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Bhavana A
Scientist, Department of Home Science, ICAR- Krishi Vigyan Kendra, Chintamani, Karnataka, India

Akshay R Patil
Ph.D., Scholar, Department of Food Science and Technology, Indian Institute of Food Processing Technology (IIFPT), Ministry of Food Processing Industries, Govt. Of India, Pudukkottai Road, Thanjavur, Tamil Nadu, India

Cashew apple processing and value addition: A review

Bhavana A and Akshay R Patil

Abstract

Cashew (*Anacardium occidentale* L.) is an evergreen important crop of drylands of many states in India. The kidney shaped nut is the real fruit while apple attached to it is the juicy peduncle having rich reserve of vitamins and minerals. The typical colour of the apple at full ripe stage varies generally yellow, golden yellow, cherry coloured or red. India being the largest producer (60%) and exporter of cashew kernels in the world has 9,23,000 ha area and produces 6,13,000 t of cashew with an average national productivity of 695 kg/ha. Karnataka is a prominent state in cashew production occupying 5th position in area (1,18,000 ha) ranking 6th in production (53,000 t) with an average productivity of 461 kg/ha which is much less than the national average. Dakshina Kannada district has the highest area of cashew in Karnataka, followed by Udupi, Belgaum, Chickballapur, Uttara Kannada, Kodagu and Kolar. The state is bestowed with many research stations working on cashew including the Directorate of Cashew Research, Puttur, Horticulture Research Station, Ullal and AICRP on Cashew at Chintamani dedicated for research, establishment and growth of cashew industry in Karnataka by releasing several high yielding cultivars suitable for both coastal and plain regions. In spite of being highly nutritious, consumption of cashew apple has been very limited due to certain drawbacks, such as high perishable and astringent in taste. Various methods have been developed to improve the shelf life and sensory properties of whole cashew apple and its juice. It is also essential to create awareness among farmers about cashew apple processing for better economic returns. Processing of cashew apple is an economically viable enterprise in cashew growing tracts especially for Women Self Help Groups. These products are also useful for strengthening of present processing industries.

Keywords: Cashew, processing, addition, *Anacardium occidentale* L.

Introduction

The cashew apple was given priority over cashew seed during the early introduction period due to its broader and eye-striking spectrum and as ready consumption. Cashew (*Anacardium Occidentale* L.) fruit belongs to the Anacardiaceae family. It is native to tropical America, and is widely available in several countries of Asia, Africa and Central America (Daramola, 2013)^[3]. Cashew apple is a thick container or artificial fruit of the cashew tree (*Anacardium occidentale* L.), to which the cashew nut is attached. A fully ripen cashew apple is concrete and juicy with lofty sugar concentration, strong flavour, low acidity and with very high astringency (Figueiredo *et al.*, 2002)^[4]. Researchers have reported that cashew apple juice contains significant amount of polyphenols (primarily flavonoids, carotenoids and tannins), vitamins and minerals (Cavalcante *et al.*, 2005)^[2]. It is highly rich in Vitamin C which is six times more than that of orange juice and about ten times more than that in pineapple juice (Michodjehoun-Mestres *et al.*, 2009)^[7]. Cashew apple also contains thiamine, niacin and riboflavin in addition to significant amount of minerals, such as copper, zinc, sodium, potassium, phosphorous and magnesium (Lowor and Agyente-Badu, 2009)^[5]. But there are certain boundaries such as inadequate shelf life, vulnerable to microbial infectivity and tannin content which holds back the wide utility and commercialization of cashew apple and their value added products. Therefore, despite of processing, cashew apple is left over as a plantation waste along with other recyclable cashew biomass to improve the physio-chemical and biological properties of the soil. Though the residual cashew apples improves the soil physico-chemical and biological properties, produces unpleasant odour in the plantation and thus, proper processing or value addition is necessary. About 65-80 per cent of the juice can be recovered from the fruits depending upon maturity. Farmers are diffident process cashew apple, due to lack of knowledge on preservation and processing, possible short or long term economic benefits and potential markets for their products.

