



PROCESSING AND VALUE ADDITION



Litchi is delicate and highly perishable, with a short storage life, hence, fruit should be sent to consumers on the day of harvest to avoid physiological loss in weight and ensure for maximum fruit quality. Insects, diseases, disorders, nutrition deficiencies, injuries due to transit and storage environment may shorten the post harvest life of litchi. All these have to be controlled by proper pre and post harvest treatment and management to give litchi long shelf life without any loss of nutrients, shape, colour, size and other things. Post-harvest diseases occur due to heat produced owing to accelerated rate of respiration, high temperature in transport containers and storage place. Post harvest technologies involve cooling the fruit, use of various packages and packaging materials and the application of fungicides and other chemicals. The objective of post harvest management should also include the preservation of litchi in the form of various products.

Very negligible quantity of the litchi fruits at present is being utilized for preservation and processing to get the different products out of the season. Due to short harvesting season, tenderness and perishable nature of fruits, large quantities go waste. Indians are fond of table enrichers, which are regularly used along with the main course as well as snacks. Apart from individual households, restaurants, eateries, roadside dhabas, clubs, hotels, caterers etc. are the bulk consumers. There are some branded litchi products. The products like canned litchi and litchi squash are available in the Indian markets but they are costly. Some Indian households make these items during the season. But this practice is gradually disappearing due to changing lifestyles, hassles of making these items and their availability throughout the year from market. There are many variants of these products and with certain change in the ingredients and taste. Litchi processing or preservation is a process in which decay or spoilage of fruits is prevented allowing it to be stored in a fit condition for future use. Every region has its own taste or liking and a care has to be taken to understand it and accordingly the recipe has to be finalized. Compliance with FPO and PFA Act is necessary, if processing is done for the market.

Basic Inputs for Small Processing of Litchi

There is no need to undertake construction by purchasing land. Instead, a readymade premise of around 100 sqm with 2 or 3 rooms would be sufficient for production, storage and packing. Majority of the operations are manual and therefore, production capacity is primarily determined by market. Processing would require facilities such as, gas furnace with burners, cutting and peeling equipments, plastic sealing machine, cap sealer, weighing scales etc., stainless steel utensils, plastic jars and tubs and other tools, bottle washing machine, mixer grinder, miscellaneous assets: furniture and fixtures, storage racks, packing tables. The products like canned litchi, squash, cordial, syrup, RTS (ready to serve), jam, jellies, juice and dried or dehydrated products (nuts) can be manufactured.

(i) Freezing of Litchi

Freezing of whole fruits is the best and most easy method of preserving litchi with its natural flavour and quality for a long time (Fig. 19.1). The fruits can be frozen in syrup with or without stone after peeling. Litchi fruits remain in excellent condition for 12 months when rapidly cooled and kept at -25°C .



Fig. 19.1 Freeze drying of litchi

(ii) Litchi Canning

The canned litchi is of excellent quality and in great demand both in India and abroad. Fully mature ripe fruits of Shahi, Early Large Red, Early Seedless, Rose Scented Purbi or Bedana are selected. After thorough washing, the peels are removed and pulp (aril) destoned with the help of knives. Requisite quantity of pulp (aril) is filled in empty cans to which sugar syrup of 30-35^o Brix is added. Sugar syrup is mixed with 0.2% citric acid and flavoured with rose or vanilla essence (Fig. 19.2). Exhausting of filled can is completed when the temperature in the centre of the can reaches to 85°C and this temperature is maintained for five minutes. The upper lids



Fig. 19.2 Canning of litchi

are then closed with the help of double seamer. These sealed cans are sterilized or processed in boiling water for 30 minutes. After sterilization, the cans are immediately cooled in running water. After cooling the cans are wiped out with dry cloth and stored in dry and cool place. Pink discoloration after 3 months of storage is the main problem which increases gradually and diminishes the consumers appeal. This is possibly associated with formation of a tin anthocyanin complex.

