



# PM Formalisation of Micro Food Processing Enterprises Scheme

## Processing of Passion Fruit Jam



**AATMANIRBHAR BHARAT**

**National Institute of Food Technology, Entrepreneurship and  
Management (NIFTEM) - Thanjavur**

(an Institute of National Importance under Ministry of Food Processing Industries, Government of India)

Pudukkottai Road, Thanjavur – 613005

<https://niftem-t.ac.in/>

Ph : 04362-228155, Fax:04632-227971

## TABLE OF CONTENTS

|                                                         | Page No. |
|---------------------------------------------------------|----------|
| <b>Chapter 1: Introduction</b>                          |          |
| 1.1 Status and Market size                              | 2        |
| 1.1.1. Commercially grown varieties                     | 3        |
| 1.1.2. Production status of Passion fruit               | 4        |
| 1.1.3. Composition & Nutritive Value of Passion fruit   | 5        |
| 1.1.4. Health benefits of Passion fruit                 | 6        |
| 1.1.5. Medicinal properties of Passion fruit            | 7        |
| 1.2 Indian Market Outlook                               | 9        |
| 1.3 Value added products from Passion fruit             | 9        |
| 1.4 Harvest & Post harvest handling of Passion fruit    | 10       |
| <b>Chapter 2: Processing of Passion fruit Jam</b>       |          |
| 2.1 Process flow for production of Passion fruit Jam    | 13       |
| 2.2 Critical points in Processing                       | 16       |
| 2.3 Defects in Processing                               | 16       |
| <b>Chapter 3: Packaging of Passion fruit Jam</b>        |          |
| 3.1 Criteria for packaging material                     | 18       |
| 3.2 Packaging material for Jams                         | 18       |
| <b>Chapter 4: Food Safety Regulations and Standards</b> |          |
| Food Safety Regulations & Standards                     | 21       |
| Machineries Manufacturers & Suppliers                   | 30       |

# CHAPTER 1

## INTRODUCTION

### 1.1. Status and Market Size

Passion Fruit (*Passiflora edulis* Sims) is a native of Brazil. It belongs to the family Passifloraceae. It is grown mostly in tropical and sub-tropical parts of the world from South America to Australia, Asia and Africa. Common names of passion fruit are granadilla, parcha, parchita, parchita maracuya, or ceibey in Spanish, maracuja peroba in Portuguese and grenadille, or couzou in French. The purple form is called purple, red, or black granadilla, or, lilikoi in Hawaii, mountain sweet cup in Jamaica and linmangkong in Thailand. The yellow form is widely known as yellow passion fruit and is called yellow lilikoi in Hawaii, golden passion fruit in Australia and parchaamarilla in Venezuela. In India, passion fruit was introduced in early part of twentieth century in the Nilgiris, Coorg and Malabar areas of Southern India.

Passion fruit is grown in most tropical and subtropical parts of the world, and it is particularly important commercially in Australia, Hawaii, South Africa and Brazil. Brazil is the world's foremost producer of passion-fruit. Brazil, Ecuador Venezuela, South Africa, Sri Lanka, Australia, Papua New Guinea, Fiji, Hawaii, Taiwan and Kenya account for more than 90% of the world's passion fruit production. Brazilian production is around 478,000 t with a yield of about 13.8 t/ha. The total global supply of passion fruit is estimated at 8.52 lakh tons. Brazil and Ecuador have dominant share in the world export market. It is followed by Australia and New Zealand in export of the fruit to other countries. Kenya and South Africa also have a decent production of passion fruit and its area under cultivation is growing rapidly.

In India, though passion fruit was introduced in early part of twentieth century but its cultivation was limited to few districts of Karnataka, Kerala and Tamil Nadu. Since last one decade passion fruit cultivation started in some parts of northern India, especially North - Eastern states. The area under this crop is rapidly increasing in Mizoram, Nagaland, Manipur and Sikkim. There is a great potential for passion fruit cultivation in these states. Presently passion fruit is cultivated in Munnar and Waynad of Kerala, Nilgiri hills and Kodaikanal of Tamil Nadu, Kodagu (Coorg) region of Karnataka and parts of Mizoram, Nagaland, Manipur and Sikkim.

The estimated area and production of passion fruit is 9.11 thousand ha and 45.82 thousand tones, respectively. Manipur and Nagaland are the leading states in passion fruit production contributing 70 percent area and production of the country. In Nagaland Kohima, Mokokchung, Wokha, Phek are main passion fruit producing districts. The average productivity of passion fruit in India is around 5.02 tons/ha which much lower than countries like Brazil, Australia, Colombia etc where productivity is 30-35 tons/ha.

There is immense potential passion fruit cultivation in North Eastern states , humid tropical areas parts of Karnataka , Kerala and Tamil nadu. These areas have all sets of climate and sufficient rainfall for growing passion fruit successfully.

### **1.1.1. Commercially grown varieties**

Passion fruit has two distinct forms, the standard yellow (*Passiflora edulis f. flavicarpa*) and the purple (*Passiflora edulis f. edulis*). The yellow fruits are more acidic and less starchy while the purple fruits are less acidic and more starchy. Both the varieties, purple passion fruit and yellow passion fruit are of commercial importance. The hybrids of these two have also been developed for cultivation.

#### **a. Purple Passion Fruit**

The vines of purple passion fruit are moderately vigorous and more productive at higher elevation. Generally fruits are smaller than yellow passion fruit. Fruit are 4 to 5 cm in diameter and deep purple colour when ripe. The average fruit weight ranges between 37-50 g. The juice content of the fruit varies from 35-38% and has a better flavour and aroma as fresh, canned and frozen juice or pulp than the yellow one. The seeds are black in colour. The commercial cultivars of the purple form are Ouropretano, Muico, Peroba, Pintado etc. in South America. In India, there is no standard cultivar. The local lines such as Ooty Purple, Coorg Purple, Moodabidri Purple, Thrissur Purple, Cherapunji Purple, Thaliparamba Purple, Ambalavayal Purple etc. are cultivated by the growers.

## **b. Yellow Passion Fruit**

The yellow passion fruit has a more vigorous vine. This type is suitable for lower elevation and is less productive at higher elevation due to its sensitivity to low temperature. The fruit is generally big, weighing about 60 g. The fruits are round in shape with yellow mottled spots and turns to golden yellow when ripe. Juice is more acidic. Seeds are brown. The local varieties such as Ooty Yellow, Coorg Yellow, Munnar Yellow etc.

