Ministry of Food Processing Industries
Government of India

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Reading Manual for Canned Mushroom

Under PMFME Scheme

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Abbreviations & Acronyms

Sr:No.	Abbreviations &Acronyms	Full Forms
1.	APEDA	Agricultural and Processed Food Products Export Development Authority
2.	FAO	Food and Agriculture Organization
3.	FBO	Food Business Operator
4.	FLRS	Food Licensing and Registration System
5.	FPOs	Farmer Producer Organizations
6.	FSSAI	Food Safety and Standards Authority of India
7.	kcal	kilocalorie
8.	MoFPI	Ministry of Food Processing Industries
9.	PA	Polyamide
10.	PET	Polyesters
11.	PFA	Prevention of Food Adulteration
12.	SHGs	Self Help Groups
13.	UK	United Kingdom
14.	US	United States
15.	WVTR	water vapor transmission rate

CHAPTER1
INTRODUCTION

1.1. Industrial Overview:

Mushrooms

The fleshy and nutritious fruit bodies of some macro-fungi species are edible mushrooms (fungi which bear fruiting structures that are large enough to be seen with the naked eye). They can either appear below ground (hypogeous) or above ground (epigeous) where they can be hand-picked.Criteria that include the lack of poisonous effects on humans and the desirable taste and aroma can define edibility.

For their nutritional and culinary value, edible mushrooms are eaten. Mushrooms are sources of umami flavor from guanylate, especially dried shiitake. As medicinal mushrooms, mushrooms eaten by those practicing folk medicine are known.While psychedelic fungi are often eaten for recreational or entheogenic purposes, psychological effects may be produced and are therefore not widely used as food. There is no evidence from high-quality clinical studies that there is any effect on human diseases from "medicinal" mushrooms. Many fungal species, which are either harvested wild or cultivated, include edible mushrooms.In markets, easily cultivated and common wild mushrooms are often available and those that are more difficult to acquire (such as precious truffles, matsutake and morel) may be collected by private gatherers on a smaller scale. Any preparations can make some poisonous mushrooms fit for intake.

It should be established before presuming that any wild mushroom is edible.The only safe way to guarantee edibility and the only protection against potential incidents is correct determination and proper identification of a species. Some mushrooms that are edible for most people can cause allergic reactions in some individuals, and food poisoning can be caused by old or poorly stored specimens.Therefore, when consuming any fungus for the first

time, great caution should be taken and only limited amounts should be eaten in the event of individual allergies. Several species of the genus Amanita, in particular Amanita phalloides, the death cap, are deadly poisonous mushrooms that are sometimes confused with edible mushrooms and are responsible for many fatal poisonings.Therefore, it is easier to consume just a few organisms which are easily identifiable than to experiment indiscriminately. In addition, even usually edible species of mushrooms can be harmful, as contaminants such as heavy metals may accumulate from mushrooms growing in contaminated areas.

1.2. Product Description:

Mushroom, a body of fungus fruit, is known as a tasty food all over the world because of its fragrance and structure of taste. It is rich in nutrients, low in calories, high in protein, minerals, vitamins and a rich source of folic acid.

For weight conscious individuals and anaemic patients, it is an alternative option. It has a protein content of 4.9 percent more than cow's milk, green vegetables such as beans etc. Mushrooms are a highly perishable product and should be sold and eaten due to their high moisture content as soon as possible after harvest (90.92 percent). However, by way of processing, its shelf-life can be extended for a longer time. Mushrooms are usually cooked, frozen, dried and canned. For commercial canning, the Agariousbisporus (White button) type of mushroom is acceptable and preferred.

Due to its flavour aroma and structure, Mushroom a fungus fruit body is considered a delicious food all over the world. It is rich in nutrients, low in calories, high in protein, minerals, vitamins and a rich source of folic acid. For weight conscious individuals and anaemic patients, it is an alternative option. Mushrooms are highly perishable goods and should be marketed and consumed as they should be marketed and consumed as soon as possible after harvest due to their high moisture content (90.92%). But, by means of processing, their shelf life may be extended for a longer duration. Mushrooms are usually cooked, frozen, dried and canned.

