MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

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NIFTEM
THANJAVUR

PM Formalisation of
Micro Food Processing Enterprises Scheme

Processing of Fig Paste

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1. Introduction

Background

Fig is a fruit of Ficus carica, an Asian species of flowering plant comes from mulberry family which is known as common fig. Figs generally are sweet in taste and has a chewy texture. Fresh figs are soft and perishable and at times to preserve it for longer duration of time it is dried. In India, Fig (Ficus Carica) is one of the traditional Mediterranean species. Fig fruit represents an important constituent of the diet, because of their nutritional and medicinal values. This type of diet is consider one of the healthiest and is associated with longevity. Figs are an excellent source of minerals, vitamins, polyphenols, and dietary fiber; they are fat and cholesterol-free and have a high antioxidant activity. Because of their low moisture content this ensures less change of microbial spoilage, large scale production and distribution possible.

According to Vinson therefore JA, (1999) the major aims of fig fruit provide good quality products with good flavor, color, texture, and taste and make convenient fruit products.

Fig is the native fruit of Asia and Middle East. It has been sought out and cultivated since ancient times and is now widely grown throughout the world, both for its fruit and as an ornamental plant. Now a day demand for fig ingredients is increasing, because of which fig plant is cultivated throughout the world. Fig plant is one of the oldest plant cultivated by Humans.

Common Figs are generally found in rocky areas above the sea level of 1,700 meters and can be grown in poor soil. It is grown in the hilly areas of India as well, most commonly found in Pithoragarh, Kumaun hills. The common fig is indigenous to Western Asia and extending to northern India, but natural seedlings grow in most Mediterranean countries; it is cultivated in warm climates. The species

has become naturalized in scattered locations in Asia and North America. As time went on, the fig growing territory stretched from Afghanistan to southern Germany and Canary Islands. The fig was one of the earliest fruit trees to be cultivated, and its cultivation spread in remote ages over all the districts around the Aegean Sea and throughout the Levant. The largest producers of fig in the world are Spain, Turkey, Egypt and Algeria accounting for almost 58% of total production. The total production of raw (fresh) fig in the world accounts for more than 1.05 million tons. In India fig farming is mostly done in Maharashtra, Gujarat, Uttar Pradesh, Karnataka and Tamil Nadu. The total area under fig cultivation is around 5600 hectares of land with a production of about 13,802 thousand tons, i.e. about 12.32 tons per hectare.

Cultivation

The fig plant is a bush or small tree, from 1 meter to 10-12 meters high, with broad, rough, deciduous leaves that are deeply lobed or nearly entire. The leaves and stems exude a white latex when broken. The fig fruit is unique. Unlike most 'fruit' in which the structure is matured ovary tissue, the fig's edible structure is actually a stem tissue. Fig fruits, known as syconia, are borne singly or in pairs above the scars of fallen leaves or in axile of leaves of the present season. At maturity, the interior of the fig contains only the remains of the flower structure, including the small gritty structures commonly called 'seed', which are the unfertilized ovaries that had failed to develop. They impart resin like flavor associated with fig. Flowers are staminate (male) or pistillate (female) and enclosed within the inflorescence structure.

The fruits may be picked from the tree or gathered normally or by mechanical sweepers after they fall to the ground. 'Brunswick' is so tender it must be picked when slightly unripe in order to be firm enough for processing. Workers must wear gloves and protective clothing because of the latex. Harvested fruits are spread out in the shade for a day so that the latex will dry a little. Then they are transported to processing plants in wooden boxes holding 10-15 kg. In India, a fig tree bears 180 to 360 fruits per year.

The fig fruit is perishable in nature and is not suitable for transport over long distances. When the fruit is intended for distant markets, then it should be harvested slightly before the full maturity. Fresh fruits that are ripe can be sold in the local markets. The fruits that are picked at optimum maturity stage are cooled within 6 hours of harvest and can be kept for 20 days at 1˚C. Similarly, the fruits can be preserved for 7 days at 10˚C and just for 2 or 3 days at 20˚C. At 40° to 43°F (4.44°-6.11°C) and 75% relative humidity, figs remain in good condition for 8 days but have a shelf life of only 1 to 2 days when removed from storage. They remain in good condition for 30 days when stored at 32° to 35° F (0°-1.67° C). If frozen whole, they can be maintained for several months.

Excess produce can be stored by dehydration of the moisture content to about 10-12%. For storage the fruits are treated with sulphur fumes @ 4 g per 10 kg of fruits and then dried at a temperature of 60˚C until the moisture is reduced to about 12%. Dehydration controls the browning of the fruit, improves fruit texture and reduces infestation. Traditional sun drying is also practiced in some parts of the world, but this method has a high risk of infestation by pests and other pathogens.