## **c. Hybrid Varieties**

The hybrids of yellow and purple form have been developed for combining the desirable characteristics of both the forms of passion fruits. Several hybrid varieties have been developed in Brazil, Australia, South Africa, etc. In India, a hybrid 'Kaveri' of purple and yellow form was developed at Central horticultural Experimental Station, Chettalli, Coorg, Karnataka.

### **❖ Kaveri Hybrid Passion fruit**

This variety is a high yielding hybrid developed from Central Horticultural Experiment Station, Chettalli in 1986. This is a cross between purple and yellow varieties. The fruits are ovoid to round and purple dotted. The average fruit weight ranges between 90-100 g. Each plant bears 40-60 fruits per annum. The average yield of a grown-up orchard is around 60-70 tonnes per year.

Its fruit yield is around 200 tonnes per ha over a three-year cropping period. Fruits contain 25-30 per cent juice, 11.5-12.0 percent sugars and 3.0-3.5 mg citric acid/100ml of Juice. This variety is tolerant to Alternaria leaf spot, Fusarium collar rot and nematodes. This variety is popular in Karnataka, Kerala, Tamilnadu and North Eastern States.

## **1.1.2. Production status of Passion fruit**

The estimated area and production of passion fruit is 9.11 thousand ha and 45.82 thousand tones, respectively. Manipur and Nagaland are the leading states in passion fruit production contributing 70 percent area and production of the country. In Nagaland Kohima, Mokokchung, Wokha, Phek are main passion fruit producing districts. The average productivity of passion fruit in India is around 5.02 tons/ha

which much lower than countries like Brazil, Australia, Colombia etc where productivity is 30-35 tons/ha.

**Table 1: State-wise area, production and productivity of Passion fruit**

| State      | Area (ha.) | Production (T) | Productivity (T/ha) |
|------------|------------|----------------|---------------------|
| Nagaland   | 7540       | 13741          | 1.98                |
| Manipur    | 3952       | 44850          | 11.34               |
| Meghalaya  | 943        | -              | -                   |
| Mizoram    | 820        | 7850           | 9.57                |
| Sikkim     | 500        | -              | -                   |
| Karnataka  | 500        | -              | -                   |
| Kerala     | 300        | -              | -                   |
| Tamil Nadu | 100        | -              | -                   |

*Source: FAO Production Yearbook, 2000*

### 1.1.3. Composition & Nutritive Value of Passion fruit

**Table 2: Nutritive value of passion fruit per 100 g of edible portions**

| Composition     | Species          |                                         |                          |
|-----------------|------------------|-----------------------------------------|--------------------------|
|                 | <i>P. edulis</i> | <i>P. edulis</i> var. <i>flavicarpa</i> | <i>P. quadrangularis</i> |
| Moisture (%)    | 85.6             | 84.9                                    | 88.0                     |
| Protein (g)     | 0.9              | 0.7                                     | 0.9                      |
| Fat (g)         | 0.1              | 0.2                                     | 0.2                      |
| Carbohydrate(g) | 13.6             | 13.1                                    | 10.1                     |
| Ash (g)         | 0.3              | 0.5                                     | 0.9                      |
| Ca (mg)         | 3.6              | 3.8                                     | 10.0                     |
| P (mg)          | 12.5             | 24.56                                   | 22.0                     |
| Fe (mg)         | 0.2              | 0.4                                     | 0.6                      |

|                    |       |       |     |
|--------------------|-------|-------|-----|
| Vitamin A (IU)     | 717   | 2410  | 70  |
| Thiamine (mg)      | Trace | Trace | -   |
| Riboflavin (mg)    | 0.1   | 0.1   | -   |
| Niacin (mg)        | 1.5   | 2.2   | 2.7 |
| Ascorbic acid (mg) | 30    | 20    | 20  |

*Source: Nutritive value of Indian foods, NIN,2019*

#### **1.1.4. Health benefits of Passion fruit**

##### **1. Rich in antioxidants**

Antioxidants fight toxic substances that cause damage to internal tissues. Polyphenols act as antioxidants and have anti-inflammatory effects, which reduces the risk of chronic inflammation and heart disease. Vitamin C is an antioxidant that boosts the immune system and promotes healthy aging.

##### **2. Good source of fibre**

Fibre improves digestion and prevents constipation. The fibre from passion fruit helps in improving digestion, preventing blood sugar spikes. Fibre eases bowel movement.

##### **3. Good for diabetics**

Passion fruit is low on the glycemic index, and therefore maintains insulin levels for diabetics. The passion fruit health benefits include high fibre content gives one the feeling of fullness, reducing cravings and unhealthy snacking.

##### **4. Prevents osteoporosis**

Being a good source of minerals like magnesium, calcium, potassium, sodium, iron, phosphorus, etc. passion fruit health benefits include keeping bones healthy. The minerals maintain bone density and prevent osteoporosis. They also accelerate the recovery of damaged bones.

##### **5. Boosts immunity**

Research has shown that the antioxidants in passion fruit strengthen the immune system. This is mostly due to the presence of vitamin C, carotene, and cryptoxanthin.

##### **6. Reduces blood pressure**

One serving of passion fruit every day provides one-fourth of the body's daily requirement of potassium. This mineral relaxes blood vessels and increases blood flow, which reduces blood pressure and improves cardiovascular health.

### **1.1.5. Medicinal properties of Passion fruit**

The health benefits of *Passiflora edulis* are attributed to the presence of phytoconstituents like Alkaloids, phenols, glycosyl flavonoids and cyanogenic compounds. These are beneficial for the treatment and prevention of diseases such as anxiety, diabetic, cardiovascular diseases, sedative, convulsive, asthma, osteoarthritis, cancer, etc.

#### **a. Diabetes**

The presence of phenols and flavonoids may be responsible for the observed hypoglycemic activity of Passion fruit. The presence of fibers, pectin which forms viscous mixture can change the gastric emptying time, increases satiety and delay the absorption of simple carbohydrates, also ability to form complexes with bile salts increases the cholesterol excretion. Passion fruit has a significant content of iron, potassium, zinc and manganese. The mechanism is due to the presence of fiber, tannins and phenolic compounds which reduces the digestion and absorption of carbohydrates, increased the sensitivity of muscle and adipose tissue to insulin. The effect of dietary fiber on insulin sensitivity is the attenuation of the glycemic response to carbohydrate through their mechanical action in the intestine where they tend to slow the absorption of nutrient. Passion fruit juice also helps in reduction of total cholesterol, triglyceride, LDL-C and increased HDL-C which may have beneficial effect in prevention and treatment of dyslipidemias and hyperglycemias.

