PM Formalisation of

Micro Food Processing Enterprises Scheme

HANDBOOK
OF
PREPARATION OF SAPOTA JUICE

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Sapota (*Manilkara achras Forb*.) is an evergreen tropical tree, the fruit of which is used fresh and processed. Sapota, also known as sapodilla, contains high levels of ascorbic acid and phenolic compounds which contribute to its numerous purported human health benefits. The fruit is characterized by a climacteric ripening behavior with a short postharvest life at ambient temperature. The main limitation of postharvest shelf life is decay. Although low-temperature storage prolongs the postharvest life of sapota fruit, chilling injury can develop if the storage temperature is less than 14 °C. The storage life of sapota fruit can also be extended with the use of modified and controlled atmospheres and the use of other postharvest treatments. Sapota is an important fruit in India, and is widely grown in the states of Gujarat, Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, and West Bengal. Sapota with low shelf life is converted to various value added products such as Sapota beverage, osmotic dehydrated bites, Candy, squash, jam etc.

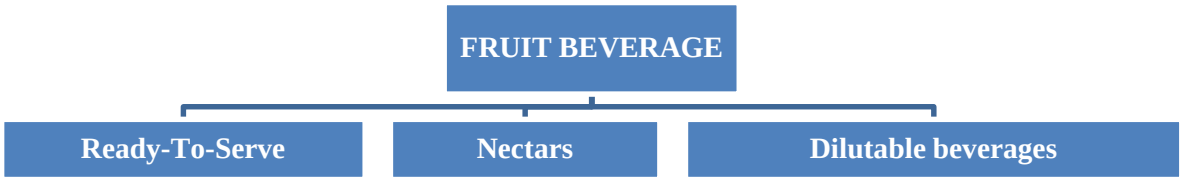
1.2 Present Status of National and Global Beverage Market

The global fruit beverages market size was valued at USD 33.92 billion in 2018 and is projected to expand further at a CAGR of 6.2% from 2019 to 2025. Rising importance of leading a healthy lifestyle is expected to boost the product demand. Rising concerns regarding various health issues including obesity and nutritional deficiencies are anticipated to boost the demand for these products, thereby supporting market growth. The Indian Food and Beverage industry is expected to be ~Rs. 4,00,000 Crores market as on 2019 and projected to grow by 2.5x to ~Rs. 10,00,000 Crores by 2025 (CAGR of 16%) – leveraging India's favorable demographic (1.4 Billion strong population, rising income levels and higher urbanization). Indian beverage Industry is approx 10%+ of the Global Beverage consumption today.

1.3 Fruit Beverages

Fruit beverages and drinks are one of the popular categories of beverages that are consumed across the globe. The fruit beverages and drinks are easily digestible, highly refreshing, thirst quenching, appetizing and nutritionally far superior to most of the synthetic and aerated drinks. In recent past the consumption of fruit based beverages and drinks has increased at a fast rate. Fruit juices or pulp used for the preparation of these products are subjected to minimal processing operations like filtration, clarification and pasteurization. The fruit juice or pulp, are mixed with ingredients like sugar, acid, stabilizers, micronutrients and preservative to develop beverages and drinks. There are various categories of fruit juice or pulp based beverages and drinks which are listed below.

Natural fruit juices, sweetened juices, ready-to-serve beverages, nectar, cordial, squash, crush, syrup, fruit juice concentrate and fruit juice powder belong to the category of non-alcoholic and non-carbonated beverages.



CHAPTER 2

PREPARATION OF SAPOTA JUICE

2.1. Sapota Juice

The sapota is a commercial tropical fruit crop, having high nutritive qualities with excellent flavour and delicious taste; hence it possesses high table value. Due to the grittiness of the sapota pulp, it is difficult to process it into commercial stable products. Even though a number of sapota products like dehydrated slices, jam, powder, etc. Have been developed, but not yet popular and available on commercial scale. The processing and equipment used for sapota juice processing has been discussed below.