Fig trees are prone to attack by nematodes (especially *Meloidogyne* spp.) and, in the tropics, have been traditionally planted close to a wall or building so that the roots can go underneath and escape damage. But control is possible with proper application of Nematicides. In India, a stem-borer, *Batocera rufomaculata*, feeds on the branches and may kill the tree. The latex of the unripe fruits and of any part of the tree may be severely irritating to the skin if not removed promptly. It is an occupational hazard not only to fig harvesters and packers but also to workers in food industries, and to those who employ the latex to treat skin diseases.

Nutrition

Fig

Nutritional value per 100 g

Nutritional parameters	Value
Energy	310 kJ (74 kcal)
Carbohydrates	19.18 g
Dietary fiber	2.9 g
Fat	0.30 g
Protein	0.75 g
Vitamins	
Niacin	0.400 mg
Thiamine (B1)	0.060 mg
Riboflavin (B2)	0.050 mg
Pantothenic acid(B5)	0.300 mg
Vitamin B6	0.113 mg
Folate (B9)	6 µg
Vitamin A	142 IU
Vitamin C	2 mg
Vitamin E	0.11 mg
Vitamin K	4.7 µg
Minerals	
Calcium	35 mg
Iron	0.37 mg
Magnesium	17 mg
Manganese	0.128 mg
Copper	0.070 mg
Potassium	232 mg
Sodium	1 mg
Zinc	4%0.35 mg

Units

µg = micrograms • mg = milligrams. IU = International units

†Percentages are roughly approximated using US recommendations for adults.

Source: USDA Nutrient Database

Fresh Figs are delicious and nutritious as they are rich in calorie, protein, calcium and iron. Fig has nutritive index of 11, as against 9 for apple and 6 for raisin. The bulk of the fruit (about 80%) is consumed in the dried form. The fruit is also credited with laxative and medicinal properties and is being applied on boils and for other skin infections.

Constituents and Health Benefits of Fig

Figs are rich in nutrients while being relatively low in calories, making them a great addition to a healthy diet. Figs also contain significant amount of calcium, potassium, phosphorus, iron and small amounts of a wide variety of nutrients, but they are particularly rich in copper and vitamin B_6. Copper is vital mineral that is involved in several bodily processes, including metabolism and energy production, as well as the formation of blood cells, connective tissues, and neurotransmitters. Vitamin B_6 is a key vitamin necessary to help your body break down dietary protein and create new proteins. It also plays an important role in brain health.

Figs have many potential health benefits, including promoting digestive and heart health, along with potentially helping manage blood sugar levels. Research also depicted that figs have antioxidant, anticancer, anti-inflammatory, fat-lowering and cell-protective properties.

Major health benefits are listed below.

1. Protects us from free radicals
2. Regulates Blood pressure
3. Improve vascular health
4. Lower risk of cardiovascular diseases
5. Improve digestive health

6. Control Blood sugar
7. Treat Piles
8. Promote the formation of bones
9. Treat Alzheimer's Disease
10. Lowers stress levels
11. Exhibit anti-Caries activity
12. Prevent Age related Macular Degeneration
13. Treats Insomnia
14. Treat Respiratory Problems
15. Treats dermatitis

Value Added Fig Products

Fig Value-added product is segment on the basis of application, form and region. On the basis of application. Fig Value-added product market is segmented into food and cosmetic segments. The food segment is further divided into sub segments that is bakery, confectionary and dairy products. Cosmetic segment is utilized in the form of face wash, face moisturizer and face cream. Among all these segment food segment is expected to grow enormously in the coming future. The demand for Fig Value-added product is more due to the ease of availability of product to the consumer. On the basis of form the fig ingredient market is mainly segmented into powder and paste. But Fig ingredients includes various types of value added fig products like Fig fruit jam, fig paste, fig powder, fig marmalade, fig squash, Fig spread, Fig Toffee, Fig jelly, Fig concentrates, Dices/sliced Figs, Fig nuggets and Dried fig. Fig ingredients has special properties which provide various health benefits such as anti- oxidant properties, acts as a superb prebiotic and has the ability to maintain good digestive system. On the basis of region fig paste market is segmented into North America, Latin America, Western Europe, Eastern Europe, Asia Pacific, MEA and Japan. Among these segment MEA is expected to have the major market share globally, as it is the largest producer and consumer of fig ingredient. In terms of revenue Asia Pacific

may be the second prominent contributor in the fig value-added product including fig paste market.

