MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

PMFME
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NIFTEM
THANJAVUR

PM Formalisation of
Micro Food Processing Enterprises Scheme

Processing of Petha

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CHAPTER 1
INTRODUCTION

1.1. History of Indian Sweets

Sweets have been traced to be originated at 500 BCE in the Indian subcontinent that suggests the production of both raw sugar (gur, vellam, jaggery) and refined sugar (sarkara). Five kinds of sugar in the official documents were acknowledged by the kingdom officials in India back at 300 BCE. By the Gupta dynasty era (300–500 CE), sugar was being made not only from sugar cane, but from other plant sources such as palm. Sushruta Samhita records about sugar being produced from mahua flowers, barley (yavasa) and honey and Sugar-based foods were also used in temple offerings as bhoga for the deities which, after the prayers, became prasād for devotees, the poor, or visitors to the temple.

1.2. History of Petha

The data shows the existence of sweets back at Mughal era, when Shah Jahan ruled Agra. He asked his chefs to make a unique dessert that is as pure and white like the Taj Mahal. The royal chefs worked hard and came up with a new sweet invention called Petha. The first form of petha is believed to be “Gulabi (or rose)” and is suspected to be over a thousand year old. The patronage of Queen Nur Jahan led to the crystalline and translucent form of petha that is considered by many to be the original form these days. Several varieties and flavors of petha have been developed over last few centuries, especially in the last couple of decades, including paan, chocolate, kesar, angoori, mango, coconut, etc. One of the main ingredients that goes into making Petha is ash gourd aka winter melon or white pumpkin.

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It is considered the purest dessert in the world, due to its ingredients, comprising of fruit, sugar and water. Petha is not cooked on a regular cooking fire, but only coal fire was used to prepare this sweet treat. Petha made in Agra has a Geographical Indication (GI) tag to certify its place of origin. With the passage of time, many varieties of Petha have come up in the market to cater to the demand and changing palate of the patrons. Nowadays, buyers can choose from the kesar petha (saffron), angoori petha (grapes), chocolate petha, paan petha, and so on. Coconut and dried fruit lovers can also have their share of the delicious Petha.

1.3. Ash Gourd

Ash Gourd is used in the preparation of a dessert called petha, which is the most famous sweet of Agra, the place that also symbolized by Taj Mahal. Ash gourd is very important in Indian religious ceremonies. It is frequently found hanging from a rope in front of newly built houses, as it is believed to ward off evil spirits. This gourd is also ground to a coarse paste and made into vadiyaalu (similar to Papad). The gourd stays well for up to three to four months without any special storage facilities.

1.3.1. Major component of Ash Gourd

Principle	Nutrient Value	Percentage of RDA
Energy	13 Kcal	1%
Carbohydrates	3g	2.3%
Protein	0.4 g	<1%
Total Fat	0.2 g	1%
Cholesterol	0 mg	0%
Dietary Fiber	2.9 g	7.6%
Vitamins		
Folates	5 µg	1.25%
Niacin	0.400 mg	2.5%
Pantothenic acid	0.133 mg	2.5%
Pyridoxine	0.035 mg	3%
Riboflavin	0.11 mg	1%

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Thiamin	0.04 mg	3.3%
Vitamin-A	0 IU	0%
Vitamin-C	13 mg	14%
Electrolytes		
Sodium	6 mg	<0.5%
Potassium	111 mg	2.4%
Minerals		
Calcium	19 mg	2%
Iron	0.4 mg	5%
Magnesium	10 mg	2.5%
Manganese	0.058 mg	2.5%
Phosphorus	19 mg	2.5%
Selenium	0.2 μg	<1%
Zinc	0.61 mg	6%

1.4. Importance on Ash Gourd

The important of Ash Gourd fruit is known since old time, it has been thought to be alkaline in nature, and hence its consumption has a cooling and neutralizing effect on stomach acids and as such used effectively for treating digestive ailments like hyperacidity, dyspepsia, and ulcers. It is also used to treat diabetes.

Ash gourd is very low calorie vegetable; just holds 13 cal/100g, relatively same calories as in cucumbers (12 cal/100g). It carries ample concentrations of vitamins, minerals and fiber that help in overall health and wellness.

Winter melon peel is a good source of dietary fiber which helps in smooth bowel movements and offers protection against colon cancers by eliminating toxic compounds from the gut.

Ash gourd is gluten-free food items and is one of better alternative food substitute in people suffering from spectrum of gluten-related disorders. Fruit of Ash gourd holds relatively more amounts of vitamin-C (14% of RDA /100 g) than cucumbers. Ash Gourd contains small amounts of (5 μg/100 gm) of folates. Some winter varieties of ash gourd too hold less sodium (6

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mg/100 g) but higher amounts of potassium (111 mg/100 g), an important intra-cellular electrolyte. Ash gourd carry modest levels of other B-complex groups of vitamins like riboflavin, pantothenic acid, and minerals like phosphorus, zinc, calcium, iron, and manganese.

