near about sixteenth century. Globally, cashew nut production is riched to 3.30 million tons in 2015. Increasing demand of cashew products make suitable this crop to become highly economic and put forward the countries towards developed status. In the current investigation, proximate attributes and mineral concentrations were studied by standard available analytical methods. From the study it was observed that Cashew nut is riched in crude fat (47.9%), crude protein (33.9%) and also contains moisture (7.1%), ash (2.9%), crude fibre (2.7%) and shown less carbohydrate (1.1%). Mineral composition was measured in mg/100 gm and potassium concentration potent to be highest (26.66 $\pm$ 0.6) plays an important role in nerve functioning and muscle contractions. Potassium followed by calcium (21.23  $\pm$ 0.30), magnesium (18.9 $\pm$ 0.15), phosphorus (13.63 $\pm$ 0.6) and sodium (7.9 $\pm$  0.1) acts as important mineral for metabolic growth and development. Iron (0.53 $\pm$ 0.06) and zinc (0.73 $\pm$ 0.05) concentration were considerably negligible in cashew sample. Physico-chemical properties were determined from cashew nut oil in terms of mg/gm and observed that cashew sample has specific gravity (0.912), refractive index (1.398), acid value (9.5 mg KOH/g), saponification number (133 mg KOH/g) that shown the inability to form soap and also iodine value (39.1 mg iodine/100 gm) and free fatty acid (4.8 mg KOH/g) efficiently make this crop highly edible. The current study may help to make pathway to explore more medicinal and antioxidant properties to become highly challenged cash crop in recent decades.

**Keywords-** Perennial, proximate attributes, Iodine, saponification number, antioxidants

## I. INTRODUCTION

The cashew (*Anacardium occidentale* L.) belongs to Anacardiaceae family is a shrub and evergreen tree cultivated mostly in tropical region around the world represented by 60–74 genera and about 400–600 species according to the classification given {[1], [2],[3],[4]}. The bushy plant is a type of pseudo-fruit (cashew apple) is the substantial cash crop in areas such as Americas, West Indies, Madagascar, India and Malaysia [5]. Presence of resinous conduits in the cortex and wood mainly known for production of resin is basic characteristics of this family [5]. Plant height generally ranging from 5 to 14 m with 20m of canopy size and also have deep root system. During germination of the nut, a tap root develops from radicle, which further produces lateral roots later on fibrous root develops from a tap root. Gradually the early developed root system taken up an intricate structure with lateral and vertical spread of roots inhabits the surface layer of the soil. Seedlings particularly with good tap roots and good no of laterals can tolerant the transplantation shock and drought, but at the seedling those who have underdeveloped root systems unable to establish at summer [6].

The initial branches grown closed to the surface, thus trunk is irregularly patterned and short. Elliptic to obovate leaves are green in colour with smooth margins and notched tip and positioned in a spiral pattern, supported by a short stalk. Usually, 3 to 14 leaves are terminally positioned on each stem, that attains complete maturation after 20–25 days of emerging {[6],[7],[8]}. Flowers are arranged in panicle of 26 cm long containing 200 to 1,600 flowers per panicle {[11], [12],[13]} and have 5 to 11 laterals that are predominantly populated by male and hermaphrodite flowers in different proportion having five to nine smaller stamens and single larger one. After 30 to 60 days of vegetative period, flowering occurs terminally over new shoots towards the periphery [14]) and in tropical zones, flowering can occur throughout the year.

Flowers are immediately become receptive to pollen after opening and this favours insects to cross-pollinate the flower, which to a great extent dominated by self-pollination due to the sticky type pollens {[11],[15],[13]}. A mature ripened ovary the fruit of the cashew tree is a combination of an accessory fruit and the true fruit. The accessory part is derived from the expansion of the pedicel and flower receptacle which is oval in shape, also represented by pear shaped hypocarpium usually called “cashew apple. The true fruit develops at the bottom of the apple is a kidney-shaped drupe. True fruits are ripened first followed by cashew apple {[9];[8];[16]}. This fruits are represented by single seed the cashew nut and wall is made of double shell constitute an allergenic antioxidants phenolic compound known as anacardic acid {[17];[9];[18]}.