Research have shown that fig ingredients helps in the nourishment of the intestine as it is a natural prebiotic and act as a natural laxative. Moreover, the market is also driven by the increasing awareness among the consumers about the health benefits associated with fig ingredients. Fig ingredients is used as treatment for diabetes, cough, piles, asthma, whooping cough and bronchitis. Although fig ingredients market is growing at a steady pace yet it may have some restrain such as consuming too much fig is not recommended by the doctors as too much consumption may cause diarrhoea. Furthermore high content of sugar may also cause tooth decay and chemical present in the fig may also cause allergy to some people.

Fig Ingredient is enriched with Soy Protein isolate. As Soy Protein Isolate improved their functional and Nutritional Characteristics. Soybean has been identified as inexpensive high protein resource. Soy protein isolates (SPI) has considerable potential for use as protein supplements because of its high protein content (90% protein) and good balance of amino acids that complement the amino acid pattern; therefore, it is recommended for dietary Supplements or protein fortification in many food products, which may solve protein-malnutrition in developing countries. In 1998, USFDA approved soy protein for health claims, because of natural phyto-chemicals such as isoflavones were found to function as antioxidants to combat oxidative degradation that could lead to diseases inside the body.

Health benefits of Soy Protein isolates

- **Nutrition**

It contains a high amount of proteins (90%) and is loaded with minerals. It contains very little fat and no cholesterol.

A 28-gram of Soy protein isolates with 90% protein:

- Calories: 95 Kcal
- Fat: 1 gm

- Carbohydrates: 2 gm
- Fiber: 1.6 gm
- Protein: 23 gm
- Iron: 25% of the Daily Value (DV)
- Phosphorus: 22% of the DV
- Copper: 22% of the DV
- Manganese: 21% of the DV
- High in Zinc, Vitamin C and folate
- Good source of Calcium, Potassium and Thiamine.

Benefits of Soy Protein isolates

- Helps in building muscles
- Lower LDL and Raise HDL
- Increase absorption of Zinc
- Improve gut microflora
- Prevent oxidation

2. Fig Paste Processing

Fig Processing

The fresh fruits have limited shelf life; therefore, it is necessary to process fresh fruits in to different value added products to increase its availability over an extended period and to stabilize the price during the glut season. Commercially, figs are peeled by immersion for 1 minute in boiling lye water or a boiling solution of sodium bicarbonate. In warm, humid climates, figs are generally eaten fresh and raw without peeling, and they are often served with cream and sugar. Peeled or unpeeled, the fruits may be merely stewed or cooked in various ways, as in pies, puddings, cakes, bread or other bakery products, or added to ice cream mix. Owners preserve the whole fruits in sugar syrup. It can also be used for the preparation of mixed fruit jam, fig paste, fig powder, fig marmalade, fig squash can be used as a beverage after dilution with water in 1:3 ratio; Fig ready to serve beverage can be used as a thirst quencher.

Fig Paste is a thick liquid made from boiling figs in water. It's ideal for desserts, pastries, pancakes, and hot beverages. It is incredibly sweet, making it a great substitute for sugar. Since it needs minimal storage, the paste is preferable to storing massive wall of dried figs. Fig paste has been traditionally used in fig cookies, energy and health food bars, as well as spreads, sauces, jams and fruit fillings. It can provide a natural sweetness, pleasing mouth feel, and adds fiber and calcium to your manufactured item. Fig paste is very dense, and can be difficult to work into flow able solution without a powerful mixer.

Preservation Techniques

Fresh figs are very sensitive to microbial spoilage, Figs are highly perishable, which limits storage for long periods, and in order to expand the potential markets, most of the production is used for drying. Figs are climacteric fruits and are slightly sensitive to ethylene action on stimulating softening and decay severity,

especially if kept at 5 ºC or higher temperatures. Very little research has been done to identify the optimum environmental conditions for extending post-harvest life of fresh figs. However, low temperatures, from 0 to 2 ºC and a high relative humidity (90 to 95% RH) are recommended. The most important cause of deterioration is the incidence of microbial molds and rots that take advantage of the easily damaged epidermis and the high content of sugar in figs. The use of SO2 can be a potential tool to control postharvest rots and, therefore, increase the market life of fresh figs.

Physical treatments

The new physical treatment applications have been reported to prolong the shelf life of the fresh figs. These treatments modifies the environmental conditions of fig storage, effecting the fruit physiology and biochemistry and inhibiting the development of micro-organisms contaminating the fruit surface, keeping the original physico-chemical quality of the fruit.