1.5. Statistics

1.5.1 Global scenario

Agra's famous petha sweet industries as well as tourist guides, who went into near closure, are ecstatic. As the Taj Mahal re-opens, the petha industry has greatly benefited. Around 50 % of sales of Petha are due to agro-tourism. However, Petha seems to be just a processed sweet dish, but in Agra and other regions of the areas, it is the lifeline of economy. The sellers, the processor, the distributor are all directly or indirectly linked to Petha processing business and development. As a result of its strong demand from tourists overseas, Petha also has strong export prospects.

1.5.2 National scenario

Petha, the “delicacy” from the Taj Mahal city of Agra, traces its history back to almost 4 centuries, when it served as an instant source of energy to thousands of workers involved in the making of the great monument, Taj Mahal. Prepared by boiling and processing Ash Gourd (the vegetable “petha”), this sweet is the livelihood of thousands of workers in Agra. About 1500 cottage units produce 700-800 tonnes of Petha daily.

1.6 Value addition Ash Gourd

Ash gourd is an important, under-exploited vegetable that is immensely used in ayurvedic medicine preparations. It has a long storage life and good scope for value addition. Petha (Candy) and Badi (Nugget) prepared from ash gourd are much preferred in India. But ash gourd varieties differ significantly as regards the taste, acceptability and nutritive value of petha and badi prepared from them. Many petha based industries at small cottage scale as well as big established petha manufacturing industries are located to produce variety of sweets from ash gourd. The delicacy of sweet can be judged that it can be prepared and served in many forms depending upon the choice of consumers. The variation in the variety of sweets from petha is reflected towards crystallized or glazed petha or dipping of cooked ash gourd in concentrated

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sugar syrup along with flavoring and coloring material for increasing the aesthetic quality. On composition basis, petha based sweets contain on an average 0.4% of fat, 65% of total carbohydrate, 3% of dietary fiber, 0.6% protein and 40% sugar content. Food Safety and Standards Act, 2006 limits the maximum permissible limit of 150 ppm of sulphur dioxide or 500 ppm sorbic acid in finished crystallized or glazed petha.

1.7 Scope of Petha Industry

In today's world where businesses face a double challenge — of tough competition and the short attention span of the consumer — innovation is the only way to survive and thrive. Traditional sweet makers, famous for its translucent, soft candy, petha, have realized this, and are thus innovating the humble sweet in myriad ways.

The competition in the Indian sweet market is increasing day by day with different kinds of Indian sweets and western influences, like doughnuts, pastries, and cakes. The petha industry has great opportunities that if offer something 'new' to the customer with old taste.

Presently 15 varieties of petha are manufactured in India. There is chocolate, paan, angoori, khus, orange, pineapple, coconut, dry fruits, and Kesar, among others. There is even a sandwich variety which is basically two layers of petha with a filling of khoya, cashew, and cardamom.

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CHAPTER 2

PROCESSING OF PETHA

2.1. Manufacturing Process

Petha Fruits (Ash Gourd) are directly procured from the farmer's field. Washing, Sorting, and peeling of Petha fruit is done manually. Then they are cut into pieces. The seed of the fruit is removed from the fruit by an SS knife Cutting them into small pieces. These pieces are pierced with nail-like spikes. Pierced pieces are then immersed in Lime Water for 2 hrs. Then these pieces are boiled in water with Alum. After they are boiled, the Pieces are finally immersed in boiling sugar syrup for an hour. Finally, these pethas are dried in trays for further packaging. Final packaging is done and sends to the market.

2.1.1 Proper processing technologies are given below:

- **Fruit selection and harvesting of Ash Gourd**

The fruits are directly procured from farmer field; the ash gourd to be candied must be of perfect maturity stage and is free of fibers.

- **Peeling, Cutting & Seed Removal**

The harvested wax gourd is washed and cleaned. The seeds are removed and It is then peeled and cut at an approximate dimension (cubical, cylindrical or spherical.), dimension and shape can vary according to choice.

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- **Piercing or Forking**

After peeling and cutting operations, pieces of Ash Gourd are pierced with metal to ensure proper porosity. This would at last ensure proper entry of the sugar syrup.

- **Soaking in lime water**

The pierced/forked pieces of Petha are then dipped in lime water for around 2-3 hours. The proportion used is usually 20 kilograms of lime per 100 liters of water. This process helps to harden Petha to makes it compact. The methodology behind the use of calcium in the fruit slices to create an intercellular bond and making it more textured and rigid.

- **Washing in running water**

After Dipping Petha in lime water, it is washed constantly in clear running water to wash the calcium dipped bits in running water until the lime is completely washed away. In order to ensure the elimination of excess calcium ions, this is an essential and mandatory process.

- **Dipping in chilled water**

The petha is dipped in chilled water after being cleaned in running water to reduce exothermic reactions due to excess Ca2+ ions are minimized. This is done for half an hour or 1 hour.

- **Hot water treatment**

Now the fruits pieces are dip in hot water (80-90^{0}C), to minimize the characteristic taste of gourds. This is done within 5-10 minutes.