Fig: a Represents a tropical cashew plant with flower.

b represents cashew nut plant with leaves and nuts

According to World Bank data, 97% of the cashew production comes from wild species and remaining 3% from plantations[19].India is seeking the highest potent producer, processor and also known for efficient exporter of cashew all over the world [20].Cashew nut is a type of major edible nut responsible for production of two oils, one of these extracted from seed coat and other from nuts called Cashew nut shell liquid (CNSL) that contains high proportion antioxidants in the form of phenolic compound. [21] Reported the ability of cashew apple act to fortify the nutritional requirements of vitamin-c and concluded highest amount (203.5mg/100 ml) for prevention of nutrient deficiency. It has long being reported that leaves or nut shell extracts are used to treatment of asthma, ulcers and cancers {[22],[17]}. Nut is made of of Linolenic acid (omega-3) act as least harmful for heart and arteries. Cashew kernel is riched in antioxidant which has highest industrial uses. The current study is focuses on the finding of nutritional value of cashew nut and kernel to explore proximate attributes and minerals constitution to enhance seed marketing to make it economically feasible and to enhance industrial and pharmacological viability.

## II. MATERIALS AND METHODS

### Sample collection and preparation

The cashew samples were collected from the Model Degree College campus, Sonapur, Odisha.The chemicals and organic solvents and equipments are used from laboratory facilities of Department of Botany, Model Degree College, and Sonapur. The collected cashew samples were smashed with cashew kernel cutter and the nuts were separates from shells. After that separated nuts were dried at maximum 40°C and incubated for 5 hours followed by homogenisation of 200gm of cashew nut and cashew nut cell and the dried samples were stored in refrigerator for further biochemical analysis.

### Analyses of sample

Crude protein, crude fat , moisture and ash were analysed by using methods of[19] earlier described by Association of Official Analytical Chemists [23]Atomic absorption spectrophotometric method was used for estimation of lead, iron, copper, zinc, magnesium and calcium were determined by [24]. Determination of Sodium and Potassium have done using methods of flame photometry [25].Phosphorous was determined by vanadate colorimetric method, where yellow-orange colour complex will form by interaction of PO<sub>4</sub><sup>3-</sup> present in orthophosphate reacts with vanadate molybdate followed by absorbance at 420nm. Methods of [26] were followed for estimation of acid and peroxide. The saponification number and iodine values were determined by method of [27] and Strong and [28] respectively. Universal hydrometer was used for determination of specific gravity and Abbe refractometer was used for refractive index.

**Statistical analysis**

Statistical analysis for the sample collected having three replica of each test was done using simple statistical software XL STAT version 2021.2.2.

**III. RESULT AND DISCUSSION**

The proximate attributes and their composition of collected cashew nut kernel was studied and shown in TABLE - 1. From the studies parameters it was observed that cashew nut kernel constitute moisture (7.1%), ash 2.9% and oil content 47.1%. The collected sample highly riched in crude fibre (2.7%), protein (33.9%) and carbohydrates by difference 1.1%. The above result somehow reported by {[29], [30], [31],[19]}. The moisture content of cashew nut was 7.1% that support the range of moisture content of legumes (7.0%-11%) and observed by [32]. Low moisture content may help to store the seeds without spoilage for prolonged period. In the above study ash content was estimated to be 2.2% supported by ash content of kolanut and cowpea seeds to be 3.1% and 3.2% respectively [32]. The value of ash content between 1.5-2.5% of nuts usually recommended as beneficial for animals feed [33] but the ash content of current study reported cashew nut may be inappropriate to be used as animal feeds [34]. The crude fat content in the above study was 47.6 % also comparable to different varieties of Melon oil seeds (47.9 -51.1%) estimated by [35] and also pumpkin seeds (49.2% and 47.01%) given by [36] and [37]. Crude fat content in flour was estimated as 36.7% by [34] and this differences may be due to viability of different varieties and their adaptation capacity to variation in environment. High protein and fat content in the current investigation was also supported by [30] on cashew nut. The protein content in above observation was 33.9% is higher than earlier studies with seeds like sahm seeds (22.5%,[38]) shown that cashew nut seeds can fulfil the nutritional requirement of protein in an adult (23.6g) as per recommendation of National Research Council (1974). The crude fibre content of cashew nut 2.7% was also recorded by [34] helps in maintenance of peristaltic movement of intestinal tract to prevent colon diseases [39].