1.3. Market Potential:

In 2018, the size of the canned food industry was valued at $91.4 billion and is expected to hit $124.8 billion by 2026, with a CAGR of 3.9% from 2019 to 2026. More than one third of the overall canned food market share was accounted for by the canned meat & seafood group in 2018. It has been estimated that the export demand for canned mushrooms is around US$1000 million in world trade.In the next five years, global trade in mushrooms is projected to hit a staggering figure of US$ 15 billion. Currently, the largest producers of mushroom products are China, Taiwan and Indonesia, which also account for a large share of the world market. More than 50 percent of the world's total mushroom supply is sold in fresh form, mostly in the domestic markets of producers.The balance, i.e. dried, frozen, canned etc., is stored. In the international market, mushroom consumption is rising at a rate of approximately 10 percent. It has also been estimated that 50 percent of the mushrooms for processing are canned. Germany, the USA, Canada, Japan, Australia, etc. are the main importing countries. The current production in India is about 30000 M.T.

In comparison, companies in developing countries such as China and India put more effort into direct sales businesses.They can simultaneously function as exports, and in this industry it is a common phenomenon. Since they do not have too much foreign brand control, when compared with leading companies, their product quality is not good enough, but they have a price advantage. In developed countries and in low-end foreign markets, they like to increase their market share.During the forecast period, between 2019 and 2025, the worldwide Canned Mushroom market is projected to grow at a considerable pace.

1.4. Raw Material Description:

Mushrooms- 95%

Canned mushrooms, like fresh mushrooms, have the same nutritional value. However, if you want to restrict how much sodium you have, the additional sodium from canning brine (saltwater) is something to remember.

- The phosphorus in canned mushrooms helps provide oxygen to red cells and can give you more energy.
- It helps to give you stronger bones and healthy teeth.While bone health is mainly linked to calcium, in order to support healthy bones, minerals such as phosphorus are also essential.

- Mushrooms contain a reasonable amount of phosphorus to enable better protection of the bone and teeth.
- Enhance your digestion. The fibre leads to a healthy digestive system in canned mushrooms. To bulk up the feces, the body requires fiber so that it can move through the digestive tract more quickly. If your stool is weak or watery, adding fiber to your diet helps as well.

The focus of Indian mushroom industry is predominantly on trade of the fresh produce rather than the real value-addition. Attractive packaging of the value-added products is yet another area which may be called the secondary value-addition. Some of the products are:

- Mushroom soup powder
- Mushroom Biscuit
- Mushroom nuggets
- Mushroom ketch-up
- Mushroom candy
- Mushroom preserve (*Murabba*)
- Pickle
- Mushroom chips

Brine Solutions- 5%

Brine is a highly concentrated salt solution present in water. In various ways, brine may refer to salt solutions ranging from about 3.5 percent (a normal seawater concentration, on the lower end of the food brining solutions) to about 26 percent (a typical saturated solution, depending on temperature).

1.5. Types of Raw Material:

The fleshy, spore-bearing fruiting body of a fungus that grows on the soil or its food supply above the ground is a mushroom. It is known as the vegetable world's 'meat'. Mushrooms are now commonly used in cooking in many cuisines, especially Chinese, Korean, European, and Japanese, as they have been discovered, slowly and steadily.