- **Boiling with Alum**

Petha bits are boiled for one hour in water containing alum. This process is called, ‘Josh Lena’. In order to preserve the standard of Petha, this is a very important step that must be performed cautiously and skillfully. This is achieved to maintain surface smoothness and reduce the effects of exothermic damage caused by excess calcium ions in the fruit tissues.

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- **Preparation of sugar syrup**

70-80% of sugar is dissolved in water and is boiled at 100^0C. After cooking for 5-10 minutes citric acid 2-3g is added / liter of water.

- **Boiling with sugar syrup**

The treated fruit pieces are dipped in boiling sugar syrup of suitable consistency. The sugar syrup and the fruit parts are boiled until the sugar syrup reaches a very high consistency (up to 80- 90 percent). To ensure consistent mixing, the petha is cooked properly and stirred periodically. After cooking properly Petha are covered with mesh overnight so that a sufficient amount of sugar enters into the innermost part of the fruit pieces.

- **Draining of excess sugar**

The excess syrup is drained out. Then one then Rose petals, essence & flavoring agents such as saffron, are added to make different flavors of pethas. It is then cooled into assorted boxes and bins until it is packaged.

- **Cooling and packing**

After overnight soaking, the Petha are cooled and are packed airtight.

2.2 Current trends of Indian sweets industry

Refined sugar was first produced by the people of the Indus Valley some 8000 years ago in India. In fact, the word Sugar in English is a derivative of the Sanskrit word Shakara. The first Indian sweet probably was a close cuisine of Malpua which finds mention in Rig Veda as Apupa- a sweet cake made with Barley, deep-fried or steamed, and then dipped in honey. Over the years Indian Mithais saw great evolution with new trends, techniques, and methods influencing their make and taste. The Mughals introduced Kulfi, for which ice was carried from the Himalayas by horse couriers for making rich desserts that having created rich desserts that made a lot of use of roses, dried fruits, fruits, and essence. In the sub-continent today thousands of regional varieties are making an inscrutable and arduous list! No wonder India is the paradise of sweet lovers and the petha is as sweet as the great choices.

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2.2.1 General Fruit Principals

Fruits are highly perishable items which needs processing to make it durable. Fruit processing is any deliberate change in a fruit that occurs before it's available for us to eat. Processing methods extend the shelf life of fruits.

Fruit processing has three major aims:

1. To make fruit safe (microbiologically & chemically).
2. To provide good quality products with good flavor, color, texture and taste.
3. To make convenient fruits products

As time passes spoilage increases rapidly. Fruit processing involves many steps.

- **Cleaning and washing**

First, the fruits should be cleaned thoroughly to remove any adhering dirt or pesticide residues. This cleaning process usually involves washing the product with running water.

- **Sorting**

To achieve a uniformly sized product, fruits and vegetables are sorted immediately after cleaning according to their size, shape, weight or color. Sorting by size is especially important if the products are to be dried or heated, because their size will determine how much time will be needed for these processes.

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- **Peeling**

Many types of fruits have to be peeled in order to be preserved. This can easily be done with a stainless steel knife. It is extremely important that the knife be made of stainless steel because this will prevent the discoloration of the plant tissues.

- **Cutting**

Cutting is important in order to get uniform pieces for heating, drying and packing. Fruits are usually cut into cubes, thin slices, rings or shreds. The cutting utensils have to be sharp and clean to prevent micro-organisms from entering the food.

- **Blanching**

Blanching is a slight heat treatment, using hot water or steam that is applied mostly to fruits before canning or freezing. It is done by immersing fruits in water at a temperature of 90-95°C. The result is that fruits become soft and the enzymes are inactivated. Blanching is done before a product is dried in order to prevent unwanted color and odour changes and an excessive loss of vitamins.

2.3 Fruit Preservation

Fruit preservation is the process of treating and handling food to stop or slow down fruit spoilage, loss of quality, edibility or nutritional value and thus allow for longer fruit storage.Preservation usually involves preventing the growth of bacteria, fungi (such as yeasts), and other micro-organisms as well as retarding the oxidation of fats which causes rancidity. Fruit preservation can also include processes which inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut, which can occur after fruit cutting.

Many processes designed to preserve food will involve a number of fruit preservation methods. Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit's moisture content and to kill bacteria, yeasts, etc.), sugaring (to prevent their re-growth) and sealing within an airtight jar (to prevent recontamination).Maintaining or creating nutritional value, texture and flavor is an important aspect of fruit preservation.

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2.3.1. Preservation methods of Fruit

- **Drying**

Drying is one of the most ancient fruit preservation techniques, which reduces water activity sufficiently low to prevent bacterial growth. Drying is the partial removal of water from solid foods. It is one of the oldest methods of food preservation. It was traditionally carried out in the presence of sun.

- **Refrigeration**

Refrigeration preserves fruit by slowing down the growth and reproduction of micro- organisms and the action of enzymes. Refrigerators should be set to below 4°C to control the growth of micro-organisms. This lowered temperature also reduces the respiration rate of fruits and retard the spoilage.Commercial and domestic refrigerators improved the shelf life of foods such as fresh fruits and salads to be stored safely for longer periods, particularly during warm weather.

