

# Increased revenue from Cashew: Focusing on cashew apple utilization

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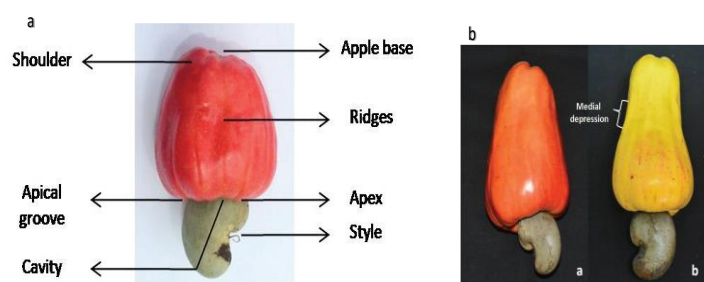
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Cashew nut (*Anacardium occidentale* L.) is one of the most important agro-industrial crops in India, Brazil, Vietnam, and African countries. It is primarily cultivated for its nut, and widely grown in tropical areas. However, due to the high value of the nut, another important produce from cashew i.e., cashew apple, has been neglected all along without any utilization. Cashew apple has several medicinal properties and is highly nutritious. The production of cashew apple in India alone is estimated to be around 60 lakh tonne per annum. The cashew apple is not commercially utilized in India, except in Goa where it is profitably used for the production of feni. The cashew apple, weighing about 8-10 times that of the nut, is an equally valuable produce from the crop, if it is economically exploited. By effective utilization of cashew apple on Cashew Apple botany (*Anacardium occidentale* L.)

Cashew is found in two parts; the nut and the commercial scale, the farmers can be assured of increased income which will encourage them to take up cashew cultivation with renewed interest.

peduncle. The nut is of greater economic interest. The peduncle region i.e., cashew apple, also a pseudo-fruit, is juicy fibrous fruit. Cashew apples are derived from a tissue called thalamus or receptacle or stalk present outside the ovary. The distinct layers like exocarp, mesocarp and endocarp are absent in cashew apple. Thus, it is called as pseudocarp or false fruit. The development and maturity of cashew apple is in consistent with nut maturation. The matured cashew apples are spherical or cylindrical in shape without or with medial depression and look like a pyriform shaped hypocarp. During maturation and ripening, the firm, fragile and green, immature cashew apples are turned to soft and juicy with the different outer spectrum (red, orange and yellow) depending on the varieties (Fig.1).



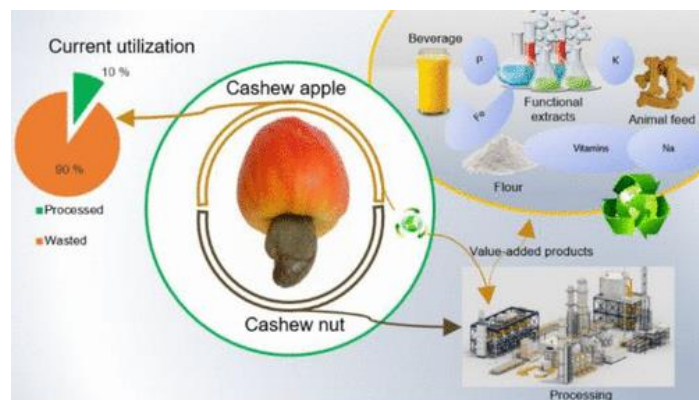
**Fig. 1: Botany of cashew apple (a) and cashew apple without and with medial expression (b) (Source: Preethi P et al, 2019).**

## Biochemical properties of cashew apple

Cashew apple is rich in ascorbic acid (240mg/100g) which is almost six times that of citrus fruits (40mg/100 g) (Nagaraja, 2007). It is also a good source of fibre and contains free soluble sugars which are mostly reducing sugars. On a dry weight basis, the crude fibre content varies from 15 to 18%. Vitamin B2 content of cashew apple is about 5-fold when compared to pineapple and grapes. The vitamin C content of cashew apple is 5 to 10-fold more than of pineapple, banana, orange and grapes (Nagaraja, 2007).

## Utilization of cashew apple

Large number of technologies that are economical and effective, have been developed for the production of various value-added products from cashew apple (Fig.2)



**Fig.2: over view of multiple uses of cashew apple (Source: Raphael Aidoo et al, 2022)**

### Fresh apple beverages

Clarified and cloudy juice, juice concentrate, syrup, squash and ready- to- serve drink are some of the nutritious and refreshing beverages that can be made from the unfermented juice of cashew apple by adding varying concentrations of sugar, citric acid and preservative.