Drying

Drying has many advantages for food quality with decreasing water activity, reducing microbiological activity and minimizing physical and chemical changes. Drying is by far the most popular and effective way of processing/preservation of figs known from prehistoric times. Important advantages of this method are its low cost and the fact that the obtained product does not depend on refrigeration. Pre drying treatments may include blanching in boiling water (normally for 1 minute) and/or sulphuring (i.e., treatment with sulphur dioxide). These methods, however, are not easily compatible with the traditional technique of sun drying, but they are often practiced before solar or mechanical dehydration. The treatments accelerate dehydration, control browning of the drying fruit, and may improve its texture and reduce infestation. Blanching also helps retain color and slow oxidation. Sulphuring can achieve long-term anti-darkening and retards spoilage. Drying can be done by various methods:

Traditional Sun Drying: During sun drying, the fruits are kept on the trays, and each fig is periodically turned from one side to the other until water content of 18% to 22% is reached. Usually it takes 3 to 5 days, depending on the weather. The effects of ambient temperature and solar radiation on the efficacy of fruit sun drying were investigated by using mathematical modelling. The main problem of the sun drying method is the high risk of fruit infestation with pests and pathogens due to its contact with soil and prolonged exposure to open environment. The major concern is colonization of the sun dried figs with toxicogenic molds, such as *Aspergillus flavus* and *A. parasiticus*, resulting in the presence of poisonous and carcinogenic mycotoxins (e.g., aflatoxin) in the fruit.

Solar drying: Introduction of more sophisticated drying methods is intended to accelerate dehydration and to limit the fruit contact with the environment, thus reducing the risk of contamination. Solar dryers use the same energy source as the traditional sun drying, but the process is more energy efficient and conducted within plastic or glass covered space. The performance of two types of solar installations for drying 'Kadota' figs was examined by under various operation regimes in comparison with sun drying. The solar drying was 2.5 to 3 times faster than the traditional method; however, the sun-dried fruit received better scores in the organoleptic test. Both sun dried and solar dried samples were found positive to aflatoxin type B1, although the concentrations were below the Food and Drug Administration (FDA) limit. However, the reduction of aflatoxin contamination level by using solar drying. A simple and inexpensive solar drier designed in India was reported not only to expedite drying but to improve quality of cultivar 'Bellary' figs. Solar tunnel driers developed at Hohenheim University (Germany) and comprising light powered fans were applied in Turkey on commercial scale and were reported to improve microbiological quality of dried figs. A newly developed solar technique for industrial fig drying in Morocco reported good performance. In spite of these encouraging results, the available information shows that the scope of commercial application of solar technologies in fig drying is still very limited.

Mechanical dehydration: The use of industrial equipment (e.g., dehydrator air flow tunnels) is another alternative to the conventional sun drying. Its advantages include

better sanitation conditions, controllable and uniform technological parameters, fast process, and lower labour demand. The study showed that a 7 hour industrial dehydration gave a ready-to-market product provided a preservative potassium sorbate was applied to ensure microbiological stability. Similar quality was attained after simulated sun drying for as long as 120 hours. Extension of industrial dehydration above 11 hours gave a product not requiring chemical additives for its preservation. However, rehydration was needed to ensure appropriate fruit palatability.

Osmotic Dehydration: Osmotic dehydration is combined with drying methods to improve food quality and reduce energy needs. Osmotic dehydration is a process that provides removing partial water from food by impregnation of hypertonic solution and it has the potential to remove water at low temperatures in addition, it is an energy efficient method, as water does not go through a phase change. Some properties of products such as color, texture and aroma are preserved by osmotic dehydration. In addition to, osmotic dehydration extends the shelf life of products by reducing the water activity

Refrigeration

The method of freezing is an important consideration in the freezing of foods. Common freezing methods include *air-blast freezing*, where high-velocity air at about - 30° C is blown over the food products; *contact freezing*, where packaged or unpackaged food is placed on or between cold metal plates and cooled by conduction; *immersion freezing*, where food is immersed in low temperature brine; *cryogenic freezing*, where food is placed in a medium cooled by a cryogenic fluid such as liquid nitrogen or liquid or solid carbon dioxide; and the combination of the methods above.

Kader, et al. and Artes recommended a fast pre-refrigeration using forced air as one of the simplest ways to extend the commercial life of fig up to 2-3 months by keeping storage temperature around 5°C.

MAP

Unlike most food products, fresh fruits and vegetables continue to 'breathe' or respire after they have been harvested. This process consumes oxygen and produces carbon dioxide and water vapour. The key to keeping these packaged products fresh for as long as possible is to reduce the respiration rate without harming the quality of the product – its taste, texture and appearance. In general, the rate of respiration can be reduced by keeping the temperature low, having lower levels of oxygen in the packaging atmosphere and increased levels of carbon dioxide.

Modified atmosphere packaging known as MAP technology and controlled atmosphere storage (CAS) are novel techniques that are widely applied for preservation of agricultural products especially for fruits and vegetables. These techniques are used to supplement low temperature management to delay ripening, reduce physiological disorders, and suppress decay in many fresh fruit and vegetable MAP is defined as 'the packaging of a perishable product in an atmosphere which has been modified so that its composition is other than that of air whereas controlled atmosphere storage (CAS) involves maintaining a fixed concentration of gases surrounding the product by careful monitoring and addition of gases, the gaseous composition of fresh MAP foods is constantly changing due to chemical reactions and microbial activity.Gas exchange between the pack headspace and the external environment may also occur as a result of permeation across the package material.