- **Vacuum packing**

Vacuum-packing stores food in a vacuum environment, usually in an air-tight bag or bottle. The vacuum environment strips bacteria of oxygen needed for survival, slowing spoiling. Vacuum-packing is commonly used for storing dried fruits to reduce loss of flavor during oxidation.

- **Freezing**

Freezing is also one of the most commonly used processes commercially and domestically for preserving fruit including prepared fruit stuffs which would not have required freezing in their unprepared state. Lowering the temperature below the freezing point of the product stops microorganisms from growing and reduces the activity of enzymes. Fruits are heat treated (blanched) before freezing to eliminate enzymes. Home freezers are held at -10°C, commercial freezers are under -18°C. At this temperature, the growth of micro-organisms is almost stopped.

- **Pasteurization**

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Pasteurization is a process of heating a product at a specific temperature for a controlled period of time to destroy the most heat resistant vegetative pathogenic organism. The process is also applied for fruit juices and juice products.

- **Canning**

Canning involves cooking food, sealing it in sterile cans or jars and boiling the containers to kill bacteria.

2.3.2. Importance of Sugar & Preservatives in Fruit Preservation

Sugar is used to preserve fruits, either in syrup with fruit such as apples, pears, peaches, apricots, plums or in crystallized form where the preserved material is cooked in sugar to the point of crystallization and the resultant product is then stored dry. This method is used for the skins of citrus fruit (candied peel) and ginger.

Preservative / food additives can be antimicrobial; which inhibit the growth of bacteria or fungi, including mold or antioxidant; such as oxygen absorbers, which inhibit the oxidation of fruit constituents. Common antimicrobial preservatives include calcium propionate, sodium nitrate, sodium nitrite; sulfites (sulfur dioxide, sodium bisulfate, potassium metabisulfite, etc) and antioxidants which include BHA (Butylated Hydroxy Anisole) and BHT (Butylated Hydroxy Toluene).

- **Storage**

Always store the preserved food in a cool place, at a temperature below 20°C. Keep glass bottles and jars out of light. The storage area has to be dry and with a consistent temperature.

2.4 Formulation of Petha Making (100 Kg)

Raw Materials Required	Weight
Ash gourd	200 250 kg

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Water	500 liters (As required)
Lime	10 Kg
Alum	500 g
Citric acid	200 g

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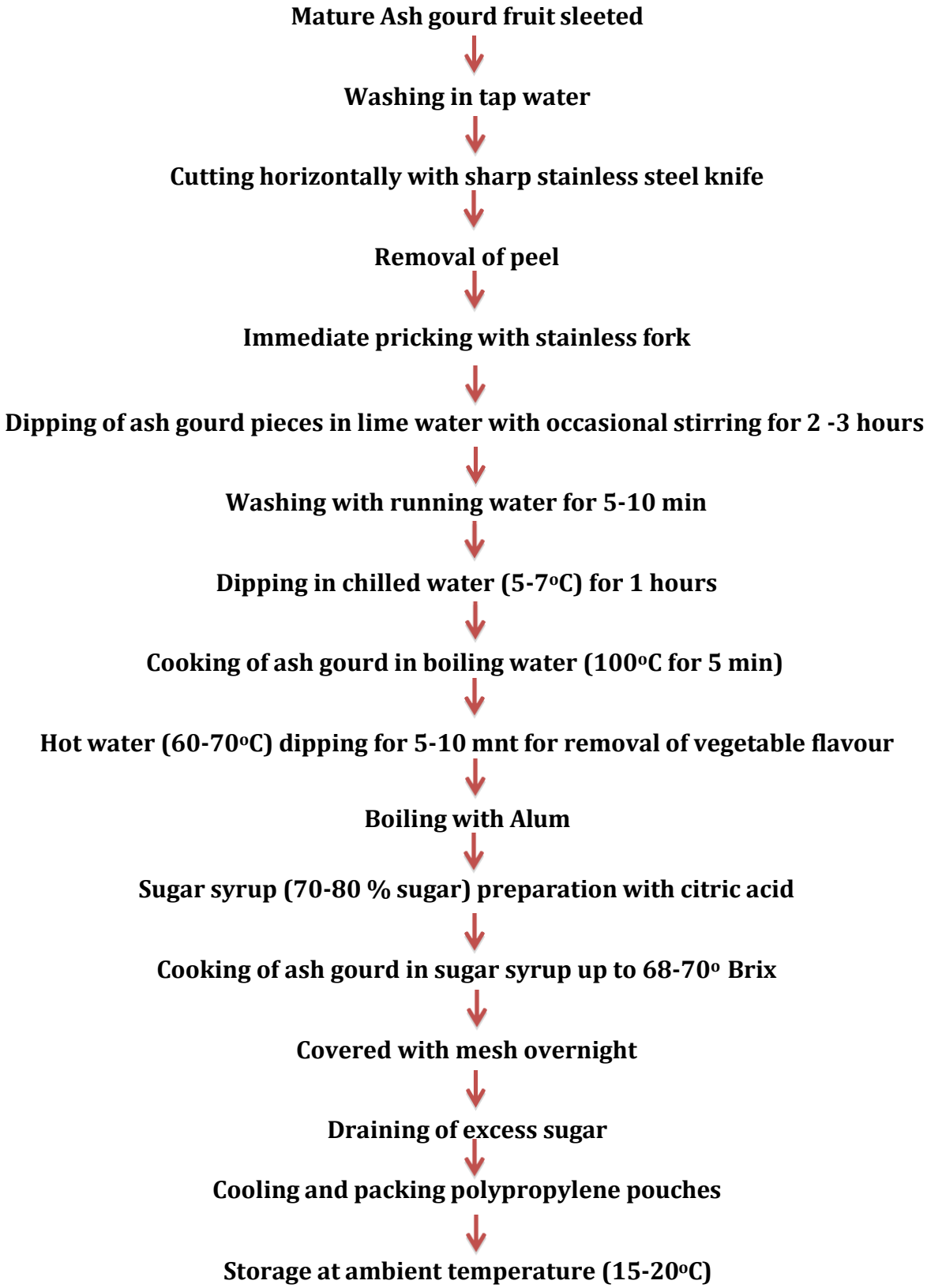
2.4.1. Flow chart of Petha preparation