ICAR-Directorate of Cashew Research, Puttur has developed a ready to serve (RTS) from cashew apple called as 'CashLime.' CashLime is a cashew apple and lemon juice blend RTS prepared using cashew apple pulp. The nutrient rich drink can be stored under refrigerated conditions for maximum of five months with maximum retention of nutrients and biochemical quality parameters (TSS- 10.5°Brix, vitamin C - 72 mg/100 ml, Tannins- 76 mg/100 ml, Total Phenols - 58 mg/100 ml).



**Fig.3: Cashew apple products developed at ICAR-DCR, Puttur (Source: Preethi P et al, 2019).**

### Fermented beverages

Cashew apple can be utilized for the manufacture of fermented products like wine, vinegar, liquor and alcohol. Cashew apple vinegar can be prepared by alcoholic and subsequent acetic fermentation of juice, which is perhaps the oldest known fermentation product (Sobhana, 2019). Cashew liquor is not made by blending of spirits as done in case of foreign liquor, it is prepared from pure cashew apple juice only. One litre of 60-62% ethyl alcohol can be obtained from eight litres of cashew apple juice.

Cashew apples are utilized widely in Goa for the preparation of the liquor, 'feni' by distillation. Cashew apple juice is extracted and kept for fermentation for a few days. Fermented juice is then double distilled and the resulting beverage is called feni or fenny. Feni has about 40-42% alcohol. The single-distilled version is called urrac, which has about 15% alcohol (Sobhana, 2019). Feni is primarily

considered as country liquor and it has a strong fruity flavour, peculiar taste, strong aroma and astringent smell. Feni liquor has been registered as the first geographical indication (GI) product from cashew (Elsy et al, 2009). Cashew wine is a product of fermentation of hexose sugar of cashew apple juice by intact yeast cells to form ethyl alcohol and carbon dioxide. Kerala Agricultural University has developed methods for producing four grades of wine such as soft, medium, hard and sweet, based on the alcohol percentage and sweetness.

### Products from Cashew Apple Pulp

Jam is the most important pulp product of cashew. It can be prepared by boiling the cashew fruit pulp with sufficient quantity of sugar and a pinch of citric acid to a reasonably thick consistency firm enough to hold tissues in position. Mini et al (2007) reported that cashew apple can be mixed with pineapple, mango or combination of mango, pineapple and apple in 50:50 ratio for preparation of jam. The Madakkathara Centre is commercially producing Cashew apple- Mango mixed jam named Cashewman (Sobhana, 2019).

### Osmo-dehydrated products

Candied fruit is prepared from cashew apple by impregnating with cane sugar with subsequent draining and drying. One kilogram of cashew apple on processing gives 745 g candies. The syrup left over from the candying process can be used for sweetening chutneys, in vinegar making or for candying another batch of fruits. Cashew apple can also be utilized for the preparation of tutty fruity. One kilogram of cashew apple on processing gives 715 g tutty fruity (Sobhana, 2019).

Osmotically dehydrated cashew apple is a novel value-added product developed from the cashew apple. Sugar has been completely replaced with honey in preparation of this product, hence having medicinal property with no side effect of sugar. Thus, it is possible to make the seasonal fruit available to the consumers throughout the year. One Kg of good quality fresh cashew apple on processing gives about 200g of osmotically dehydrated cashew apples (Sobhana, 2019).

### Culinary uses

Sliced raw green fruit can be used to prepare pickle using chili powder, gingelly oil, fenugreek powder, asafoetida, turmeric powder, garlic, mustard powder, a pinch of sodium benzoate and salt to taste. Chutney can be prepared from sliced cashew apple using sugar, onion, ginger, cumin, pepper, cardamom, cinnamon, coriander powder, salt, vinegar etc. (Sobhana, 2019).

### Potential uses of cashew apple

Considerable amount of cashew apple residue is obtained as waste after utilization of cashew apples for the manufacture of soft drinks or fermented beverages. Nutrient content of cashew apple residue includes total ash (1.6%), total tannin (5.2%), calcium (20.6mg/100g), phosphorus (152.7 mg/100g), crude fibre (8.4%), protein (8.8%) etc. The cashew apple residue has several agricultural, industrial, medicinal and nutraceutical uses.