**Table I:** Determination of proximate attributes

Composition	Percentage (%)
Moisture	7.1
Ash	2.9
Oil	47.9
Protein	33.9
Crude fibre	2.7
Carbohydrate	1.1

**Physico-chemical characterization of cashew kernel oil**

The physicochemical characterisation of cashew nut oil was represented in Table -2. Yellowish colour cashew nut had a specific gravity of 0.912 represents density is less than water and a refractive index of 1.398 which showed that thickness is almost negligible as most drying oils whose refractive indices normally ranges between 1.475 and 1.485 [40]. The essential trace element iodine value is 41.3mg /100g of cashew nut has high similarity with the value 44.4 ± 0.1 mg iodine/100g reported by from previous work on cashew nut by [34] and determination of iodine value was also shown in Hausa melon seed, 38.50 ± 0.67% [41]. Cashew kernel oil has iodine value lower than 100, thus it could only be classified as a non-drying oil out of drying, semi-drying and non-drying classification of oils. Decrement in the iodine value represents low unsaturated fatty acids content oil supported by acid and free fatty acids value 9.5 mg KOH/gm and 4.8 mg KOH/gm respectively. The values of coconut oil (253mgKOH/g) and palm kernel oil (247mgKOH/g) [42] have high saponification value than this perennial crop (133mgKOH/g). Soap making is impossible as the saponification number becomes lowered.

**Table II:** Physicochemical analysis of cashew kernel derived oil

Characteristics	Concentration
Specific activity	0.912
Refractive index	1.398
Saponification number(mg KOH/gm)	133
Iodine value (mg iodine/100 gm)	39.1
Acid value (mg KOH/g)	9.5
Free fatty acid (mg KOH/G)	4.8

**Mineral composition of cashew nut kernel**

Table -3 represents the mineral composition of collected cashew nut kernel. From the above table it was observed that cashew nut is highly riched with potassium concentration ( $26.66 \pm 0.6$  mg/100gm) and it was earlier supported by Nigerian agricultural products by [43] and also by [19]. After potassium calcium is the highly riched mineral ( $21.23 \pm 0.30$ ) followed by Magnesium ( $18.9 \pm 0.15$ ). Mg has imp role in maintaining electric potential in nerves and activation of some important enzyme systems for proper functioning of metabolism [44]. The result of calcium concentration in current investigation ( $21.23 \pm 0.30$  mg/100gm) is also reported by [43]. Calcium has important role in formation of bone and regulation of heart beat and muscle action. In the current research, phosphorus has mean value of  $13.63 \pm 0.6$  mg/100gm and act as valuable mineral in bone development and carbohydrate, protein and fat utilization. Fe ( $0.53 \pm 0.06$ ) and Zn ( $0.73 \pm 0.05$ ) concentration is least supported by [43].

**Table III: Determination of mineral composition of cashew nut kernel**

Mineral	Composition (mg/100g)
Calcium(Ca)	$21.23 \pm 0.30$
Sodium(Na)	$7.9 \pm 0.1$
Magnesium(Mg)	$18.9 \pm 0.15$
Iron(Fe)	$0.53 \pm 0.06$
Potassium(K)	$26.66 \pm 0.6$
Phosphorus(P)	$13.63 \pm 0.6$
Zinc (Zn)	$0.73 \pm 0.05$

Values are means  $\pm$  standard deviation of triplicates taken in current study

**IV CONCLUSION**

Cashew is a perennial crop of higher interest globally which is also spreading to international market over current decades. The demand of cashew nut oil and cashew nut shell liquid is increasing day by day and has high economic value. From the current investigation it was shown that cashew nut is nutritionally wealthy than others. Cashew nut riched in protein resultant in the supplementation of essential amino acids to children and adults. Low moisture content helps to store the seeds for prolong period and become efficiently available for marketing. Its nut shell liquid content showed the usefulness as surface coatings, paintings and making of resins that makes this plant production become economically viable. High potassium, phosphorus and calcium content shown the high nutritive value and act as important supplement for growth and development. Further work should be done to explore its medicinal and antioxidant properties and also research is needed to explore phenolic resins from cashew nut liquid.

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