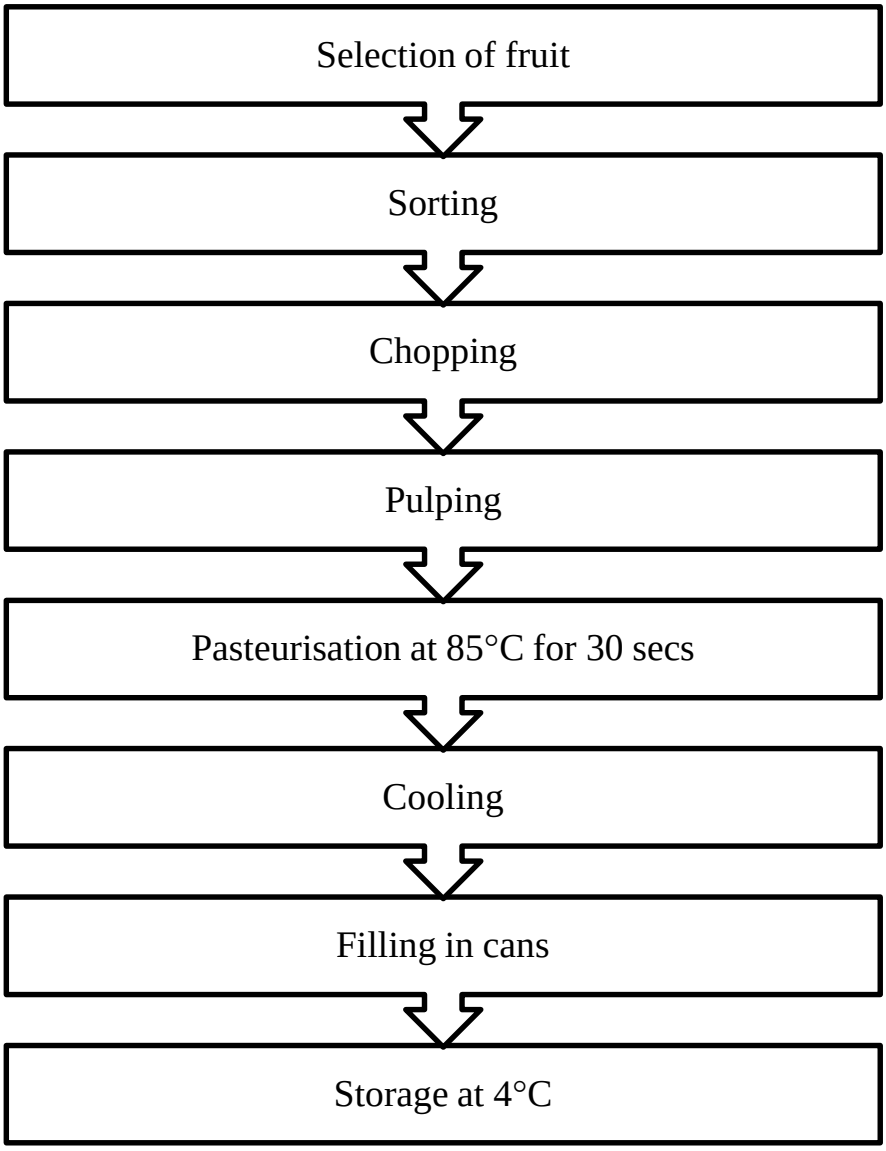
2.2. Role of Ingredients used for Preparation of Sapota Juice

Fresh fruit:

Selection of fresh fruits for juice extraction and removal of impurities before juice extraction. Climatic condition, variety of fruit, maturity and type of soil plays a main role in processing of juice. Over ripen, under ripen, damaged and diseased fruit should be rejected as it influences the quality of the product.

PTO…….

2.3 Flowchart for Processing of Sapota juice



2.4. Equipment used in for processing of Sapota juice

Conveyor

Washer

Sorter

Twin pulper

Screw type pulper

Pasteuriser

Chopper

Cold storage

2.5. Sapota Juice Processing

Selection of fruits

- The fruits were inspected thoroughly to avoid any damaged and spoiled fruits.
- They were ripened at ambient temperature.
- The variety and maturity of the fruit should be taken as a priority.

Sorting

- Sorting to remove decayed and moldy fruit is necessary to make sure that the final juice will not have a high microbial load, undesirable flavors, or mycotoxin contamination.
- Wet cleaning will be carried out with 10-100 ppm chlorine water to remove sand and other dirt compounds

Chopping

- The aim of this step is to smash, cut the fruit, increase its surface, and launch cell-fluid elimination.
- Chopping can lead to enzymatic reactions damaging valuable components.
- The fruit has to be processed immediately after chopping.
- If this step is done appropriately, the fruit is not pulpy but consists of homogenous, irregular-shaped, few-millimetre-sized particles, which tend to form channels to drain the liquid when pressed

Pulping of sapota fruits

- Pulping is process that performed by the extraction or pulper equipment which crush the food products and separate the pulp, seed and skin of fruits and vegetable.
- Pulper may be either mechanically or electrical operated to forces the feed in the machine.