Artes and Tomas Barberan reported the applications of controlled and modified atmospheres (CO2 enriched and/or reduced O2), use of the thermal treatments for fruit conditioning and curing and intermittent warming during the cold storage to avoid fungal developments and physiological disorders that develops below 5°C. Active MAP involves a quick process of gas flushing or gas replacement or the use of gas-scavenging agents to establish a desired gas mixture within the package. Studies have shown that modified atmosphere packaging (MAP) and controlled atmosphere storage (CAS) have the ability to delay quality loses and thus extends the shelf life of fresh or minimally processed or fresh-cut produce Modified atmosphere packaging can result in reduction in the respiratory activity by decreasing O2 concentration, delay in

softening and ripening and a reduced incidence of the various physiological disorders and pathogenic infestations. MAP sensing and Monitoring: 'Smart' or 'active' or 'intelligent' packaging system is introduced to improve the safety of MAP products and to extend the technology to a broader spectrum of products. Summers defined the Smart packaging as an interaction between the packing system and the product itself which confers intelligence appropriate to function and use of the product with the ability to sense or to be sensed and to communicate. Nano biosensors can serve as the best smart packaging tool for MAP sensing and monitoring. Research recommended a controlled atmosphere of 5-10% O2 + 15% to 20% CO2 composition for the storage of Fig at 5° C with RH 95% to minimize decay weight loss and chilling injuries and better keeping quality.

The advantages of MAP are extending the shelf-life, preserving or stabilizing the desired properties of fruits and vegetables, convenience in use and distribution for retail sale. Recent development achieved in packaging material such as bio-based polymers provides feasibility of MAP development for new applications. Also developments in MAP claim new equipment and machinery and accurate control of process. Recent advances in mechatronics and automation provides reliable control of all machine functions in MAP process such as temperature and gas injection. Many factors should be considered to facilitate MAP process based on the nature of the product and the market requirements. Some of these parameters are quality, cleanability, throughput, flexibility, operating cost, processing yield and equipment price.

3. Preparation of Fig Paste

Flow Diagram

The typical Procedure for manufacturing of fig paste is as below:

Selection of Fig Fruit
(Mature fig fruits with bright color and characteristic flavor will be used)

↓

Sorting
(Diseased, damaged or decayed fruits are rejected or trimmed)

↓

*Washing and cleaning
(rinsed with chlorine dioxide solution (10-100ppm))

↓

*Aflatoxin check under BLAK-RAY UV lamp

↓

*Metal detection

↓

Grinding

↓

Pulping

↓

Addition of preservatives @ 0.05%, sugar @ double rate and Soy Protein Isolate @ 3%

↓

Colloid mill

↓

*Boiling with scraping (100°C for 5-10 minutes)

↓

Brix testing (70° degree Brix)

↓

*Hot filling

↓

Sealing

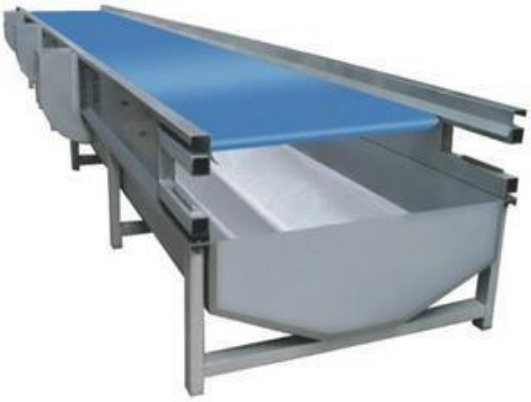
↓

Storing (Refrigerated temperature)

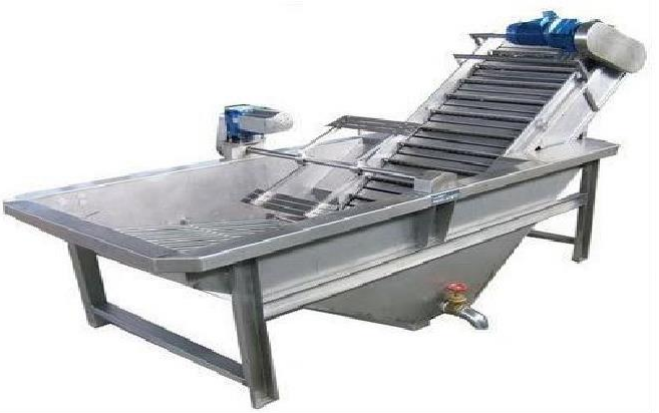
Note: * indicates Critical Control Points.