Corresponding Author:
Bhavana A
Scientist, Department of Home Science, ICAR- Krishi Vigyan Kendra, Chintamani, Karnataka, India

In this context, the aim of this paper is to provide a detailed overview made in the post harvest technologies, preservation, processing technologies and value addition in cashew apples.

Adoption of Post harvest technologies

Cashew apple is a non-climacteric fruit and hence its respiration pattern is also non-climacteric, high respiration rate (62 to 72 ml kg⁻¹ hr⁻¹) and steady increase in ethylene expression rate was observed (200 to 400 ml kg⁻¹ hr⁻¹). Drastic reduction in ethylene release rate and emission of volatile compounds at the post-harvest stage is unreplicable to cashew apple. Tannins are usually referred to as an anti-nutritional factor are the major threat which interferes with the assimilation of proteins in the body, resulting in non-availability of nutrients. Consuming of fresh cashew apple or cashew apple juice is has the presence of tannins (35%). Hence, tannin reduction or de-tanning is an important step prior going for any product to be made out of cashew apple. (Preethi *et al.*, 2020)

Post-harvest spoilage treatment

The delicate skin of cashew apples aid to quick post harvest onslaught by fruit flies which inturn creates platform for fungal inoculums such as Rhizopus, Aspergillus and Colletotrichum to infect the fruits. To avoid this, sudden dip into 0.25% citric acid or 0.3% ascorbic acid or 0.1% sorbic acid is beneficial before fresh consumption or before development of the product. (Preethi *et al.*, 2020)

Cashew apple value added products

Cashew apple juice

Cashew apple juice preparation very simple process where the perty harvested cashew apples are washed made sure to be free from dust or microbial spoilage. Basket press, screw press or hydraulic press are the methods used for juice extraction from cashew apples. Ten grams of Poly Vinyl Pyrrolidone is added to the 8 to 10 litres of extracted juice and passed through muslin cloth for filtration. Clear supernatant is settled after 20 to 40 mins to that supernatant sugar is added 0.5 kg per litre of juice and finally preservatives such as sodium benzoate and citric acid each of 6 g are added for better shelf life. (Sobhana *et al.*, 2011) [10].

Cashew apple squash

Similarly, cashew apple squash can be prepared by keeping high concentration of sugar and citric acid. Cashew apples free from contaminants and microbes are freshly harvested and washed thoroughly in clean water. The juice extraction carried on through basket press, screw press or hydraulic press. Ten grams of Poly Vinyl Pyrrolidone is added to the 8 to 10 lit of extracted juice and passed through muslin cloth for filtration. Clear supernatant is settled after 20 to 40 mins to that supernatant sugar is added 3 kg per litre of juice and at the end preservatives like sodium benzoate of 6 g and citric acid of 100 g. To make one glass of juice three times dilution of squash can be done with water and served (Sobhana *et al.*, 2011) [10].

Cashew apple syrup

For clarified cashew apple juice of 1 lit is added with 2 kg of sugar and kept under the condition moderate heat. Till the sugar dissolves completely the mixture is stirred continuously so that there will be no improper mixing. Then 15 g of citric acid is dissolved with small quantity of the prepared syrup

taken in a bowl and then dissolved into the large quantity and stirred continuously. To make one glass of juice five times dilution of syrup can be done with water and served. (Sobhana *et al.*, 2011) [10].

Fenny

Fenny has been awarded as the Geographical Indication registration in 2009 as a special alcoholic beverage from Goa. It is prepared through fermentation and distillation process of cashew apple. Matured and ripened cashew apples are collected, juice extracted, fermented and subjected to the process of distillation. Distillation method, helps to adjust the concentration of alcohol. The major hydrocarbons, volatile and mineral constituents of fenny are ethanol (42.85%), acetic acid (12.28%), ethyl acetate (55.97%), acetaldehyde (18.28%), furfural (3.22%) and copper (1.04%) (Sobhana *et al.*, 2011) [10].