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2.4.2 FPO Specification:

Fruit Products Order -1955, promulgated under Section 3 of the Essential Commodities Act - 1955, aims at regulating sanitary and hygienic conditions in manufacture of fruit, vegetable products. It is mandatory for all manufacturers of fruit, vegetable products to obtain a license under this Order. To ensure good quality products, manufactured under hygienic conditions, the Fruit Product Order lays down the minimum requirements for:

1. Sanitary and hygienic conditions of premises, surrounding and personnel.
2. Water to be used for processing.
3. Machinery and equipment.
4. Product standards.

Besides this, maximum limits of preservatives, additives and contaminants have also been specified for various products. This order is implemented by Ministry of Food Processing Industries through the Directorate of Fruit & Vegetable Preservation at New Delhi. The Directorate has four regional offices located at Delhi. The Directorate has four regional offices located at Delhi, Mumbai, Calcutta and Chennai, as well as sub-offices at Lucknow and Guwahati. The officials of the Directorate undertake frequent inspections of the manufacturing units and draw random samples of products from the manufactures and markets which are analyzed in the laboratories to test their conformity with the specifications laid under FPO.

The Central Fruit Advisory Committee comprising of the officials of concerned Government Departments, Technical experts, representatives of Central food Technology Research Institute, Bureau of Indian standards, Fruits and Vegetable Products and processing Industry, is responsible for recommending amendments in the Fruit Product Order, In view of the demands of the industry, and the liberalized economic scenario, major amendments were made in FPO during 1997.

- **FOOD LAWS:**
  - Prevention of Food Adulteration Act (Ministry of Health)
    The Act lays down specifications for various food products and is mandatory. The

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Ministry of Health in 1995 had constituted a Task Force under the chairmanship of Shri E.S. Venkataramaiah, Chief Justice of India (retired). The Task Force recommended that there should be emphasis on good manufacturing practices instead of detection of adulteration and prosecution. It also expresses concern about lack of laboratoryequipments and quantified persons. In addition it also suggested that the name of PFA Act be changed to Food Safety Act.

- Agriculture Produce (Grading & Marking) Act (Ministry of Rural Development) This Act is commonly known as AGMARK and is voluntary. The Act lays down the specifications for various agricultural commodities including some processed foods.
- Laws being operated by Bureau of Indian Standards (BIS) BIS is the largest body for formulating standards for various food items. These standards are also voluntary.
- Essential Commodities Act- A number of quality control orders has been issued under Essential Commodities Act such as FPO, MMPO, Meat Product Order and Vegetable Oils Control Order. These orders are mandatory and primarily meant for regulating the hygienic conditions. They need to be clubbed under one order which may call Food Products Order.

- Harmonization of Food Laws- The review of multiple laws is necessary to have a uniform and logical approach for regulating the quality of food. The following action is being taken by various Ministries:-
  - The Ministry of Civil Supplies & Consumer Affairs has brought out a paper for consideration of Committee of Secretaries (COS). The paper recommends that BIS should formulate standards for all food items in the country. This will be a major step towards harmonization of food laws and is still under consideration of COS for finalization.
  - The Task Force constituted by the Prime Minister under the chairmanship of Shri Nulsi Wadia has submitted its report which is under the consideration of the Government. The Task Force had advocated promotion of food safety and quality. The Task Force has further made following suggestions:-
    - Food Regulation Authority (FRA) is set up to formulate and update food standards for domestic and export market.

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- FRA should replace the PFA to conform to international standards. The Task Force has given ten specific recommendations such as provision of storage simplicitor, simplification of sampling procedure, simplification of procedure for nominee, time limit for prosecution, standard methods of analysis to be prescribed, penalty should graded according to the gravity of offences and provision of adequate/infrastructure and laboratories.
- Harmonization of Indian standard with quality norms of Codex and WTO.