(iii) Juice Preservation

Litchi juice extracted with the help of basket press is preserved by 700 ppm SO_2 , Juice is first pasteurized at 85°C for 15-20 minutes. During pasteurization 0.2% citric acid dissolved in a little quantity of water may be added. After cooling 0.12 per cent potassium meta-bi-sulphate dissolved in little quantity of water is thoroughly mixed. Juice is then filled in sterilized bottles and after capping stored in cool and dry place. Such preserved juice may be used in preparation of various beverages i.e. squash, nectar, RTS, cordial and syrup, etc (Fig. 19.3).

Juice as such added with sugar is also a very refreshing drink. In its preparation juice may be mixed with 15% sugar and heated to 85°C for 15-20 minutes. The hot juice is immediately filled in the bottles, crown corked and again filled bottles are sterilized at 85°C for 20-30 minutes by keeping them in water. A layer of cloth is placed at the bottom of the bottle to prevent breakage during heating.

Another method of litchi pulp preservation is by heating at 85°C and then adding 500 ml/l SO_2 and 1% citric acid and filling in glass bottles which are sealed with corks and made air tight by dipping in molten paraffin wax. The pulp remains acceptable organoleptically for 6 months at room temperature ($25^\circ\text{--}35^\circ\text{C}$) and upto 12 months at low temperature ($4\text{--}5^\circ\text{C}$). Brownish discoloration is commonly observed when juice is preserved at room temperature which can be prevented by keeping bottles of juice at low ($4\text{--}5^\circ\text{C}$) temperature.

(iv) Squash

Squash is prepared by blending the juice with sugar, citric acid and water and preserved chemically with 350 ppm SO_2 . As per F.P.O. specification the squash must contain 25 percent juice and at least 40° Brix (T.S.S.). The recipes contain juice-1 kg, sugar-1.5 kg, citric acid-8gm, water-0.750 litre, potassium meta-bi-sulphite-0.06% and vanilla or rose essence-15 drops (0.5 ml). First of all sugar syrup is prepared by dissolving sugar in water by heat application.



Fig. 19.3 Litchi juice

During heating, citric acid dissolved in little quantity of water is mixed with syrup. The syrup is then allowed to cool and after straining, the sugar syrup is mixed with juice. Potassium meta-bi-sulphate dissolved in little quantity of water is mixed with prepared squash. Required quantity of essence is added to enhance the flavour. The squash is served after diluting three times with water. Another recipe for the litchi squash is juice-1litre, sugar-1.25 kg, water-0.75 litre, citric acid-30g and potassium meta-bi-sulphate-11.8g.

Mixed squash can be prepared from the fruit juices of orange, lemon, mango, litchi, aonla, carrot, raspberry, pineapple etc. The recipe for mixed squash contains mango juice- 0.5 litre, litchi juice-0.5 litre, lemon juice-0.5 litre, sugar-2.5 kg, water-2 litre, citric acid- 45g and potassium meta-bi-sulphate-3.25g.

Indian Agricultural Research Institute, New Delhi, has provided recipe for litchi squash is as preserved juice-1 kg, sugar-1 kg, water-400ml, citric acid-8g, potassium meta-bi-sulphate-1 g and rose essence-20 drops (0.8 ml).

Calcuttia and Desi cultivars have been found superior in comparison to other cultivars and maintained its organoleptic quality for a longer period as squash. The browning of litchi squash which is usually observed at room temperature storage (25-30°C) after 3 months can be reduced by low temperatures storage (4-5°C) and addition of 100 mg / litre ascorbic acid in the squash.

(v) Litchi Syrup

A fruit syrup is the sweetened juice of a fruit usually with a high concentration of sugar and containing a small quantity of fine pulp of the fruit usually with a low acid content. Syrup does not spoil due to high sugar content. Litchi juice can also be utilized in preparation of fruit syrup. There are many recipes for litchi fruit syrup. One recipe includes juice-1 litre, sugar-1.5 kg , citric acid- 10.4g and essence-½ ml and another consist of juice-1 litre, sugar-7 kg, water-2litre, citric acid-28 to 56g and essence-3-12 ml.