#### **b. Sedative and anticonvulsant**

Passion fruit and its flower contain medicinal alkaloids, its phytonutrients are known to have mild sedative properties. It was found that eating passion fruit relaxes the nervous system and induces sleep. It also showed anti-convulsant activity protecting against seizure.

#### **c. Antimicrobial activity**

The crude extract petroleum ether of passion fruit leaf at (500µg/disc) showed anti-bacterial activity for *Bacillus megaterium* and *Pseudomonas aeruginosa* and moderate antibacterial activity (gram positive bacteria like *B. megaterium*, *B. Subtilis*, *S. Aureus* and *Sarcinalutea*, gram negative bacteria like *E. Coli*, *P. aeruginosa*, *S. paratyphi*, *S.typhi*, *Shigella boydii*, *Vibrio mimicus*).

#### **d. Antioxidant activity**

The phenolic compounds present in the extract passion fruit might be the major contributors to the antioxidant activities.

#### **e. Anticancer activity**

Passion fruit contains high amount of vitamin A and vitamin C both of which are strong anti-oxidants. They neutralize free radicals and protects from cancer. The flavonoids further enhance the potency of passion fruit in providing antioxidant to body and protecting from cancer. The studies have also shown that in cancer patients, passion fruit can kill the cancerous cells in vitro. Antioxidants in passion fruit primarily eliminate free radicals, which are known for mutating the DNA of healthy cells into cancerous ones.

Passion fruit is found beneficial in high blood pressure and diabetic. High potassium content makes passion fruit highly effective in protecting from blood pressure. Potassium regulates electrolyte balance and controls the muscle function of our entire body including heart muscles that create heartbeat. Passion fruit contain high amount of fibre which reduces cholesterol levels in blood. It increases HDL-C and reduces LDL-C. The anti-oxidant activity of passion fruit clears the plaque formation along the inner lining of arteries. A daily dose of 220 mg passion fruit peel was administered to 41 type II diabetic patient to reducing cardiovascular risk and found that there was a significant reduction in blood pressure. Passion fruit is a rich source of dietary fibre, both soluble as well as insoluble fibre. Insoluble fibre helps in bowel movement and cleaning the digestive system. Passion fruit is among those healthy food which is beneficial for eye, containing high amount of antioxidants like vitamin A, Vitamin C and flavonoids.

## **1.2. Indian Market Outlook**

In India, passion fruit was introduced in early part of twentieth century and its cultivation was limited to few districts of Karnataka, Kerala and Tamil Nadu. Since last one-decade passion fruit cultivation started in some parts of northern India, especially North - Eastern states. The area under this crop is rapidly increasing in Mizoram, Nagaland, Manipur and Sikkim. There is a great potential for passion fruit cultivation in these states. Presently passion fruit is cultivated in Munnar and Waynad of Kerala, Nilgiri hills and Kodaikanal of Tamil Nadu, Kodagu (Coorg) region of Karnataka and parts of Mizoram, Nagaland, Manipur and Sikkim.

The estimated area and production of passion fruit is 9.11 thousand ha and 45.82 thousand tones, respectively. Manipur and Nagaland are the leading states in passion fruit production contributing 70 percent area and production of the country. In Nagaland Kohima, Mokokchung, Wokha, Phek are main passion fruit producing districts. The average productivity of passion fruit in India is around 5.02 tons/ha which much lower than countries like Brazil, Australia, Colombia etc where productivity is 30-35 tons/ha.

There is immense potential passion fruit cultivation in North Eastern states, humid tropical areas parts of Karnataka, Kerala and Tamil nadu. These areas have all sets of climate and sufficient rainfall for growing passion fruit successfully.

The fresh whole fruit has a very low shelf life of 1 week; because of this perishable nature passion fruits produced during a particular season results in a glut in the market and become scarce during other seasons.

## **1.3. Value added products from Passion fruit**

### **1.3.1. Juice**

The passion fruit juice is mixed with strained syrup solution (as per requirement) and the mixture is homogenized. This RTS beverage is filled in glass bottles and corked tightly. The bottles are pasteurized at 85°C for 20 min and cooled to room temperature. The RTS bottles are stored at ambient temperature and usually chilled for serving.

### **1.3.2. Squash**

The fruit juice is strained to remove seed and unwanted particles from juice. The juice is measured to prepare sugar syrup. The sugar syrup is prepared by mixing 1.8 kg sugar, 1 L water and 15 g citric acid and then strained to remove dirt and scum. Once the sugar is completely dissolved, the syrup is mixed with juice homogeneously. Permitted level of Sodium benzoate is added and the squash is bottled in clean and sterilized bottles.

### **1.3.3. Jam & Jelly**

Using pectin as a setting agent, the fruit pulp can be converted to jam by adding sugar and boiling, whereas the juice can be transformed into jelly under definite conditions of sugar and pectin concentrations. The fruit juice though it has very less pectin content, the skin is an excellent source of pectin. So an extract of the skin is an excellent and inexpensive source of pectin.

## **1.4. Harvest & Post Harvest handling of Passion fruit**

### **1.4.1. Harvesting**

The first harvest extends from August to December and the second one from March to May. The first fruits are obtained from the ninth month and full bearing is reached in 16-18 months. Several different indices may be used to determine harvest maturity of passion fruit, including the length of time after transplanting, after bloom and external skin colour. Initial fruit harvest from seeded yellow passion fruit plants normally begins about 10 months after transplanting, with full production occurring after 18 months. Grafted passion fruit plants begin initial production earlier, after about 7 months. The timing of initial harvest depends on the vigour of the plant and environmental growing conditions. The fruit matures in about 75 days after flowering and will naturally fall to the ground when fully coloured and mature.

The most obvious index of fruit maturity is external skin colour. As the fruit matures, the skin colour will change from green to either yellow or purple, depending on the type of passion fruit. Green fruit or fruit with limited colour, is not fully ripe and should not be harvested. Incompletely coloured fruit will be higher in acidity, lower in flavour

and aromatic compounds, and may not develop a full yellow or purple colour after harvest.