- Ripened fruits were washed in tap water, peeled and sliced into small pieces. The sliced fruits were ground into pulp using mixer.
- The sapota pulp was treated with 70ppm of potassium metabisulphate, as pretreatments are necessary to prevent discoloration and microbial growth during processing.
- The ground pulp was kept under refrigeration (4ºC) condition before use.

Pasteurisation

- Pasteurization is a sterilization technology used to eliminate harmful microbes without damaging the raw material quality.
- Thermal pasteurization of fruit juices is related to heating at 85°C for 30 secs to destroy target microorganisms or enzymes.
- In order to produce safe fruit juice that is free of pathogens, is of high quality, meets consumer expectations, and minimizes commercial losses, thermal pasteurization must be effective

Filling

- Hot filling should carry out to prevent the contamination
- Aseptic filling can also be carried out to result in high quality products
- The process of filling the cooled pasteurised juice to the cans and stored at refrigeration temperature

Packing

- Sapota juice concentrate was packed in (P1) Low density polyethylene pouches (LDPE), (P2) High density polyethelene pouches (HDPE) and (P3) PET bottles.

Storage

- The packed concentrates were stored at 4°C. The concentrate samples were analyzed periodically during storage for 90 days.

2.6. Impact of Processing on Quality of Sapota Juice

- ✓ Temperature and pH of the juice should be maintained properly as it will impact the quality of juice.
- ✓ The variety and maturity of fruit should be selected properly as it will produce bitter taste in the product

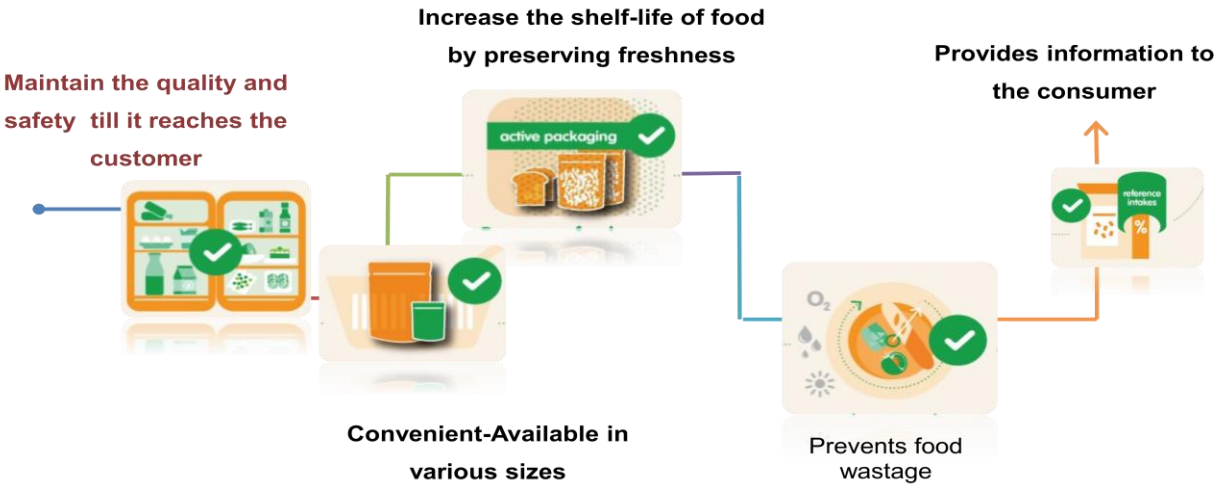
CHAPTER 3

PACKAGING OF SAPOTA JUICE

3.1. Packaging

Packaging is a co-ordinated system of preparing goods for transport, distribution, storage, retail and end use. It is a techno-economic function aimed at minimizing costs of delivery while maximizing sales.

3.1.1Why food Packaging?



Packaging keeps the product free from contamination, protects from damage during shipment and storage, and displays the product favourably. The principal packaging material for sapota juice is the cellophane bag, which provides moisture-proof protection for the product and is used easily on automatic packaging machines, but is difficult to stack on grocery shelves. Many manufacturers utilize boxes instead of bags to package sapota juice because boxes are easy to stack, provide good protection for fragile sapota juice products, and offer the opportunity to print advertising that is easier to read than on bags.