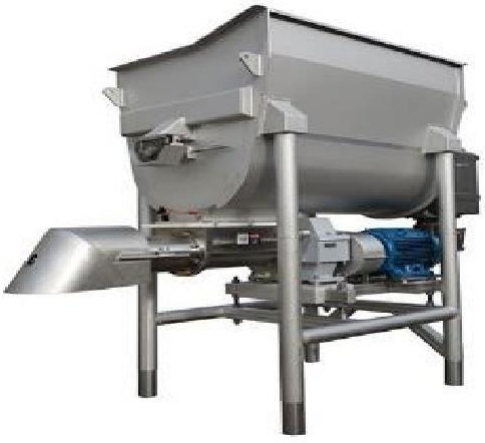
Equipment Employed

Sorting Conveyor

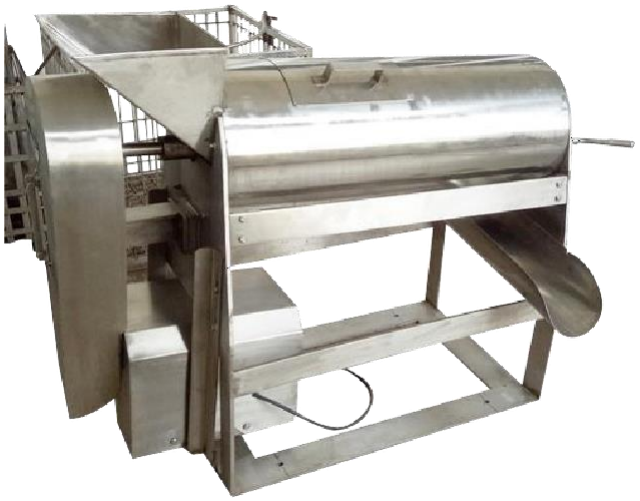


Washing tank



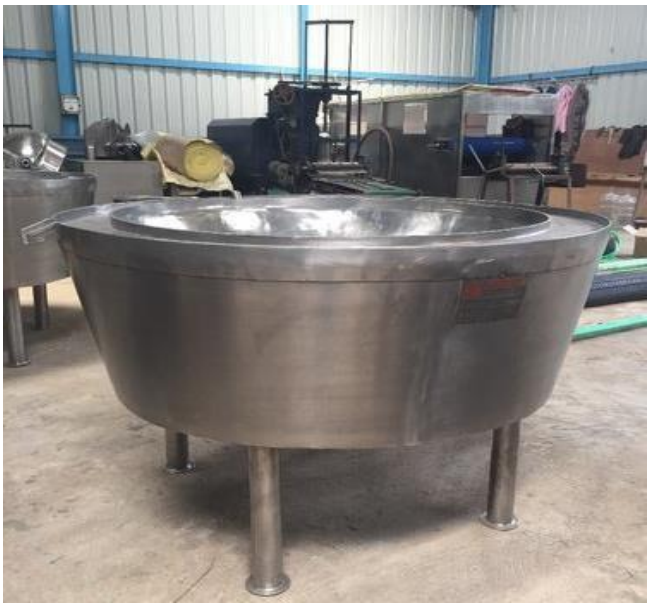


Fruit Grinder

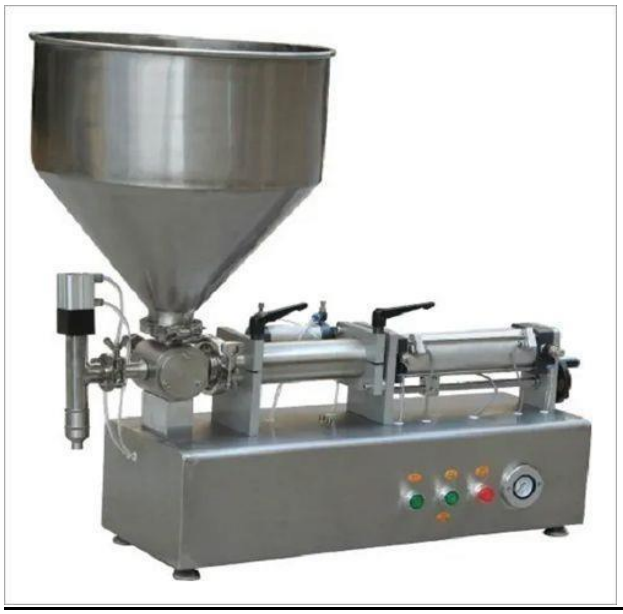


Fruit Pulper

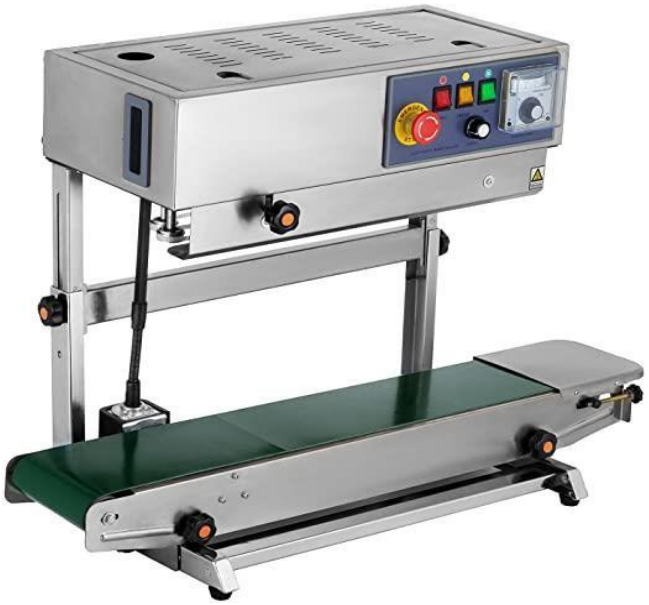
Colloid mill



Thermic fluid steel jacketed kettle with scraper



Paste filling machine



Continuous Sealing Machine

Food Safety Concern

Common Food Safety concern should be considered while handling and processing of products are mentioned below:

1. Bacterial and Pathogen Contamination:

- Application of Chlorine dioxide solution (10 ppm) with contact time of 2-5 minutes to sanitize surface of fruits. And it destroys microorganisms including pathogen. Chlorine itself will be evaporated in gaseous form after killing the bacteria, and traces will not be there at the end.
- Hot filling is necessary for achievement of desired shelf life.
- Irradiation: A treatment with ionizing radiation at doses up to 1 KGy can be applied to fruit and vegetables. It is generally applied to inhibit post-harvest pathogens and to protect produce quality. Irradiation may be effective for eliminating pathogenic microorganisms from surfaces of produce. An irradiation dose of 1 KGy has been reported to be effective for destruction of Listeria monocytogenus.
- Storage area should have accurate recorded temperature and humidity control to prevent or delay microbial growth.
- Keeping and maintain low temperature during transportation also can inhibit or greatly retard growth of pathogens.

2. Fungal and Mold Contamination:

- Damaged, decayed, rotten and over ripen fruits removal is essential for preventing and reducing contamination.
- Preservatives like Sulphur dioxide and other suitable preservatives are added in prescribed limit to prevent and reduce the contamination of Fungal and Mold.
- Maintain proper hygienic conditions at every possible steps.

3. Pesticides/fertilizer residues:

- Ultrasonic washing will eliminate all the fertilizers and pesticides residues used during farming and present in fruit.

4. Aflatoxin detection:

- Aflatoxin should be detected by BLAK-RAY UV lamp. If aflatoxin is detected, then fruit should be eliminated from further processing.

Other Risk associated with Fig as follow:

1. Medication interaction: Both fresh and dried figs contain a high level of vitamin K. People taking blood-thinning medications such as warfarin need to keep the vitamin K levels in their diet consistent, so they may avoid figs.

2. Digestive symptoms: Since figs have a high fibre content, eating too many figs especially dried figs can cause diarrhoea.

3. Allergies: Some people may be allergic to figs. So consumption of fig resulted into skin allergy issue.

4. Packaging of Fig Paste

Packaging Material Employed for Such Products

Glass:

Chemically inert and will not affect the quality, odour or taste of the product. It is Strong, rigid and 100% recyclable.

PET (Poly Ethylene terephthalate)

It is Light weight, flexible and recyclable. It is considered to be the backbone of packaging films. Polyethylene films are fairly free of plasticizers and other additives and are quite extensively used as a part of lamination. Its ability to heat seal increases its value.

Low Density Polyethylene (LDPE) is an economical material with low WVTR, however, it has high permeabilities to flavours/volatiles, poor grease resistance and are limp. High-density polyethylene (HDPE) is stiffer, more translucent and has better barrier properties but needs higher temperature for sealing.

Later additions include high molecular weight high-density polyethylene (HM HDPE) and linear low-density polyethylene (LLDPE). HM HDPE is a paper like film with high physical strength and barrier properties, but is less transparent than ordinary polyethylenes. HM HDPE is available in twist-wrap grades. Polyethylene films are also suitable for making bags and pouches. A copolymer of polyethylene and poly vinyl alcohol, and EVOH has outstanding gas barrier properties especially when dry.