With a wide range of mushrooms, the possibilities and recipes are limitless and the numerous varieties on the market are available. Various kinds of Mushrooms are cultivated commercially in the country. Types of Mushrooms in India are:

Name	Description	Image
1. Button Mushroom	This is one of the varieties of mushrooms most widely available. The taste is mild, with a creamy-white hue. In both raw and cooked forms, you can eat them. With numerous dishes such as pizza, burgers, soups, and salads, buttons go well. They are also widely used in India, and their cultivation is carried out seasonally or in a controlled climate.	
2. Straw Mushroom	These are as common in India as the button mushrooms, also known as 'Chinese Mushroom,' They have a nice fragrance and taste, and they are rich in different nutrients and proteins. In India, their cultivation typically takes place in the states of Madhya Pradesh, Uttar Pradesh, Andra Pradesh, Maharashtra, Tamil Nadu, Chhattisgarh, etc.	
3. Oyster Mushroom	In India, people name it 'dhingri' in Hindi, one of the common types of mushroom. In tropical and temperate regions, this variety can grow readily. In many cuisines and dishes, these are popular. Shaped like a fan and a dusty color, like their names, they look a lot like oysters. In India, their cultivation traditionally takes place in the states of Madhya Pradesh, West Bengal, Orissa, Karnataka, and Maharashtra.	

4. Milky Mushrooms	Often known as summer mushrooms, Milky Mushrooms are In states such as Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, and Odisha, it's a wonderful variety that grows. They are less demanding as well and have a high yield. With their bright white hue, these mushrooms look enticing and also have a long shelf life.	
5. Cremini Mushroom	Such fungi belong to the same genus as button mushrooms. Due to the creation of a coffee-colored skinny layer on the hat, they only differ slightly and thus have dark tan patches on top. Nevertheless, these mushrooms are more savory in taste and have a firmer texture than button mushrooms.	
6. Shiitake Mushroom	This variety, famous for its medicinal qualities, is gaining popularity among mushroom consumers. The demand for this form is therefore growing in the country as well. Some farmers have successfully started to cultivate this variety in Himachal and other northern states of India. When roasted, those mushrooms taste better, carrying a Smokey flavour and low water content.	

7. Portobello Mushroom	In both raw and cooked forms, you can eat these mushrooms. When they are fully grown, they have a large cap that has black gills at the back of it. This cap is flat on top and has a curved shape that is umbrella-like. Popular for their smooth, meaty texture, they go well with a lot of dishes throughout the year and are readily available.	 **i**

CHAPTER 2
PROCESS & MACHINERY REQUIREMENT

2.1. Raw Material Aspects:

In order to avoid or slow down spoilage, loss of consistency, edibility or nutritional value, vegetable preservation is the method of treating and handling food and thus allows longer storage. In general, preservation includes preventing bacteria, fungi (such as yeasts) and other micro-organisms from developing, as well as delaying fat oxidation that causes rancidity. Processes that prevent visual degradation, such as the enzymatic browning reaction in apples after they are sliced, which can occur after fruit cutting, can also be used in preservation.

A variety of preservation approaches will require several procedures designed to preserve food. For example, preserving fruit by converting it into jam requires boiling (to reduce the moisture content of the fruit and destroy bacteria, yeasts, etc.), sugaring (to prevent their re-growth) and sealing inside an airtight jar (to prevent recontamination). An essential aspect of fruit preservation is the conservation or production of nutritional value, texture and flavour. In case of mushrooms, White button mushrooms (agariousbisporus) are preferred over other types of mushrooms for canning. Commercially, mushrooms are canned in brine.

2.2. Source of Raw Material

In the international market, mushroom consumption is rising at a rate of approximately 10 percent. Currently, the largest producers of mushroom products are China, Taiwan and Indonesia, which also account for a large share of the world market. More than 50 percent of the world's total production of mushrooms is sold in fresh form, mostly in the domestic markets of producers. The equilibrium is stored, such as dried, frozen, bottled, etc.50 percent of the mushrooms for processing have also been estimated to be canned.