### Agricultural uses

#### Vermicompost

The cashew apple waste which is highly perishable and seasonal, can be converted to vermicompost with good manurial value of 1.69% N, 0.44% P and 0.58% K using *Eudrilus euginae*. The pH of the compost from cashew apple is 8.9 and hence it can be used as a good ameliorant for acidic soils.

### Animal feeds

The cashew apple residue can be utilized for the preparation of cattle feed, pig feed and poultry feed. Cashew peel (7.6% protein, 12.3% fat and 59.2% carbohydrate) is a good poultry feed. Cashew apple residue after fermentation can be blended up to 20% to prepare animal or poultry feed without any adverse effect on milk yield (Nagaraja et al, 2007).

### Industrial uses

#### Bio fuel

The potentials to utilize cashew apple for production of alcohol to be used as a bio fuel are immense. Fresh cashew apple contains 9.5 to 10% carbohydrate in addition to varying quantities of fat, mineral and vitamins. It is estimated that cashew apple can yield 8 to 10% of ethanol. Every kilogram of

raw nut generates apple equivalent to produce 500 to 600 ml of ethanol of about 70% purity. There is a huge potential of generating ethanol from cashew apple.

### Bio gas

Ripened cashew apples can be used as raw material for biogas plant.

### Medicinal uses

Cashew apple is used as a curative against scurvy and stomach ailments like dysentery and diarrhoea. Cashew apple juice without removal of tannin is prescribed as a remedy for sore throat and chronic dysentery. Fresh or distilled, it is a potent diuretic, possessing anti scorbutic properties and is useful for kidney problems and in advanced cases of cholera.

### Use in nutraceuticals

Ascorbic acid, fibre, carotenoid pigments, minerals and other chemicals which are of significance to human health are present in cashew apple. A valuable by product that can be obtained from cashew apple waste is pectin (1.6 to 2.03%). Pectin is used in manufacturing jams, jellies, marmalades, preserves etc. It is useful in thickening, texturizing and emulsifying agent and finds numerous applications in pharmaceutical preparations and cosmetics. The cashew apple pomace or fruit waste has been identified as the ideal medium for pectinase enzyme production for *Aspergillus foetidus* through solid state fermentation.

### Economics and marketing of cashew apple products

Economics of processing of cashew apple for syrup production has been worked out (Mini et al, 2006). By processing one tonne of cashew apple, a net profit of Rs. 10,368/- can be obtained. Considering that the average yield of nut in India is 800 kg/ha, a production of 6.4 t/ha of cashew apple can be anticipated. A production of about 2t/ha of cashew apple can be ensured, taking 30% of the total production as good for processing. Thus, the additional income from a hectare of cashew orchard from the processing of cashew apple worked out to be Rs. 20,736/-, if a farmer or farmers group can venture into this endeavour. The income can be further enhanced by processing cashew apple for high value

products like alcohol and wine. Compared to other fruits, the advantage of cashew apple is that it is available free of cost and hence, the price of cashew apple can be fixed by about 20% less than that of conventional fruit drinks like mango and pineapple.

### Way forward

Economic utilization of cashew apple has not progressed to the desired level in spite of excellent qualities of cashew apple and the availability of technologies for its processing to various value-added products. Processing of cashew apple is to be considered as a programme of agricultural waste utilization, adding income to the growers. Commercial exploitation of cashew apple is the need of the hour considering its vast potential in enhancing the income from cashew plantations. However, the financial and policy support of the state and central governments are vital in promoting the economic utilization of cashew apple. Additional income from cashew apple processing will make cashew cultivation more attractive to farmers, thereby enabling the country to achieve self-sufficiency in raw nut production.

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**Table 1: Vitamin and mineral contents of various tropical fruits (mg/100g) (Source: Nagaraja, 2007)**

Constituent	Cashew apple yellow	Cashew apple red	Pineapple	Avocado	Banana	Lime	Mandarin	Orange
Riboflavin	99	124	20	150	60	Traces	30	30
Vitamin C	240	186	24	16	10	45	31	49
Calcium	41	41	16	10	8	14	33	33
Phosphorus	11	11	11	38	29	10	23	23
Iron	3	3	0.3	0.3	0.6	0.1	0.4	0.1

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