Polypropylene

Polypropylene films are undergoing a growth trend in the food industry. They have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good seal ability has been a problem, however, PVDC and vinyl coating have been used to overcome this problem. Some varieties of PP have been specially developed for twist-wrap applications as they have the ability to lock in position after twisting. Pearlised polypropylene with an opal finish and attractive gloss is also used. Both as

Laminates and overwraps, PP film is now widely used for all types of foods packaging applications. Trays can be ordered in bulk in multiple sizes, or they can be custom molded to your products. These are the plastic trays you find inside deluxe two-piece boxes or gift boxes that hold products in place.

Mainly aluminium and steel metal cans are also used for such premium products. The Figs packed in Primary and Secondary packages are finally packed into cartons.

The modified atmosphere packaging offered an additional innovative tool for the optimal use and value addition of lower grade fig fruits.

Tetra Packaging

Tetra packaging is six layer packaging technology. It uses Aseptic packaging technology. In aseptic processing the product and the package are sterilized separately and then combined and sealed in a sterile atmosphere. It consists six –layers material as follows:

i. First layer- which seals in the liquid

ii. Second layer is adhesion layer of polyethylene

ii. Third layer is aluminium foils, which acts as barrier for oxygen, flavour and light.

iv. Fourth layer is adhesion layer again of polyethylene same as second.

v. Fifth layer is of paper board for stability.

vi. Top layer is again of polyethylene for protection against outside moisture.

Aseptic Packages

- Aseptic packages are made by combining thermoplastic with paperboard and aluminum foil.
- Aluminum foil layer is strong barrier for O_2 and light.
- Inner plastic layer is made of polyethylene makes it possible to seal through the liquid.

- The outer paper layer provides the stiffness thus, enabling maximum utilization of available storage and transportation space. Excellent graphics are possible leading to good display and shelf appeal.

5. Food Safety regulations and Standards for Fig paste

- According to the FSSAI standards fig paste is not categorized as individual category but its similar product like a Jam means the product prepared from sound, ripe, fresh, dehydrated, frozen or previously packed fruits including fruit juices, fruit pulp, fruit juice concentrate or dry fruit by boiling its pieces or pulp or puree with nutritive sweeteners namely sugar, dextrose, invert sugar or liquid glucose to a suitable consistency. It may also contain fruit pieces and any other ingredients suitable to the products. It may be prepared from any of the suitable fruits, singly or in combination. It shall have the flavour of the original fruit(s) and shall be free from burnt or objectionable flavours and crystallization

FSSAI standards and guidelines for Jam

Sr. No.	Requirements	Limits
1	Total soluble solids (m/m)	Not less than 65.0 percent

Additive standards & Recommended maximum levels

Sl No	Name of additives	Limits
1	Aspartame (methylester)	100ppm
2	Sucralose	450 ppm

3	Maltitol / Maltitol syrup	GMP
4	Sulphur dioxide	40ppm

Sl No	Name of additives	Limits
1	Sorbic acid	500ppm
2	Citric Acid	GMP
3	Fumaric Acid	GMP
4	L-Tartaric Acid	GMP
5	Malic Acid	GMP
6	Dimethyl Polysiloxane	10 ppm Max
7	Ascorbic Acid	GMP

Microbial standards

Sl No	Products	Parameters	Limits
1	Jam / Marmalade / Fruit jelly / Fruit Chutney and Sauces	**Mould Count**	Positive in not more than 40.00 percent of the field examined
2	Jam / Marmalade / Fruit jelly / Fruit Chutney and Sauces	**Yeast and spores**	Not more than 125 per 1 / 60 c.m.m

6. SANITARY AND HYGIENIC REQUIREMENTS FOR FOOD MANUFACTURER/ PROCESSOR/HANDLER

- The place where food is manufactured, processed or handled shall comply with the following requirements:
- 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.
- The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
- The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
- 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.
- 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.
- 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.
- 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.

- 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).
- All equipment's shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
- All equipment's shall be placed well away from the walls to allow proper inspection.
- There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
- The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
- 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.
- 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.

- 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.
- Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.
- All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
- The vehicles used to transport foods must be maintained in good repair and kept clean.
- Foods while in transport in packaged form or in containers shall maintain the required temperature.
- Insecticides / disinfectants shall be kept and stored separately and away from food manufacturing / storing/ handling areas.

7. Labelling Standards

Labelling requirements for packaged food products as laid down in the Part VII of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colours and Flavours
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number

10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Wherever applicable, the product label also must contain the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of colouring material. Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown colour-filled circle inside a brown square outline

Prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green colour-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the "FSS (Packaging and Labeling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labeling) Regulation before designing labels for products to be exported to India. FSSAI revised the labeling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labeling Regulation 2011, "prepackaged" or "pre packed food" including multi-piece packages, should carry mandatory information on the label.

Contact Us

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