The main importing nations are Germany, the United States, Japan, Canada, Australia, etc. Presently in India production amounts to around 30000 M.T. As per the available information from APEDA (2001-2002), 15897 M.T. Mushrooms are exported with a volume of Rs. 72,47,54,829.Total exports are classified into two groups, i.e. Fresh Mushroom 1,17,97,631 Kg, value Rs 51,05,30,325 and 40,99,258 kg prepared and stored, value Rs. 21,42,24,504 which, compared to the world share, is a very negligible figure.

2.3. Technologies:

Retort sterilization

Conventional canning, also known as retort processing, is an efficient way of achieving optimal storage life with this technology which can be achieved with relatively simple equipment. It is a process in which mushroom is hermetically sealed in a tube, typically a tin canister or glass jar, which is then commercially sterilized to efficiently eliminate spoilage and pathogenic microorganisms and to protect the nutrition and consistency of canned product . Retorts sterilize canned mushrooms enclosed in tanks using steam or other heating processes. Usually, sterilization temperatures range from 110°C to 135°C.

Continuous sterilization

Continuous sterilization is a rapid transfer of heat to the medium by a condensate of steam without the need for a heat exchanger. Once the device is in a holding loop, steam is released through a nozzle into the machine. The medium will remain in this cycle for a fixed keeping period until the whole medium is sterile. This is more effective than batch sterilization since instead of requiring energy to heat, retain, and cool the whole device, small parts of the inlet streams are heated at a time. Through looping sterile media tubes (which are at higher temperatures) past inlet tubes, the temperature difference is used to help heat the sterile medium. But instead of making a cold-water stream cool the sterile media, the low-temperature sterile media stream collects heat from the warm stream, cooling the sterile media. Finally, the sterile media is cooled by an expansion valve to adjust the temperature to suit the procedure requirements.

2.4. Manufacturing Process:

White button mushrooms (*agariousbisporus*) are preferable to canned mushrooms of other types. Mushrooms are canned commercially in brine; the process requires the following steps:

- Picking-Mushrooms are gathered by gentle hand twisting at the button stage (cap. Diameter 2-2.5 cm). With the assistance of a sharp edge stainless steel knife/blade, the soil and section carrying any microbial flora is then cut off/removed. The length of the stalk should ideally be 0.5-1 cm. Oh. Long.

- Sorting and grading-Diseased, damaged/bruised, shrivelled and browned mushrooms are discarded, sorting and separating only the good white and tight buttons into two groups, i.e. cap.Up to 2.5 cm in diameter with a compact head like A and a hat. Diameter as B grade above 2.5 cm.
- Washing-Graded mushrooms are thoroughly washed in cold running water 3-4 times to remove dirt, soil, etc. without unnecessarily damaging or scratching them.
- Blanching-Blanching is required to inhibit enzymatic activity. In order to achieve a suitable and uniform kit, it also inactivates micro-organisms and extracts the air from the raw materials. For few minutes, mushroom are blanched in boiling water, followed by immediate cooling in cold water.
- Filling of cans-Mushrooms are packaged commercially in two sizes, i.e. A-1 tall can be preferred by retailers to A-2.5 A-1 tall cans, while hoteliers, exporters and other establishments want A-2.5 cans. In cans with declared drain weight, i.e. 440 gms in A-2.5 can, blanched mushrooms are filled.
- Brining- After filling the cans with mushrooms, 2 percent common salt, 1 percent sugar and 0.05 percent citric acid are added to the brim of the can. Brining provides the product with flavour, decreases processing time and increases the shelf life of canned mushrooms.
- Exhausting- After brining, the cans are exhausted to clear the substance from any trapped air and other accumulated gases to ensure a longer shelf life.Depending on the exhaust tunnel duration and container capacity, cans filled with brine solution are fed to the exhaust box for a specified period of time.
- The shorter the tunnel, the longer the exhaustion can also be carried out by putting the filled cans in boiling water until the middle of the tunnel temperature reaches 85-90c for 1-2 mts.
- Seaming/can closing- Cans are sealed immediately after exhaustion with the aid of a double seamer to acquire hermetically sealed containers. In order to sterilize the closed lids, sealed cans are then positioned in an upside down position.