A proper packaging system provides not only the required physical protection that maintains the integrity of a food product but also the needed

microenvironment that minimizes quality degradation.

3.2. Functions of packaging

It is important to understand the functions of sapota juice packaging to effectively select, design, and utilize noodle packaging systems. The functions of packaging can generally be described as

1. Promoting and Selling the Product
2. Defining Product Identity
3. Providing Information
4. Expressing Customer Needs
5. Ensure Safe Use
6. Protecting the Product

3.2.1. Components of Sapota juice packaging

Like most food packages, sapota juice packaging is usually composed of three components:

(1) Primary package,

(2) Secondary package, and

(3) Tertiary package.

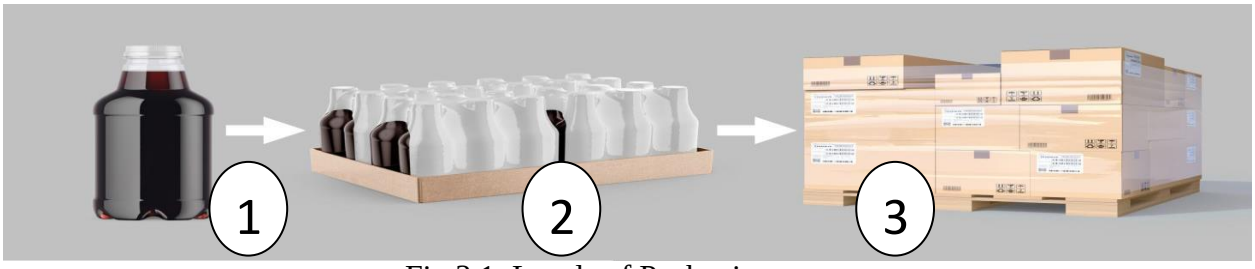


Fig 3.1. Levels of Packaging

Depending on the specific sapota juice product and the way it is served, there

could be at least one or two or all three components used in a noodle packaging system.

A primary package is defined as a package that is directly in contact with the sapota juice product. It is mainly used to form a sealed microenvironment to protect and isolate the sapota juice content from an unwanted environment (e.g., high humidity, oxygen, microbial) and other contamination from dust and undesired human contact.

Secondary package is the package that contains one or more primary packages. A secondary package can also be used to provide convenience in handling. Another function of the secondary package is to provide sapota juice product information such as lot number, production and expiration dates, and nutritional labels. It is also often used as a product display box.

A tertiary package incorporates the secondary package in the final shipping and distribution. The purpose is to consolidate secondary packages and to assist in storage and handling and to provide an additional layer of protection for the packaged sapota juice against physical damage and weather conditions. Examples are corrugated boxes, pallets, and stretch plastic films.

3.3. Requirements for effective food packaging

1. Be nontoxic
2. Protect against contamination from microorganisms
3. Act as a barrier to moisture loss or gain and oxygen ingress
4. Protect against ingress of odors or environmental toxicants
5. Filter out harmful UV light
6. Provide resistance to physical damage
7. Be transparent - be tamper – resistant or tamper – evident
8. Be easy to open
9. Have dispensing and resealing features
10. Be disposed of easily
11. Meet size, shape and weight requirements
12. Have appearance, printability features

13. Be low cost
14. Be compatible with food
15. Have special features such as utilizing groups of product together.

3.4. Characteristics of Fruit Beverages

Fruit Beverages These include fruit juices, fruit drinks, and fruit nectars. They contain fruit juice, water, sugar, dextrose, invert sugar etc. The major deterioration that occurs in fruit beverages is loss ofnutrition, physico-chemical changes and microbial growth. The product characteristics to be considered in relation to packaging are:

Acidity: All the fruit juices usually maintain an acidic character because they contain organic acids. • Enzymes: Enzymes exist in all fruit juices. Sometimes they have to be destroyed and sometimes to be added.

Vitamin C (ascorbic acid): The Vitamin C content of a fruit increases until just before ripening, and then decreases due to the action of an enzyme, ascorbic acid oxidase. When fruits are cooked, most of the ascorbic acid transfers from the tissue into the liquid or may be oxidized, oxidation occurring more easily in iron, copper or badly tinned vessels. Losses of Vitamin C also occur during storage. Storing at low temperature, and preventing contact with air and light reduces this. Addition of sulphite has a preserving effect on Vitamin C.

Colour and Flavour: They are very important, and many fruit drinks contain certain legally permitted colourings. These are added to overcome the bleaching effect of the sulphite used as a preservative, and to provide an attractive appearance.