2.4.3 Equipments involved

- Weighing machine- weighing scales are used to measure weight of product and raw materials.

- **Iron Karahi-**Karahi serve for the Boiling, frying of different type of food. In Petha manufacturing this is used for boiling petha fruit. Which are often named Karahi dishes after the utensil.

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- **Stove-** Stove is heating device in which natural gas is used for fuel. Gas may be supplied to the burner prior to combustion at a pressure sufficient to induce a supply of air to mix with it.

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CHAPTER 3

PACKAGING OF PETHA

3.1 The factors that lead to spoilage/defects the petha are highlighted as below:

- **Blemishes** - Scars, discoloration, sunburn, dark spots, black nose, or similar abnormalities in surface appearance affecting an aggregate area greater than that of a circle 7 mm in diameter.

- **Dirt**-preparation of packaging in an open area can lead to this problem. dirt can reduce the quality of petha**.**

- **Insects and mites**- as it is sweet and prepared from sugar it can be damaged by insects or mites or contaminated by damage and contamination the presence of dead insects or mites, fragments of insects or mites, or their excreta.

- **Scouring-** Breakdown of the sugars into alcohol and acetic acid by yeasts and bacteria.

3.2. Selection of Packaging Material

Factors to consider include product damage, fines, stickiness, bag opening size, re-closure among other things. In selection of packaging materials for sweet packaging the following need to be considered:

3.2.1. Water Vapour Transmission Rate (WVTR)

Knowledge of WVTR of packaging materials and the effect of folding, creasing, crumpling of materials on papers and aluminum foil show considerable effect. However, thermoplastic materials are not much affected.

Effect of Folding and Crumpling on the WVTR

	WVTR, g/m², 24 hr. 38°C & 90% RH.			
	Flat	Folded	Crumpled	Gelboflex
Met PET (12µ)	0.9	1.7	3.4	18
Met PET / LDPE (50µ)	0.5	0.6	0.7	0.6
2-sides PVDC coated PET	4.2	3.7	5.9	4.8
2-sides PVDC coated PET/LDPE	2.9	3.6	3.3	3.1

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3.2.2. Gas Transmission Rate

Permeability to gases like oxygen decides the shelf-life of oxygen sensitive fruit items. The oxygen transmission rates (OTR) of some plastic materials and the effect of folding and crumpling.

Effect of Folding and Crumpling on the OTR

	Oxygen transmission rate, ml /m², 24 hr. Atm. at 25°C.			
	Flat	Folded	Crumpled	Gelboflex
Met PET (12µ)	< 1	5.5	16	59
Met PET / LDPE (50µ)	< 1	< 1	2	3.5
2-sides PVDC coated PET	6	6	8	7
2-sides PVDC coated PET/LDPE	7	7	9	11

Besides OTR, permeability to volatiles and flavours is important in candies packaging. Polyolefins have high values, whereas plastics such as polyester, nylons, ethylene vinyl alcohol (EVOH) have good barrier properties for transmission of volatiles. The odour permeability's (for volatiles used in candies) of some materials.

Odour Transmission of Packaging Materials

Packaging Material	Thickness (µ)	Days to Aroma Leakage			
		Vanillin	Menthol	Piperonal	Camphor
BOPP / PE	17/50	6	2	1	13
PET / PE	12/50	2	16	5	< 30
PET / EVOH	12/15	< 30	< 30	30	< 30
OPP / EVOH / PE	18/15/50	30	< 30	27	< 30
PET / EVOH / PE	12/15/50	15	25	27	< 30

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3.2.3. Tensile Strength & Elongation

Tensile Strength and Elongation properties of materials need to be studied as their running on high-speed machines should be suitable.

3.2.4. Tear Strength

For a fruit processed product, tear strength is of importance as low tear values are necessary and useful for opening packages by hands.

3.2.5. Heat Seal Strength

The performance of a finished package is determined by the effectiveness of the package seal i.e. the permeability to water vapor, gases and volatiles increase if the seal is not perfect. Thermoplastic films such as polyethylene give excellent heat seals.

3.2.6. Performance Properties

Apart from the above mentioned important properties, a material has to perform well on machines; therefore knowledge of physical properties like slip, stiffness, blocking resistance is also necessary.

Twist retention for twist wrap is also of importance. The initial function of packaging is to protect. However, the emotional role played by packaging is also of importance, especially when the confection is a gift. A sophisticated packaging using deluxe materials is often used as a way of expressing feelings.

Packaging must also be specialized for specific target groups. A different pack size is required for quick impulse buys at petrol stations and roadside shops than for the super markets selling predominantly family sized packs.