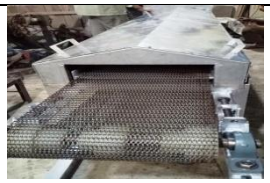
- Processing/Sterilization-Processing, also known as sterilization, is an integral procedure of the canning machine. This is achieved by processing the hermetically sealed cans for a specified period of time at a pressure of 15 lbs psi depending on can size and processing position altitude. Nevertheless, for areas like Shimla, processing time is recommended to be 45 minutes for A-2.5 size cans.
- Cooling- Cooling of cans is carried out immediately after sterilization at room temperature in cold running water to send the micro-organisms an abrupt shock to get rid of their adverse behaviours.
- Labellingation and storage-To prevent rusting, the cooled cans are placed in a cool dry position and smeared with grease to remove any adhering moisture from the body of the container. Cans are held for 8-10 days at ambient temperature to inspect prior to labelling for any swelling, leakage, puffing and other disorders.

Proper labelling is done to comply with regulatory provisions of the order of fruit products, 1955 Prevention of Food Adulteration Act, 1954 and 1975 packaged goods (Regulation) Act, before the cans are exposed for sale.

2.5. Flow Chart:

Steps	**Machine Name**	**Description**	**Machine Image.**
Steam Generation	Boiler	Boiler is steam generating device which simply produce stem from appropriate feed water utilizing appropriate heat generated using appropriate fuel. This steam here will be utilised in blanching & sterilization processes.	

Grading	Mushroom Grading Machine	This machine utilizes a rotating perforated drum to sort the mushrooms based on their sizes, the perforation diameter varies along the cylinder length to accomplish effective sorting and these sorted mushrooms are collected separately. This is used at the initial stage.	
Washing	Vegetable and Fruit Washing Machine:	Its water washing class machine which utilizes water to clean the given product, they come in various arrangements and mechanism. Here it is used to clean mushrooms prior to further processing.	
Blanching	Blanching Machine	This machine is basically a blanching tank attached to material handling equipments, heating arrangement and flow control equipments. It's essentially used for blanching process of mushroom after it is chopped.	
Can Washing	Can Washing Machine	Can Washing Machine is used to wash the can in which canned food is to be stored and packed. Before packaging process takes place the cans or tins are washed in can washing machine. The machine is used to wash the cans before they are filled with mushroom.	

Can Filling	Can Filling Machine	As the name suggests this machine simply fills the can with the required product which is to be canned in appropriate quantity. In this process, these machines are used after blanching the mushroom.	
Exhausting	Canned Food Exhausting Machine	This machine utilizes steam to heat and expand the food items, so as to expel the air and other gases present within the food item. This creates a sort of partial vacuum, which in turn increases its shelf life after filling the cans with the mushroom.	
Seaming	Can Seamer	These machines simply seal the cans with lids in order to produce an air tight seal, for many canned foods vacuum seamer are preferred as they reduce possibility of entrapped air and thus microbial growth. The machine is used to seal the mushroom cans after they are filled.	
Sterilizing	Can Sterilizer	These are simply machine designed to sterilize contents of cans by utilizing appropriate temperature in order to prevent any microbial growth. Once the can are filled and seamed, they are sterilized by this machine.	

2.6. Additional Machine & Equipment:

MACHINE AND EQUIPMENTS	USES	PICTURE
Can reformer	Used for Re-Forming Flattened Round Cans.	
Purified Water Storage and Distribution System	This is the compact system required for water purification and distribute through channel for avoid contamination during processing.	

2.7. General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.

4.	Loss of Interface	1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. 2. Provide proper physical shielding for the connections.
5	Scaling in Blancher	1. It's essential to use RO water to prevent scaling in Blancher also, else scaling will take place in blancher. 2. In-case scaling is already observed in blancher then you used descaling solutions & genteelly remove salt scales.