Juice sugar and citric acid are made into syrup by applying heat. The scum, if any, is removed and syrup is strained and cooled. In second recipe, sugar is first dissolved in water by applying heat. Scum is removed, strained and cooled. Juice is then mixed with sugar syrup. After adding required quantity of vanilla or rose essence, the syrup is filled in sterilized bottles and capped. After proper dilution with water, it is served as soft drink.

(vi) Cordial

Cordial is a clear, sparkling, sweetened juice from which the pulp and other suspended materials are completely eliminated. It is mostly used after duration with certain alcoholic drink. For preparation of litchi cordial, first of all, juice is extracted and filtered. Filtered juice is stored in large sized glass container. This is preserved by adding 1.2 g potassium metabisulphite per litre of juice after dissolving in a little water. The preserved juice is allowed to stand for at least 10 to 15 days. Within the period, suspended matter will settle down. The supernatant clear juice

is siphoned out and used in cordial making. There are three recipes which may be adopted in the preparation of cordial. The first contains juice-1 kg, sugar-1.25 kg, water-1 litre, potassium meta-bi-sulphate-2 g and vanilla or rose essence -1/2 ml. The second recipe has juice-1 kg, sugar-2.25 kg, water-200ml, potassium meta-bi-sulphate-2.5 g and vanilla or rose essence-1.25 ml. The third recipe contains 1 litre litchi juice, 1.5 kg sugar, 600 ml water, 2.2 gms potassium metabisulphite, 30 gms citric acid. It is prepared by dissolving sugar in requisite quantity of water. All other ingredients are added according to the procedures followed in squash making. The prepared cordial is strained through a fine muslin cloth and then bottled.

(vii) Jam

Litchi jam is prepared from the fruit pulp. The pulp is taken out and mixed with 1/4th quantity of water and then heated to make it soft. It is then cooked with 3/4th quantity of sugar. During cooking when temperature reaches to 102°C, citric acid @ 2g per kg dissolved in little quantity of water is added. The cooking is stopped when the temperature reaches 106°C. Before filling in the wide mouth glass jar, sodium benzoate @ 0.02 percent dissolved in little quantity of water is mixed with jam. A layer of molten paraffin is spread on the top of the jam filled in the jar.

(viii) Litchi Sherbet

Litchi lends a refreshing flavor to this simple sherbet. The ingredients are peeled and seeded 24 litchi, 1^{1/4} packet unflavored gelatin, 1/4 cup cold water, 2/3 cup milk, 1/2 cup sugar, 1 cup half-and-half and 1 teaspoon lemon juice. Litchi fruit are placed in a blender or food processor and pulsed until finely chopped. Two layers of cheese cloth over a bowl are placed. Chopped litchi is poured into cheese cloth. Litchi juice is squeezed out to fill 1 cup. Solids are discarded. In a medium bowl, unflavored gelatin is sprinkled over the cold water. It is left for 5 minutes to bloom. 1/3 cup of the milk is poured into a small saucepan. Heating is done until small bubbles begin to form around the edge of the pan. The pan is removed from heat and scalded milk is added to the gelatin water. It is stirred vigorously until gelatin is dissolved. Then sugar is added and stirred until no granules remain, then remaining 1/3 cup milk, half-and-half, litchi juice, and lemon juice are added. It is mixed well with the help of manual or electric ice cream maker.

(ix) Fermented Beverage from Litchi

A quality litchi wine (a fermented beverage) with about 11% alcohol, typical rosy flavour and high nutritional value can be prepared by adjusting the fermentation process of the juice by using wine yeast (*Saccharomyces cerevisiae* var. *bayamus*). Litchi is a distinctly delicious, aromatic and fascinating fruit having good source of mineral and vitamins. The TSS of the litchi fruits is about 20° brix, with 27 per cent reducing sugar and 0.5 per cent acidity is highly

suitable for preparation of wine. Besides these, litchi fruits have their own rosy aroma and flavour which adds to the quality of wine (Fig. 19.4). To utilize the surplus and physically damaged unmarketable fruit for production of litchi wine would be a novel dish to the Indian cuisine apart from its export to the user countries. The wine industry in India will provide considerable opportunities for value addition, income and employment generation in the agro processing sector.