The minimum ripeness stage for initiation of harvest should be when at least 50% of the fruit surface has turned yellow or purple. Fruit quality will improve if the fruit are allowed to completely change colour and ripen on the vine. Passion fruit will turn a deep purple or yellow colour when ripe and eventually fall to the ground after full colouration. Colour changes in the fruit begin 7 to 21 days before the fruits abscise, depending on cultivar and environmental conditions.

Fruit intended for immediate processing into juice products may be allowed to fully ripen on the vine and naturally abscise, falling to the ground. The fruit should be collected off the ground on a daily basis and processed as soon as possible.

#### **1.4.2. Harvesting method**

Passion fruit is harvested manually by cutting or clipping the fruit off the vine. The recommended harvest tools are a sharp knife or clippers with a sharp edge. Fruit should be picked at the stricture in the stem and not close to the shoulder of the fruit. A short piece of stem, approximately 4 cm (1.5 inches) in length should be left attached to the fruit to help prevent water loss and fungal development. The fruit should not be pulled from the plant. All the fruits on the trellis should be reachable from the ground.

The fruit should be harvested with care and put in a plastic bucket or field container without dropping or throwing. The fruit should always be handled gently to avoid bruise damage and the inner surface of the field container should be lined with newspaper or padding to minimize fruit scarring. No more than 15 kg of fruits should be put in the harvest container in order to avoid compression bruising of the fruit. The field container should be strong and capable of being stacked without damaging the fruit.

#### **1.4.3. Yield**

A mature passion fruit vine normally produces two to three crops annually; one main harvest followed by several smaller crops. Therefore, passion fruits are usually available for harvest year round. On an average, yield of 10-12 tonnes per hectare per year can be obtained. The vines are perennial and can produce yield for 10 to 15 years but maximum production can be obtained up to six years after which the yield declines

The average fruit weight ranges between 90-100 g. Each plant bears 40-60 fruits per annum. The average yield of a grown-up orchard is around 60-70 tonnes per year. Its fruit yield is around 200 tonnes per hectare over a three-year cropping period.

#### **1.4.4. Storing and Transporting**

The initial sorting of marketable versus unmarketable fruits should be made in the field at the time of harvest. Severely damaged, decayed, over-ripe fruits, or unmarketable fruits should be put into a separate container and discarded in a location away from the passion fruit vines to minimize the build-up of decay-causing microbial growth in the field.

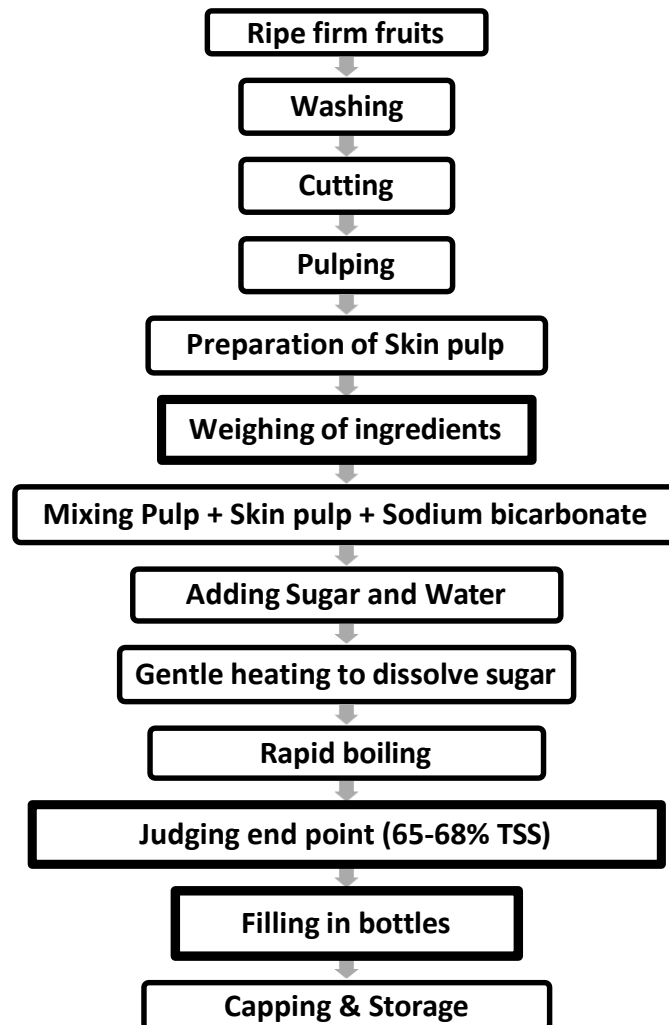
The field containers with marketable fruits should be put in the shade to avoid overheating of the fruit prior to transport to the processing area. Passion fruit should never be harvested when wet, as this will encourage the spread of disease. Fruit harvested when wet and stored in unventilated crates or sacks will rapidly spoil. The fruits may be packed in net sack bags (to enable proper ventilation) or plastic crates and transported to processing centre.

Passion fruit picked fully ripe will have only about a 7 to 10-day shelf life. The sooner the optimum storage temperature is obtained, the longer fruit quality can be maintained and water loss is minimized. Maximum postharvest life of yellow passion fruit is of 2 to 3 weeks obtained at 7°C storage, while purple passion fruit should be stored at 4°C to have a 4-5-week shelf life. Passion fruit held at temperatures above optimum will ripen more quickly and lose more weight. Below the optimum storage temperature, the fruit will suffer from low temperature chilling injury. With proper temperature control, longer shelf life can be obtained.

## CHAPTER 2

### Processing of Passion Fruit Jam

#### 2.1 Process Flow chart for Production of Passion Fruit Jam



##### 2.1.1. Washing

The The fruits are washed to remove extraneous matter. Simultaneously, the fruits are inspected to remove any immature, spoiled, bruised or damaged ones.

##### 2.1.2. Cutting

The washed fruits are manually cut into two. Simultaneous removal of any undesirable fruits are done. This process is done using food grade Stainless steel knives.

### **2.1.3. Pulping**

Pulping may be done manually or mechanically. Manually, spoons are used by workers to scoop out the pulp. The pulp is then liquidized at low speeds using blenders. Low speeds are employed to avoid chipping of seeds, as they appear as black specks in the jam, which are very difficult to remove and give the product a bad appearance.