Cashew apple wine

The required quantity of cashew apples are sorted out from unwanted or spoiled parts then washed thoroughly in clean water. Since, cashew apples have tannins and the action has to be taken to decrease it, the minimally processed cashew apples are immersed in 5 per cent salt solution for 2-3 days for tannin diminution. The apples then will undergo steaming at 15 lb for 15 min. This steaming process can be carried on using pressure cooker or autoclave. The steamed apples are then crushed using squeezer or grinder to procure maximum juice content and filtered using muslin cloth. The preservative sodium metabisulfite is added at 1g/litre juice. Sugar of 1 kg and tartaric acid of 6g are added to the juice with continuous stirring till it reaches 17°Brix. The bacterial culture *Saccharomyces cerevisiae var. bayanus* is added to the prepared mixture at 2 per cent (v/v) and the fermentation process carried out at room temperature (28±3°C) for 6 consecutive days. The TSS of product at the final stage has 2-3°Brix. (Sobhana *et al.*, 2011) [10].

Cashew apple vinegar

Cashew apple vinegar is prepared in two stages as alcoholic fermentation and acidic fermentation. To prepare a starter solution yeast of 2g quantity added to 20ml of coconut water and kept for 12 hours. Cooked and cooled sago gruel of 5g added along with starter solution into 1 lit of extracted unclarified cashew apple juice to clarify the cashew apple juice. This solution is kept for twelve days for alcoholic fermentation to take place in narrow-mouthed plastic bottles, with cotton plugging which completes the stage one fermentation process (alcoholic fermentation). After twelve days, the fermented supernatant juice is separated through filtering (to obtain alcoholic ferment) into a wide mouth glass container or a clay pot and then added with thrice the quantity of mother vinegar for acidic fermentation. This container is kept tied with a muslin cloth, allowing air passage, for 15 days. The clear juice portion is filtered to a clean stainless steel vessel and pasteurized by keeping in boiling water for 10 minutes, cooled and bottled on the 16th day to get vinegar with acidity 5 to 6 per cent. To have continuous vinegar production, the filtrate can be used as the mother vinegar. (Sobhana *et al.*, 2011) [10].

Cash Lime

Cash lime is a blend of cashew apple and lemon juice RTS/Nectar prepared using cashew apple pulp. The nutrient

rich drink can be stored under refrigerated conditions upto five months with maximum retention of nutrients and biochemical quality parameters (TSS10.5°Brix, vitamin C - 72 mg/100 ml, Tannins - 76 mg/100 ml and total phenols - 58 mg/100 ml) compared to the fresh one (TSS- 12°Brix, vitamin C - 86 mg/100 ml, Tannins - 76 mg/100 ml and total phenols - 72 mg/100 ml) keeping tannins contents constant. But if in case the samples stored at room temperature then it will begin to lose its quality after two months of storage. (Preethi *et al.*, 2020)

Cashew Apple Cider

Cashew apple cider analyzed for its functional nutrient value and shelf life aspects in both stored conditions like refrigeration and room temperature as well. Based on biochemical behavior of the products at both the storage conditions, it was observed that the product stored at refrigeration temperature was able to retain maximum of its nutrients till completion of 24 months (vitamin C - 109 mg/100 ml, total phenols - 137 mg/100 ml, CUPRAC Assay - 84 mg/100 ml and FRAP Assay - 246 mg/100 ml) compared to the fresh one (vitamin C - 220 mg/100 ml, total phenols - 205 mg/100 ml, CUPRAC Assay - 98 mg/100 ml and FRAP Assay - 452 mg/100 ml). But, the samples stored at room temperature were found stable with maximum nutrient retention only up to 12 months of storage without any damaging change in sensory quality of the product. (Preethi *et al.*, 2020)

Conclusion

Cashew apple and their products are a very good source of vitamins and minerals and as per health concerns made it has a potential market in the domestic and international platform. Though there are some constraints, processing and preservation criterias, it can be refined and further research has to be taken up to improve quality and palatability of cashew apple products by retaining and enhancing its significant nutritive properties.

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