Fig. 19.4 Litchi (A) Wine making process, and (B) Finished products

(x) Litchi Nuts

Litchis are also marketed as the traditionally known “litchi nuts” (Fig. 19.5), and canned, in syrup. In these forms, they can be distributed without refrigeration. To obtain a quality product, the drying operation must begin with “washing” the fruit well in boiling water or steam at atmospheric pressure for 15 minutes. This is followed by a sulphur dioxide treatment similar to that applied to fresh fruit to obtain a good colour. If for any reason the colour has not returned after treatment,



Fig. 19.5: Litchi Nuts

Rapid dipping in a weak solution of hydrochloric acid is recommended. The fruits are then washed in clean water. Actual drying should begin in the sun, which will help convey a more natural colour to the final product. Care must be taken to turn the litchis from time to time so that the colour will be uniform over the entire surface. Drying may continue in the sun or in an oven at 26-27°C until the pulp contains only approximately 30 percent of its initial water content. To prevent the skin and pulp from shrinking, care should be taken to avoid rapid drying in the first 6-12 hours. It is also advisable to begin drying in the shade for the first two hours after treatment with SO₂. This reduces the risk of skin-cracking.

(xi) Jelly

Jelly can also be prepared from the mature litchi fruits. The juice is first extracted and the quantity of pectin is tested by alcohol test. As per pectin strength the required quantity of sugar is added and cooked. Citric acid @ 7g per kg of sugar used is mixed with little quantity of water and added while cooking. The end point reaches at 105^o to 107^oC. Then cooking is stopped and after removing the scum, product is filled in wide mouth glass jar. Excessive sweetness and tartness, singly or combined masks natural flavours. Sweetness is increased by heating sucrose in acid solution or by higher sugar concentration. Good jelly formation requires a high ratio of juice to sugar. Litchi jelly made with juice of 18% soluble solids and combined with sugar in a 55.45 ratio exhibits a strong natural flavor and high quality. However, because of proportionately high content of litchi juice, the expense of manufacturing is high. A good litchi jelly may be prepared with the juice of 16% or more soluble solids and combined by weight with sugar in a 50:50 ratio. The juice pH should be adjusted with phosphoric acid to pH 3.7 and subsequently to pH 3.2 with citric acid. The addition of 1% commercial slow set pectin to litchi jelly was found sufficient for good gel formation

(xii) Litchi Salad

Litchi salad is prepared by tossing litchis with potatoes, peas, cucumber, macaroni, carrots and cheese with lemon. The ingredients are: 1 cup peeled litchis, 1 cup boiled and quartered potatoes, 1 cup boiled peas, 1 cup quartered cucumbers, 1 cup boiled macaroni, 1 cup boiled and quartered carrots, 2 tbsp chopped fresh green coriander, 1/2 cup diced cheese, 1 cup quartered tomato, capsicum 1/2 cup, juice of three lemons, salt and pepper. All ingredients are mixed together and tossed in the lemon dressing. It is chilled before adding the dressing (Fig. 19.6).

(xiii) Litchi Souffle

The ingredients of souffle include 100 ml milk, 5 tbsp sugar, 3 egg yolks, 3 egg whites, 2 tsp gelatin, 3 tsp water, 4 tbsp cream, litchi pulp 1/2 cup and juice of 1 lemon. Milk is heated and then removed from fire. Sugar is added and beaten egg yolks in the lukewarm milk and cooked on slow fire till it reaches custard like consistency and the cooled. Gelatin is dissolved in warm water and added to cold custard. Egg whites is beaten till stiff and folded into the cold custard. Beaten cream and litchi pulp, lemon juice mixture are mixed and kept in a pre-cooled mould and chilled in refrigerator till set



Fig. 19.6: Litchi Salad