Mechanical pulpers are also used for passion fruit pulping. Here the seeds, pulp and the rind are separated. The pulp and the rind go for further processing, wherein the rind becomes source of pectin for the jam

### **2.1.4. Preparation of skin pulp**

The Skin pulp is the source of pectin for the jam, since the fruit pulp has very low pectin.

- ❖ The same quantity of skins, as skin pulp required is taken. The skins are boiled for approximately 30 minutes, until the flesh of the skin is soft and translucent.
- ❖ Then they are removed from the water and flesh from the outer cuticle is scooped out.
- ❖ This softened flesh is liquidized with water (2 parts softened flesh to 1-part water) until it forms a smooth cream. The water in which the skins were boiled can be used as this will contain pectin washed out during the boiling.
- ❖ The mixture is squeezed through a muslin cloth to remove hard pieces of pith.

### **2.1.5. Weighing of ingredients**

The ingredients are to be weighed in the following proportion

Assuming a batch size of 100 kg,

- ❖ Fruit pulp: 20 kg

- ❖ Skin pulp: 20 kg
- ❖ Sugar: 50 kg
- ❖ Water: 11 kg
- ❖ Sodium bicarbonate: 0.015 kg (15 g)

#### **2.1.6. Mixing of Ingredients**

The weighed fruit pulp and skin pulp are mixed with the Sodium bicarbonate before boiling. Sodium bicarbonate is generally added to passion fruit juice to decrease the acidity. Then sugar and water are added. The mix is heated gently at first to ensure the sugar has dissolved.

#### **2.1.7. Boiling**

After sugar is dissolved, the mix is boiled rapidly to evaporate the water. Rapid heating is continued until the jam thickens. By optimally reducing the amount of water in the starting recipe, the boiling time can be reduced.

Continuous stirring should be done during boiling to make sure the jam does not stick to the base of the pan. Jam should not be over-boiled as this can give rise to caramel flavours, over sweetness and discolouration, apart from being a waste of energy.

#### **2.1.8. Judging the Endpoint**

When the jam starts to thicken, it is important to test for the end point at frequent intervals. Endpoint should be measured using a Refractometer for consistency. Temperature/ other tests can be used, but these are not consistent methods. The final Total Soluble Solids (TSS) content of a jam or “end-point of the jam” should be 65 to 68%. Once this TSS is reached, the boiling is stopped.

#### **2.1.9. Packaging**

The jam should be allowed to cool slightly (to about 80°C for glass jars and 60°C for

plastic jars). Then the jam is filled into clean, sterilized jars.

The jars should be warm to prevent them from cracking when the hot jam is poured in. If the jam is cooled too much it will be difficult to pour. Place the clean lids on top and fasten. Invert the jars to form a seal. The filled jars can be placed in water to cool down the jam so that it does not keep cooking in the jar. The gel starts to form as the temperature of the jam reduces (about 55°C) and continues until it is cold.

## **2.2 Critical points in Processing**

- ❖ The weighing of ingredients should be done accurately, as it affects the total quality of the product.
- ❖ The correct sugar content is critical for proper gel formation and for preservation of the jam or jelly.
- ❖ Refined, granular and pure sugar is preferable for a high quality product.
- ❖ Monitoring of the final TSS content is very critical it influences the setting, texture and shelf life of the product
- ❖ The pan should be removed from the heat during testing as the jam will continue to cook and may become over-cooked, which cannot be reversed.
- ❖ It is important to stir the jam at all times during heating, otherwise it may burn at the bottom of the pan, causing off-flavours and discoloration.
- ❖ When the jam starts to thicken, it is important to test for the end point at frequent intervals
- ❖ The jars should still be warm to prevent them from cracking when the hot jam is poured in.
- ❖ The filled jars can be placed in water to cool down the jam so that it does not keep cooking in the jar. The temperature and level of water level are very critical

## **2.3 Defects in processing**

- ❖ Jam should not be excessively boiled for longer time as this can give rise to caramel

flavours, over sweetness and discolouration, apart from being a waste of energy.

- ❖ If the final TSS of jam is lower than 65-68% the shelf life will be reduced. The jam will have a runny consistency and bacteria and moulds will be able to grow in the product.
- ❖ If the TSS is higher than 68%, the jam will be very stiff and the sugar might start to form crystals in the jam.
- ❖ During testing as the jam will continue to cook, it may become over-cooked and if the endpoint is crossed it cannot be reversed.
- ❖ Improper stirring may cause burning at the bottom of the pan, causing off-flavors and discoloration.
- ❖ If the jam is cooled too much it will be difficult to pour into the containers.
- ❖ If the water for cooling the jars is too cold, the glass may crack
- ❖ If the jars are moved or shaken while they are cooling or the gel will not form and the jam will not set.

## **CHAPTER 3**

### **Packaging of Passion Fruit Jam**

#### **3.1 Criteria for packaging material**

The primary packages for jams must have the following characteristics:

- It should allow heat transmission. Heat transmission i.e. heat transfer is very fast during heating and cooling.
- It should be heat-resistant i.e. it should have resistance towards high filling temperature.
- It must be able to achieve and maintain vacuum and thereby prevent contamination with moisture, air and micro-organisms by assuring vacuum sealing.
- It should be sturdy in order to prevent handling and storage hazards.
- “Product quality maintenance” i.e. the package should not react with and change the properties of the product over a given period of storage and preservation.
- It should have resistance towards sunlight, storage temperature and atmospheric humidity.

#### **3.2 Packaging material for Jams**

For packaging of jams various packaging materials can be used. Glass is in major use and also among plastics HDPE, PVC, PS, PP etc. and Aluminium foil, are being used.

##### **3.2.1. Metal Containers - Lacquered**

Tin containers are also used namely, “Open Top Sanitary cans (OTS cans)”. The tinplate used for this is a low carbon mild steel base plate suitably coated with a thin layer of tin metal. Tin plate must have a very low sulphur, phosphorus and copper content. For preservation and processing, tin is an ideal container for jam packaging. It is hermetically sealed thereby avoiding contamination.

The only disadvantage with tin cans is that it slowly reacts with the contents over a period of time leading to “corrosion”. To overcome this, inside lacquered or resin-coated tin cans are used for food containing high acid content and sulphur content.

##### **3.2.2. Glass Jars with Lug Caps**

Basically, glass is better than other materials for packaging of jam for few reasons viz. it is very much chemically inert, aesthetic appeal in glass is much better and the product has long shelf-life in glass than any other material.