2.8. Nutritional Information:

Canned mushrooms are a viable "meat replacer" thanks to their protein content and fleshy texture. Canned mushrooms are also an excellent source of:

- Riboflavin
- Niacin
- Potassium
- Phosphorus
- Copper
- Pantothenic Acid
- Selenium

A cup of canned, drained, mushroom pieces contains: (182g)

Nutrient	Facts/ % Daily Value
Calories 58	Calories from Fat 11
Total Fat 1.2g	2%
Saturated Fat 0.2g	1%
Trans Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 0g	
Cholesterol 0mg	0%
Sodium 699mg	29%
Potassium 142 mg	4%
Total Carbohydrates 8.4g	3%
Dietary Fiber 4.6g	18%
Protein 7g	
Vitamin A	0%
Vitamin C	0%
Calcium	1.4%
Iron	14%[ii]

2.9. Export Potential & Sales Aspect:

Mushroom production in the country began in the 1970s, but with the growth of environmental protection technologies and the understanding of cropping systems, the production of mushrooms increased from just 5,000 tons in 1990 to around 1,20,000 tons at present. Today, button and oyster mushrooms, followed by paddy straw, milky mushrooms, etc., are commercially grown plants.Marketing of fresh mushrooms, particularly in Delhi, Bombay, Madras, Chandigarh and others, is always done in the nearby city. Most of the products are canned in brine from large commercial farms and exported to destinations outside India, especially the USA.

As most of the major commercial farms are growing hybrid strains of A bisporus made available to them by multinational spawning companies such as Sylvan, Amycel and others, the quality of the mushrooms exported is excellent.

India's export market is primarily the United States, with some amounts going to the United Arab Emirates, Russia, the Netherlands, Germany, Switzerland, Denmark, Israel, Sweden and other nations.

No quota is available for India from the EU, and Indian exporters are forced to sell processed mushrooms in the EU with additional taxes imposed under EU law, making it difficult for Indian exporters to compete in the EU market.

CHAPTER3
PACKAGING

3.1. Shelf Life of Product:

The shelf life of food stored depends on these 4 main criteria:

- Temperature:

  Foods stored at room temperature or cooler (75°F/24°C or lower) will be nutritious and edible much longer than previously thought according to findings of recent scientific studies. Foods stored at 50°F to 60°F (which is optimal) will last longer than foods stored at higher temperatures. Heat absolutely destroys food and its nutritional value. Proteins break down and some vitamins will be destroyed. Taste, color, and smell of some foods may also change.

- Moisture:

  The reason long term food storage is dehydrated or freeze dried is to eliminate moisture. Too much moisture promotes an atmosphere where microorganisms can grow and chemical reaction in foods causing deterioration that ultimately can sicken us.

- Oxygen:

  Too much oxygen can deteriorate foods and promote the growth of microorganisms, especially in fats, vitamins, and food colors. That is the reason to use oxygen absorbers when dry packing your own food products.

- Light:

  Exposure to too much light can cause deterioration of foods. In particular if affects food colors, vitamin loss, fats and oils, and proteins. Keep long term food storage in low light areas for longest shelf life.

  Most expiration dates on foods in cans range from 1 to 4 years but keep the food in a cool, dark place and the cans undented and in good condition, and you can likely safely double that shelf life from 3 to up to 6 years.It shall also conform to the following standards.

3.2. Canned Mushroom Packaging:

Packaging refers to the act of designing and producing the container or wrapper of a product. It is one of the most important parts of marketing.

There are many factors that need to consider while selecting a suitable type of pack for the product:

- The product contents.
- The application of the product.
- Content stability.
- Protection from any environmental factors
- Acceptability of the pack to the customer.
- Regulatory, legal, and quality issues.

Characteristics of packaging material

- The material selected must have the following characteristics:
- Must meet tamper-resistance requirements
- Must not reactive with the product
- They must protect the preparation from environmental conditions
- Must be non-toxic
- Must not impart odour/taste to the product
- Must be FDA approved.