Yeast: Spoilage of fruit juices is mainly due to yeast. Its growth depends upon the temperature. Spoilage of raw fruit juice at room temperature results in alcoholic fermentation, followed by the oxidation of alcohol and fruit acids by yeasts or moulds growing on the surface. Hence every living yeast cell must be removed or suppressed by pasteurization, filtration and/or preservatives.

3.5. Different packaging materials for packaging of fruit beverage

3.5.1. Glass Containers: The use of glass bottles for the packaging of fruit beverages was wide-spread although the hot-fill/hold/cool process had A be applied with care avoid breakage of the containers. Glass is still the preferred packaging medium for high quality fruit beverages. However, over recent years, an increasing proportion is being packed aseptically, into cartons.

The improvements that have occurred in glass bottle packaging are:

• Light weight

• Surface coating to increase abrasion resistance

• Use of wide mouth containers fitted with easy-open-caps.

3.5.2. Metal Containers: Tinplate cans made of low carbon mild steel of 99.75% purity, coated with tin with easy open ends are used. These tinplate containers are either 3 piece or 2 piece containers. They are lacquered internally to prevent corrosion.

3.5.3. Plastic Containers: Fruit juices contain organic substances, which are sensitive to bacterial contamination. Packaging of such products is done through hot filling, to achieve extended shelf-life, PET bottles are usually used for hot filling applications. Special features are added to the containers through design and manufacturing process. The package is heat-set in order to improve the temperature resistance of the containers. PET resins with a higher Tg (glass transition) temperature and/or a faster rate of crystallisation are used. Normally hot-filled PET bottles are designed about 1.5 times heavier than cold-filled bottles. Reinforcing ribs and grooves are also provided along the circumference and base of the bottle. After filling and capping operations, the liquid continues to cool, which results in formation of vacuum. The bottle wall can deform under the influence of vacuum, and this problem is overcome by providing vacuum panels in the container side wall. Generally, lower levels of PET co-polymer are preferred and intrinsic viscosities of about 80 are acceptable. Flexible plastic packages offer economic savings over conventional glass and metal containers but they are permeable to oxygen. Therefore,

it is critical to select a flexible package that minimizes the permeability to oxygen. Flexible laminated pouches like metalli.d polyester/polyester/ polyethylene are used for hot fill packaging method without retorting for acidic fruit juices. These are used either as flat pouches or stand-up pouches. However, the shelf-life of the product in these pouches is limited.

3.5.4. Aseptic Packages:

Aseptic packages are made by combining thermoplastic with paperboard and aluminium foil. Their multi-layered construction enables the carton to protect the contents from various factors responsible for spoilage. The aluminium foil layer is a strong barrier for 02 and light. The inner plastic layer made of polyethylene makes it possible to seal through the liquid. The outer paper layer provides stiffness making it possible for the cartons in a brick shape, thus, enabling maximum utilisation of available storage and transportation space. Excellent graphics are possible leading to good display and shelf appeal and also providing information regarding the product. The aseptic process makes the product bacteria-free before being packaged. To provide convenient access to the contents, beverage cartons offer a variety of opening devices. A familiar opening feature of the pack is the drinking straw, which is attached to the package. Some recent trends are pull-tab opening, which can be readily detached from a pre-punched hole without compromising the package integrity. Also, custom designed caps and closures can be incorporated on beverage cartons for easier pouring and for enhancing the brand image.

3.5.5. Bag-in-Box System: It consists of a collapsible bag within a rigid container, a filling machine to introduce the liquid product into the bag and a dispenser to draw the product out.

Bag: The outer container can be a box, a crate or a drum. The bag actually consists of two bags. An inner bag contains the liquid and an outer bag provides the barrier properties. Both are heat-sealed at the edges. The tubular spout fitted to the bag aids in filling and dispensing of the product. As little as 3 litres or as much as 1000 litres, can be packed.

The bag is the "life" of the system. The bag itself consists of three components:

i. An inner layer

ii. An outer layer

iii. A spout

The function of the inner layer, the one in contact with the material being packed, is to provide the bag with seal integrity. The seals are to be strong enough to withstand constant mechanical and chemical "pressure" for at least twice the expected shelf-life of the product. Generally, the inner layer is not designed for barrier unless the product needs extra barrier, which the outer layer cannot provide. Plastic films manufactured from high performance polyethylene, with excellent sealing and puncture properties are usually used as inner layer materials.