But on the other hand, the major drawbacks associated with glass are that they are heavy in weight, fragile, and require sterilization before refilling of product thereby increasing the production cost.

### **3.2.3. Plastic Containers**

Plastic jars are already making in-roads into this market because of their light weight and resistance to breakage. High density polyethylene, polyvinyl chloride and some of the newer acrylics have been used for this purpose. HDPE has a linear structure. The promising properties of HDPE, which make it suitable for jam packaging, are its good moisture barrier properties, its excellent resistance to a wide range of chemical compounds, good tensile characteristics and good high temperature resistance. Injection moulded containers of PP or HIPS are also used for packing 200 grams of the product.

Unit servings of jams are packed in injection moulded plastic cups. They are closed with peelable membrane lids. Plastic cups are moulded from polystyrene, polyethylene, polypropylene or polyvinyl chloride. Closures can be foil laminates, clear plastic film or metallized plastic film. The type of plastic used must be capable of heat sealing or the membrane must have a suitable peelable adhesive or heat-seal coating, the selection of which will be governed by the material used to form the cup.

In the selection of a suitable heat-seal formulation, note must be taken of the temperature of jam fill. Jams are filled hot (82.2°C or higher) and the actual degree of peelable seal does not become evident until it has “set” for 24 hours. Problems revolving around membrane formation i.e. heat-seal coating separating from the inner foil ply, are a frequent plague to the material supplier. The foil used must be clean and free from oily residues to prevent separation of the laminate plies.

### **3.2.4. Flexible Packs**

Jams are also packed in 2-3 layered co-extruded polyolefinic pouches of 200 and 400/500g capacities. The individual pouches are further placed in printed paperboard or E-fluted corrugated cartons.

The current changing trend in packaging indicates that products such as jams and sauces, which were earlier packed using conventional materials like metal and glass have now gradually moved to plastics packaging. The plastics offer advantages of lighter weight, cost competitiveness, ease of handling and variety of shapes and sizes as compared to the conventional packs. This trend of plastics packaging is on the rise and is likely to continue.

## **CHAPTER 4**

### **Food Safety Regulations & Standards**

#### **2.3 Fruits and Vegetable Products**

##### **a. Regulation 2.3.31 Jam, Jellies & Marmalades**

1. Jam means the product prepared from a suitable fruit ingredient of one or two or more types which shall be—
  - (i) whole fruit, pieces of fruit, fruit pulp or fruit puree;
  - (ii) with or without fruit juice or concentrated fruit juice or dehydrated fruit as an optional ingredient;
  - (iii) mixed with a nutritive sweetener, with or without water; and
  - (iv) processed to a suitable consistency.
5. Jams shall be prepared from any fruit ingredient singly or in combination.
6. The minimum fruit content for cashew apples shall be 23 per cent. and 8 per cent. for passion fruit.
7. The total soluble solids content, in the case of jams shall be not less than 65 per cent. by weight
8. The other substances that may be added to the products are cane sugar, sucrose, dextrose, and invert sugar, liquid glucose, honey, salt, herbs, spices, condiments and their extracts and other ingredients appropriate to the product whose standards are prescribed in these regulations.
9. Pectin derived from any fruit may be used at GMP level.
10. The product shall conform to the following quality factors, namely: -
  - (1) in case of jams, the finished product shall have gelled consistency. It shall have colour and flavour of original fruit and shall be free from burnt or objectionable flavours, weeping, crystallization, mould growth and shall show no sign of fermentation;
11. The product shall be free from extraneous matter normally associated with the fruits such as skin, pits, pit fragments and seeds.
12. Containers shall be well filled with the product which shall occupy not less than 90 per cent of the water capacity of the container.

(The water capacity of the container is the volume of distilled water at 27°C which the sealed container will hold when completely filled. When product is packed in glass containers, the water capacity shall be reduced by 20 ml.)

13. Standards specified in this sub-regulation shall not apply to—

(a) the products when indicated as being intended for further processing including as those intended for use in the manufacture of fine bakery wares, pastries or biscuits;

(b) the products which are clearly intended or labelled as intended for special dietary uses;

(c) the reduced sugar products or those with very low sugar content;

(d) the products where the foodstuffs with sweetening properties have been replaced wholly or partially by food additive sweeteners.

## **b. Permitted Additives**

| <b>Additive</b>                                    | <b>Limit</b> | <b>Additive</b>                        | <b>Limit</b> |
|----------------------------------------------------|--------------|----------------------------------------|--------------|
| Acesulfame potassium                               | 1,000 mg/kg  | Canthaxanthin                          | 200 mg/kg    |
| Alitame                                            | 100 mg /kg   | Caramel III - ammonia caramel          | 200 mg/kg    |
| Allura red AC                                      | 100 mg/kg    | Caramel IV – sulfite ammonia caramel   | 1500 mg/kg   |
| Annatto                                            | GMP          | Carmoisine                             | 200 mg/kg    |
| Aspartame                                          | 1,000 mg/kg  | Carnauba wax                           | 400 mg/kg    |
| Aspartame-acesulfame salt                          | 1,000 mg/kg  | beta-Carotenes, vegetable              | 1,000 mg/kg  |
| Benzoates                                          | 1,000 mg/kg  | Curcumin                               | GMP          |
| Brilliant blue FCF                                 | 200 mg/kg    | Dimethylpolysil oxane                  | 10 mg/kg     |
| Carotenoids                                        | 500 mg/kg    | Ethylene Diamine Tetra Acetates (EDTA) | 130 mg/kg    |
| Chlorophylls and chlorophyllins & Copper complexes | 200 mg/kg    | Erythrosine                            | 100 mg/kg    |
| Fast green FCF                                     | 200 mg/kg    | Saccharins                             | 200 mg/kg    |
| Grape skin extract                                 | 500 mg/kg    | Sorbates                               | 1,000 mg/kg  |
| Hydroxybenzoates para                              | 250 mg/kg    | Riboflavins                            | 200 mg/kg    |

|                                |           |                                         |           |
|--------------------------------|-----------|-----------------------------------------|-----------|
| Iron oxides                    | 200 mg/kg | Steviol glycosides                      | 360 mg/kg |
| Indigotine<br>(Indigo carmine) | 200 mg/kg | Sucralose<br>(Trichlorogalactosucrose)) | 400 mg/kg |
| Neotame                        | 70 mg/kg  | Tartaric acid, L (+)                    | GMP       |
| Polydimethylsiloxane           | 30 mg/kg  | Tartrazine                              | 200 mg/kg |
| Ponceau 4R                     | 200 mg/kg | Sunset yellow FCF                       | 200 mg/kg |

### **c. Food hygiene:**

(a) The product shall be prepared and handled in accordance with the guidance provided in the Schedule 4 of the Food Safety and Standards (Licensing and Registration of Food Businesses) Regulations, 2011 and any other such guidance provided from time to time under the provisions of the Food Safety and Standards Act, 2006 (34 of 2006).