3.3. Frequently-used plastic-based packaging materials

- A very high quantum of polymeric materials, besides cellulosic and aluminum foil, are used for packaging items. Paper board and metal containers are also used for certain applications. Although a variety of packaging materials are available, the ultimate choice of the wrapper depends upon the required shelf-life, performance of the wrapping machine, and the cost which is purely based on the segment of the market targeted by the manufacturer. The most common choice of packaging medium is plastic (generally

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flexible) as it provides the required protection and preservation, grease resistance, physical strength, machinability, and printability. Plastics being lighter in weight are, therefore, the most preferred material for packaging of sweets. There are many changing trends in the packaging of petha. Plastic films and their laminates are increasingly used due to better properties and aluminum foil laminates due to price and better flex crack property. Plastic-based packaging materials that can be used for petha are listed below.

- **Polyethylene (PE)**

  It is considered to be the backbone of packaging films. Since one of the greatest threats to the quality of sweets comes from moisture, polyethylene with its low water vapor transmission is of definite interest. 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 flavors/volatiles, poor grease resistance, and are limp. High-density polyethylene (HDPE) is stiffer, more translucent, and has better barrier properties but needs a 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 polyethylene. HM HDPE is available in twist-wrap grades. Polyethylene films are also suitable for making bags. A copolymer of polyethylene and polyvinyl alcohol and EVOH has outstanding gas barrier properties especially when dry.

- **Polypropylene**

  Polypropylene films have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good salability 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. Paralyzed polypropylene with an opal finish and attractive gloss

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is also used. Both as laminates and overwraps, PP film is now widely used for all types packaging applications.

- **Poly Vinyl Chloride (PVC)**

  PVC is a stiff and clear film having a low gas transmission rate. PVC can be used as small wraps, bags, and pouches. PVC when co-polymerized with polyvinylidene chloride is known as Saran. Since it is a costly material, it is only used as a coating to obtain barrier properties and heat salability. PVC film is also used for twist wraps, as it has twist retention properties and is excellent on high-speed machines.

- **Polyesters (PET) and Polyamide (PA)**

  Polyethylene terephthalate film has high tensile strength, gloss, and stiffness as well as puncture resistance. It has moderate WVTR but is a good barrier to volatiles and gases. To provide heat seal property, PET is normally laminated to other substrates. Nylons or polyamides are similar to PET but have high WVTR.

- **Metallised Films**

  When polymeric films are metalized there is an improvement in their barrier properties. Metallization is also used for decorative purposes and aesthetics. The films, which are used for metallization, are PVC, PET, PP, and polyamides. To safeGourd the interest of the consumer the Standards of Weights & Measures (Packaged Commodities) Rules, have imposed a limit on the weight of the wrapper.

3.3.1. Types of Packages

- **Hanging Bags-** Hanging bags are frequently seen in grocery stores and other retail locations. They are a type of plastic bag that is sealed on both ends and sometimes with a back-middle seam as well. Hanging bags have a pre-cut hole that allows them to hang easily from hooks, so they can be displayed in an attractive way.

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- **Pillow Bags -** Another common type of packaging is a pillow bag. The bags get their name from their shape, which resembles a pillow. They are found lying flat on grocery store shelves and have been known to hold sweets and chicklets.
- **Gusseted Poly Bags-** Gusseted bags are often called flat-bottom bags because they feature a tucked in pleat that's been pressed flat. It allows the bag to expand for greater carrying capacity and to keep the shape of a box if necessary. These types of poly bags can be heat sealed, tied, stapled, or taped shut. They're the perfect poly bag for anyone looking to get more sweets in a single bag.
- **Reclosable Zipper Bags and Pouches-** Reclosable bags and pouches are good for flavored petha because they give customers convenient access to their goodies while preserving freshness.
- **Flexible Pouches-** Flexible pouches are a great option for holding any processed products. They can be manufactured with zipper-seal closures, which help keep the interior contents fresh for use. Flexible pouches offer amazing printing capabilities, so you can add your attractive product branding to the pouch itself. Many pouches stand up on their own, which helps you improve your shelf appearance.

3.4. Methods for Petha packaging

From the business perspective, the appearance of packaging is particularly important because it identifies the product in the distribution chain and differentiates it when it reaches the consumer. Next, the most used materials in the food industry are detailed: plastics, glass, metals, and wood and its derivatives.

- **Wood, cardboard, and papers**

Products derived from wood are widely used in the packaging of petha in the form of paper and cardboard. Paper is a very cheap, lightweight product with excellent printing capacity. Although it is very sensitive to moisture, it can be corrected with a combination of paper and other materials such as plastic or paraffin. Cardboard is a material made up of several superimposed layers of paper, making it thicker, harder, and more resistant than paper. Its main use is for packaging and containers in the form of boxes.

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In recent years, paper and cardboard manufacturers are paying special attention to issues related to health and the environment by working with recycled products that increase the useful life of these raw materials.

- **Glass**

Glass is an inert material that is impermeable to gases and vapors. It is an excellent and completely neutral oxygen barrier when in contact with food. However, it is a fragile, heavy material that requires a lot of energy to be manufactured. it is a recyclable product since it can be used as a container repeatedly.