CHAPTER 4

FOOD SAFETY REGULATIONS AND STANDARDS OF SAPOTA JUICE

4.1. FSSAI

FSSAI stands for Food Safety and Standards Authority of India which is an organization that monitors and governs the food business in India. It is an autonomous body which is established under the Ministry of Health & Family Welfare, Government of India. The FSSAI has been established under the Food Safety and Standards Act, 2006 (FSS Act) which is a consolidating statute related to food safety and regulation in India.

4.1.1. Functions of FSSAI

1. Framing of regulations to lay down food safety standards
2. Laying down guidelines for accreditation of laboratories for food testing
3. Providing scientific advice and technical support to the Central Government
4. Contributing to the development of international technical standards in food
5. Collecting and collating data regarding food consumption, contamination, emerging risks etc.
6. Disseminating information and promoting awareness about food safety and nutrition in India

4.2. Food Standards

FOOD SAFETY AND STANDARDS (FOOD PRODUCTS STANDARDS AND FOOD ADDITIVES) REGULATIONS, 2011

2.3. FRUIT AND VEGETABLE PRODUCTS

2.3.6: Thermally Processed Fruits Juices

1. Thermally Processed Fruits Juices (Canned, Bottled, Flexible and/ or Aseptically Packed) means unfermented but fermentable product, pulpy, turbid or clear, intended for direct consumption obtained by a mechanical process from sound, ripe fruit or the flesh thereof and processed by heat, in an appropriate manner, before or after being sealed in a container, so as to prevent spoilage. The juice may have been concentrated and later reconstituted with water suitable for the purpose of maintaining the essential composition and quality factors of the juice. It may contain salt. One or more of the nutritive sweeteners may be added in amounts not exceeding 50 g/kg but not exceeding 200g/kg in very acidic fruits except in case of Apple Juice, Orange Juice (reconstituted from concentrate), Grape Juice, Pineapple Juice (reconstituted from concentrate). The product is not required to be called sweetened juice till the added nutritive sweeteners are not in excess of 15g/kg.

2. The product may contain food additives permitted in these Regulations and Appendices. The product shall conform to the microbiological requirements given in Appendix B. The product shall meet the following requirements: —

FRUIT JUICES	**TSS Min(%)**	**Acidity expressed as Citric Acid Max.(%)**
Other fruit juices of single species- not very acidic	10	3.5

3. The container shall be well filled with the product and shall occupy not less than 90.0 percent of the water capacity of the container, when packed in the rigid containers. The water capacity of the container is the volume of distilled water at 20ºC which the sealed container is capable of holding when completely filled.

4.2.2. List of food additives for use in Fruit beverages

Table 4.1. List of food additives for fruit juice

Name of the additive	**Level of use**
ACIDIFYING AGENTS	
Citric acid	GMP
Phoshphoric acid	GMP
L-Tartaric acid	GMP
Malic acid	GMP
ANTIOXIDANTS	
Ascorbic acid	GMP
Calcium Ascorbate	GMP
Sodium Ascorbate	GMP
FLAVOURS	
Natural Flavouring and Natural Flavouring substance/Nature identical Flavouring Substances / artificial flavouring substances	GMP
PROCESSING AIDS Nitrogen and carbon dioxide	GMP
Preservative	
Benzoate	1000 mg/kg
Phosphate	1000 mg/kg
Sorbate	1000 mg/kg
Sulfite	50 mg/kg
Tartarates	4000mg/kg

THICKENING AGENTS (Singly or in combination)	
Alginic acid	GMP
Sodium alginate	GMP
Calcium alginate	GMP
Propylene glycol alginate	GMP
Gum arabic	GMP
Potassium alginate	GMP
Pectins	GMP
Glycerol ester of wood resin	100 mg/kg
Alginic acid	GMP
Gellan gum	GMP

4.2.3. Microbiological requirements of Fruit juice

Table 4.2. List of microbiological requirement for fruit juice

	Products	Parameters	Limits (CFU)
1	Fruit juice	1. *Salmonella* 2. *Listeria monocytogenes* 3. *Sulphite Reducing Clostridia (SRC) E. Coli 0157 and Vero or Shiga toxin producing E coli* 4. *Vibrio cholerae*	Absent/25 ml Absent/25 ml Absent/25 ml Absent/25 ml Absent/25 ml

4.3. Labelling Standards

Labeling 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 coloring 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 color- 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 color-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 packags, should carry mandatory information on the label.

4.4. 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. 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.

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