### **d. Packaging and labelling:**

The product covered by this standard shall be labelled in accordance with the Food Safety and Standards (Packaging and Labelling) Regulations, 2011.

#### **Chapter 1 - General**

##### **1.2: Definitions**

1.2.1 : In these regulations unless the context otherwise requires:

1. “Best before” means the date which signifies the end of the period under any stated storage conditions during which the food shall remain fully marketable and shall retain any specific qualities for which tacit or express claims have been made and beyond that date, the food may still be perfectly safe to consume, though its quality may have diminished. However, the food shall not be sold if at any stage the product becomes unsafe.
2. “Date of manufacture” means the date on which the food becomes the product as described;
3. “Date of packaging” means the date on which the food is placed in the immediate container in which it will be ultimately sold;
5. “Lot number” or “code number” or “batch number” means the number either in numericals or alphabets or in combination thereof,
  - representing the lot number or code number or batch number,
  - being preceded by the words “Lot No” or “Lot” or “code number” or “Code” or Batch No” or “Batch” or any distinguishing prefix

- by which the food can be traced in manufacture and identified in distribution.
10. “Use – by date” or “Recommended last consumption date” or “Expiry date” means the date
- which signifies the end of the estimated period under any stated storage conditions,
  - after which the food probably will not have the quality and safety attributes normally expected by the consumers and the food shall not be sold
11. “Vegetarian Food” means any article of Food other than Non- Vegetarian Food as defined in regulation 1.2.1(7).

## **Regulation 2.1: Packaging**

### **Regulation 2.1.1: General Requirements**

2. Containers made of plastic materials should conform to the following Indian Standards Specification, used for packing or storing whether partly or wholly, food articles namely: -
- i.IS : 10146 (Specification for Polyethylene in contact with foodstuffs);
  - ii. IS : 10142 (Specification for Styrene Polymers in contact with foodstuffs)
  - iii. IS : 10151 (Specification for Polyvinyl Chloride (PVC) in contact with foodstuffs);
  - iv. IS : 10910 (Specification for Polypropylene in contact with foodstuffs);
  - i.IS: 12252 - Specification for Polyalkyleneterephthalates (PET)

## **Regulation 2.2: Labelling**

### **Regulation 2.2.1: General Requirements**

1. Every pre-packaged food shall carry a label containing information as required here under unless otherwise provided, namely -
2. The particulars of declaration to be specified on the label shall be in English or Hindi in Devnagri script: Provided that nothing herein contained shall prevent the use of any other language in addition to the language required under this regulation.
3. Pre-packaged food shall not be described or presented on any label or in any labelling manner that is false, misleading or deceptive or is likely to create an erroneous impression regarding its character in any respect;
4. Label in pre-packaged foods shall be applied in such a manner that they will not become separated from the container;
5. Contents on the label shall be clear, prominent, indelible and readily legible by the consumer under normal conditions of purchase and use;

6. Where the container is covered by a wrapper, the wrapper shall carry the necessary information or the label on the container shall be readily legible through the outer wrapper and not obscured by it;
7. License number shall be displayed on the principal display panel in the following format, namely: -



Provided that the existing products of a unit shall comply with the requirement of this clause on and after the six months of commencement of the Food Safety and Standards (packaging and labeling) Amendment Regulation, 2013.

### **Regulation 2.2.2 Labelling of Pre-packaged Foods**

In addition to the General Labelling requirements every package of food shall carry the following information on the label, namely, —

1. The Name of Food: The trade name or description of food contained in the package.
2. Ingredient: *(For a single ingredient product, it can be mentioned as such.)*
3. Nutritional information —
4. Nutritional Information or nutritional facts per 100 gm or 100ml or per serving of the product shall be given on the label containing the following: —  
energy value in kcal;  
the amounts of protein, carbohydrate (specify quantity of sugar) and fat in gram
5. Declaration regarding Veg or Non veg

Every package of Vegetarian Food shall bear a declaration to this effect by a symbol and colour code as stipulated below for this purpose to indicate that the product is Vegetarian Food.

The symbol shall consist of a green colour filled circle, having a diameter not less than the minimum size specified in the Table below, inside the square with green outline having size double the diameter of the circle, as indicated:



iv. Size of the logo (vegetarian)

| S No | Area of principal display panel | Minimum diameter mm |
|------|---------------------------------|---------------------|
| 1.   | Upto 100 cms. Square            | 3                   |
| 2.   | 100-500 cm square               | 4                   |
| 3    | 500-2500 cm square              | 6                   |
| 4    | >2500 cm square                 | 8                   |

The symbol shall be prominently displayed on the package having contrast background on principal display panel, just close in proximity to the name or brand name of the product and on the labels, containers, pamphlets, leaflets, advertisements in any media.

5. Declaration regarding Food Additives-

- (i) For food additives falling in the respective classes and appearing in lists of food additives permitted for use in foods generally, the following class titles shall be used together with the specific names or recognized international numerical identifications:

Acidity Regulator, Acids, Anticaking Agent, Antifoaming Agent, Antioxidant, Bulking Agent, Colour, Colour Retention Agent, Emulsifier, Emulsifying Salt, Firming Agent, Flour Treatment Agent, Flavour Enhancer, Foaming Agent, Gelling Agent, Glazing Agent, Humectant, Preservative, Propellant, Raising Agent, Stabilizer, Sweetener, Thickener

6. Name and complete address of the manufacturer

- The name and complete address of the manufacturer and the manufacturing unit if these are located at different places; in case the manufacturer is not the packer, the name and complete address of the packing unit shall be declared on every package of food;
- Where an article of food is manufactured or packed by a person or a company under the written authority of some other manufacturer or company, under its brand name, the label shall carry the name and complete address of the manufacturing or packing, the name and complete address of the manufacturer or the company and on whose behalf it is manufactured or packed or bottled.