- **Metals (steel, tin, aluminum)**

The main use of these metals is the preservation of canned foods and beverages. The most commonly used are tin-coated steel and aluminum cans. It is an opaque material that provides an advantage for food that is sensitive to light. Petha is canned nowadays for export purposes and the metal coating is being frequently used in this industry.

Tin cans are made of steel sheets coated with tin as a measure of protection against corrosion of steel, especially when they contain products with low ph.

3.4.1. Quality considerations during packing

Quality control of packed products is the last time the petha product is checked before reaching the customer.

Documented checking of the packages entails:

- Weight of the package
- Weight of the Petha
- Arrangement of the petha
- Uniformity of the fruit
- Damage to the fruit
- Defects; and Moisture content.

The surrounding area is also checked:

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- Cleanliness of the handling equipment during processing
- Calibration of the scales (automatic or manual);
- Writing on the packages;
- Satisfactory working of the metal detector (installed on every retail packing line);
- Repackaging installations and marking; and
- Qualification for international standards such as ISO and HACCP

3.5 Future Trends in packaging industry

- It is projected that the global production of packaging materials will reach 180 million tons per year, with demand for more creative and advanced packaging materials growing annually. By 2018, the global packaging industry is forecast to increase to US$975 billion and rise at a 4 percent annual rate. Asia alone has the capacity to make up more than 40 percent of global demand. Flexible packaging is currently rising by 4 percent to more than 16 million tons, with a volume in excess of US$50 billion. Many students and entrepreneurs have been drawn to this area of research by such tremendous development seen in the world economy. The well-being of the packaging industry is closely related to the economy of the world. The greater the success of the packaging industry, the greater the positive change of the world's economy.

The driving force responsible for the packaging industry growth.

- The aging of the population worldwide
- The movement towards smaller families
- The growing customer demand for convenience
- Growing awareness of health among consumers
- The trend of increasingly poor customers towards 'on-the-go' lifestyles
- Growing brand improvement/differentiation criteria in an increasingly competitive world
- Creation of new packaging materials
- Rising numbers of Nuclear Families
- Growing environmental consciousness and the introduction of new legislative standards for the recycling of packaging.

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CHAPTER 4

FOOD SAFETY REGULATIONS AND STANDARDS OF PROCESSED PETHA

4.1 Food Standards

Sugar boiled confectionery (2.7.1):

Sugar boiled confectionery whether sold as hard boiled sugar confectionery or pan goods confectionery or toffee or milk toffee or modified toffee or lacto-bon-bon or by any other name shall mean a processed composite food article made from sugar with or without doctoring agents such as cream of tartar by process of boiling whether panned or not. It may contain centre filling, or otherwise, which may be in the form of liquid, semi-solid or solids with or without coating of sugar or chocolate or both. It may also contain any of the following:

I. sweetening agents such as sugar, invert sugar, jaggery, lactose, gur, bura sugar, khandsari, sorbitol, honey, liquid glucose;
II. milk and milk products;
III. edible molasses;
IV. malt extracts;
V. edible starches;
VI. edible oils and fats;
VII. edible common salts;
VIII. **fruit and fruit products and nut and nut products**;
IX. tea extract, coffee extract, chocolate, cocoa;
X. vitamins and minerals;
XI. shellac (food grade) not exceeding 0.4 per cent by weight bee wax (food grade), paraffin wax food grade, carnauba wax (food grade), and other food grade wax or any combination thereof;
XII. edible desiccated coconut;
XIII. spices and condiments and their extracts;
XIV. candied peels;

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XV. enzymes;
XVI. permitted stabilizing and emulsifying agents;
XVII. edible foodgrains; edible seeds;
XVIII. baking powder;
XIX. gulkand, gulabanafsha, mulathi;
XX. puffed rice;
XXI. china grass;
XXII. eucalyptus oil, camphor, menthol oil crystals, pepper mint oil;
XXIII. thymol;
XXIV. edible oil seed flour and protein isolates;
XXV. gumarabic and other edible gum.

It shall also conform to the following standards, namely:—

I. Ash sulphated (on salt free basis) Not more than 2.5 per cent by weight.
II. Provided that in case of sugar boiled confectionery where spices are used as centre filling, the ash sulphated shall not be more than 3 per cent by weight.
III. Ash insoluble (in dilute Hydrochloric acid) not more than 0.2 Per cent by weight.
IV. Provided that in case of sugar boiled confectionery where spices are used as centre filling, the ash insoluble in dilute Hydrochloric acid shall not be more than 0.4 per cent.

4.1.2 Processed fruits

Includes all forms of processing other than peeling, cutting and surface treating fresh fruits.

- Ash Gourd used for making Products shall be free from diseases and contain unripe fruits.
- They shall be free from fermentation and mold, insects or insect fragments, eggs, larvae, dirt, and foreign matter.
- It shall not contain any other foreign material trance.
- It shall also conform to the following standards.

4.2 Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration

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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.

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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 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.

10. All equipment's 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.

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20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

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, Colors and Flavors
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

4.3.1 Wherever applicable, the product label also must contains 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

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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 packages, should carry mandatory information on the label.

Contact Us

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