7. Net quantity by weight shall be declared on every package of food.
8. Lot/Code/Batch identification shall be given on the label.
9. Date of manufacture or packing.

The date, month and year in which the commodity is manufactured, packed or pre-packed, shall be given on the label.

If the 'Best before Date' of the products is

- More than three months, the month and the year of manufacture, packing or pre-packing shall be given.
- Less than three months, the date, month and year in which the commodity is manufactured or prepared or prepacked shall be mentioned on the label.

10. Best Before and Use by Date: the month and year in capital letters upto which the product is best for consumption, in the following manner, namely: —

“BEST BEFORE.....MONTHS AND YEAR

OR

“BEST BEFORE.....MONTHS FROM PACKAGING

OR

“BEST BEFORE.....MONTHS FROM MANUFACTURE (Note: blank be filled up)

12. Instructions for use:

(i) Instructions for use, including reconstitution, where applicable, shall be included on the label, if necessary, to ensure correct utilization of the food.

#### **e. Schedule H of FoSCoS: Sanitary and Hygienic Requirements for Food**

##### **Manufacturer/ Processor/ Handler**

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.
2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects.
  - No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises.
  - Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.
6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.
7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.
8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).
9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
10. 10. All equipments shall be placed well away from the walls to allow proper inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.
15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.
16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
18. The vehicles used to transport foods must be maintained in good repair and kept clean.
19. Foods while in transport in packaged form or in containers shall maintain the required temperature.
20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

## Manufacturers List of Food Processing Machineries

| So | Name of the company                                                                                                                                                                                                                                                                                       | Machineries                                                             |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1. | Eastend Engineering Company<br>173/1 Gopal Lal Thakur Road<br>Calcutta 700 035 India<br>Tel: +91 33 2553 6397                                                                                                                                                                                             | Cutting machinery                                                       |
| 2. | Gardners Corporation<br>158 Golf Links New Delhi 110003 India<br>Tel: +91 11 2334 4287/2336 3640<br>Fax: +91 11 2371 7179                                                                                                                                                                                 | Cutting machinery, Juice filters, weighing machinery, Boiling equipment |
| 3. | Narangs Corporation<br>P-25 Connaught Place New Delhi 110001 India<br>Tel: +91 11 2336 3547 Fax: +91 11 2374 6705                                                                                                                                                                                         | Cutting machinery                                                       |
| 4. | Bajaj Machine Private Limited<br>7/20 7/27, Jai Lakshmi Industrial Estate,<br>Side-IV Sahibabad Industrial Area<br>Ghaziabad - 201301 U.P India<br>Tel: +91 120 22775119/22775137<br>Fax: +91 120 22775137<br>Website: <a href="http://www.indiamart.com/bajajmachine">www.indiamart.com/bajajmachine</a> | Juice extractors and Pulpers                                            |
| 5. | Buhler (India) Pvt Ltd<br>13-D, K A I D B Industrial Area, Attibele Bangalore<br>Karnataka 562107 India<br>Tel: +91 80- 27820000 Fax: +91 80-7820001<br>Website: <a href="http://www.buhlergroup.com">www.buhlergroup.com</a>                                                                             | Juice extractors and Pulpers                                            |
| 6. | Delhi Industries<br>4 Paharganj Lane, New Delhi 110055 India<br>Tel: +91 11 2529720, 27525200, 27536888<br>Fax: +91 11 25791291                                                                                                                                                                           | Juice extractors and Pulpers                                            |
| 7. | Food Packs Indiana<br>Thrikkariyoor, Kothamangalam,<br>Ernakulam Kerala 686692 India                                                                                                                                                                                                                      | Juice extractors and Pulpers                                            |

|     |                                                                                                                                                                                                                                                                                                              |                                      |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| 8.  | <p>Geeta Food Engineering</p> <p>Plot No C-7/1 TTC Area Pawana MIDC</p> <p>Thane Belapur Road</p> <p>Behind Davita Chemicals Ltd</p> <p>Navi Mumbai 400 705 India</p> <p>Tel: +91 22 2782 6626/2766 2098</p> <p>Fax: +91 22 2782 6337</p>                                                                    | Juice extractors and Pulpers         |
| 9.  | <p>Sri Rajalakshmi Commercial Kitchen Equipment</p> <p>No.57, (old No. 30/1) Silver Jubilee Park Road,</p> <p>Bangalore - 560 002 India</p> <p>Tel: +91 (0)812 2222 1054/223 9738</p> <p>Fax: +91 (0)812 2222 2047</p>                                                                                       | Boiling equipment                    |
| 10. | <p>Raylons Metal Works Kondivita Lane</p> <p>J. B. Nagar Post Office Post Box No. 17426</p> <p>Andheri (E) Andheri - Kurla Road,</p> <p>Mumbai - 400 059 India</p> <p>Tel: +91 22 26323288 / 6325932</p>                                                                                                     | Boiling equipment                    |
| 11. | <p>Acufil Machines</p> <p>S. F. No. 120/2, Kalapatty Post Office</p> <p>Coimbatore - 641 035 Tamil Nadu, India</p> <p>Tel: +91 422 2666108/2669909</p> <p>Fax: +91 422 2666255</p> <p>Email: acufilmachines@yahoo.co.in,</p> <p>acufilmachines@hotmail.com</p>                                               | Bottle filling & Packaging equipment |
| 12. | <p>Autopack Machines Pvt Ltd</p> <p>101-C Poonam Cambers A Wing,</p> <p>1st Floor Dr Annie Besant Road,</p> <p>Worli Mumbai 400018 India</p> <p>Tel: +91 22 2493 4406/2497 4800/2492 4806</p> <p>Fax: +91 22 2496 4926</p> <p>E-mail: autopack@bom3.vsml.net.in</p> <p>Website: www.autopackmachines.com</p> | Bottle filling & Packaging equipment |



## Contact Us

### **National Institute of Food Technology, Entrepreneurship and Management (NIFTEM) - Thanjavur**

(an Institute of National Importance under Ministry of Food Processing Industries, Government of India)

Pudukkottai Road, Thanjavur – 613005, Tamil Nadu, India

Ph: 04362-228155, Fax: 04362-227971

Email: [director@iifpt.edu.in](mailto:director@iifpt.edu.in) Web: <https://niftem-t.ac.in/>