Classification of Canned Foods:

There are three basic classification of canned foods based on their acidity, they are classified as low acid canned food, acidified canned food and high acid canned food.

- **Low Acid Canned Food (LACF):**

  A low-acid canned food (LACF) is any food (other than alcoholic beverages) with a finished equilibrium pH greater than 4.6 and a water activity greater than 0.85, excluding tomatoes and tomato products having a finished equilibrium pH less than 4.7. They include red meats, seafood, poultry, milk, and all fresh vegetables except for most tomatoes.

- **Acidified Canned Food (ACF):**

  Acid foods have a pH of 4.6 or lower. They include fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters. Although tomatoes usually are considered an acid food, some are now known to have pH values slightly above 4.6.

- **High Acid Canned Food (HACF):**

  The high-acid foods include jams and jellies, pickles, and most fruits. Because there is no fear of Clostridium botulinum growth, these foods require much less heating than low-acid foods. To be safe, such foods need only to reach pasteurization temperatures. For foods with a pH value of 3.5 or less, 175°F (79.5°C) is a sufficient pasteurization temperature.

3.3. Canning:

The canning process itself consists of several stages: cleaning and further preparing the raw food material; blanching it; filling the containers, usually under a vacuum; closing and sealing the containers; sterilizing the canned products; and labelling and warehousing the finished goods.

- Cleaning usually involves passing the raw food through tanks of water or under high-pressure water sprays, after which vegetable or other products are cut, peeled, cored, sliced, graded, soaked, pureed, and so on.
- Almost all vegetables and some fruits require blanching by immersion in hot water or steam; this process softens the vegetable tissues and makes them pliable enough to be packed tightly, while also serving to inactivate enzymes that can cause undesirable changes in the food before canning. Blanching also serves as an additional or final cleansing operation.
- The filling of cans is done automatically by machines; cans are filled with solid contents and, in many cases, with an accompanying liquid (often brine or syrup) in order to replace as much of the air in the can as possible.
- The filled cans are then passed through a hot-water or steam bath in an exhaust box; this heating expands the food and drives out the remaining air; thus, after sealing, heat sterilizing, and cooling the can, the contraction of the contents produces a partial vacuum within the container.

- Certain products are vacuum-packed, whereby the cans are mechanically exhausted by specially designed vacuum-can sealing machines.
- Immediately after the cans are exhausted, they are closed and sealed; a machine places the cover on the can, and the curl on the can cover and the flange on the can body are rolled into position and then flattened together. The thin layer of sealing compound originally present in the rim of the cover is dispersed between the layers of metal to ensure a hermetic seal.
- The sealed cans are then sterilized; i.e., they are heated at temperatures high enough and for a long enough time to destroy all microorganisms (bacteria, molds, yeasts) that might still be present in the food contents. The heating is done in high-pressure steam kettles, or cookers, usually using temperatures around 240° F (116° C). The cans are then cooled in cold water or air, after which they are labelled.

  Note: This is generalized canning process, there can be several variations and additions depending on the product but the fundamental process remains same.

3.4. Material of Packaging:

- Glass Bottle- Gradually packed in glass bottles under different brand names appeared in the market, and became popular. The trend started in Maharashtra and Gujarat. They looked hygienic and appealed to the brand conscious upper class.

- Tin cans-Steel Cans are Among the Safest Forms of Food Packaging: Steel cans are strong, tamper resistant and feature an airtight seal to help guard against foodborne illness and contamination. In addition, steel cans are the most recycled food package.

Food packaged in glass containers can have a very long shelf life provided that the food has been properly processed before packaging, no contamination occurs at the filling stage and that the container is properly closed with a lid or seal. It should be remembered that the pack is only as good as the closure. Recommended shelf-lives vary but are usually 6 to 12 months not because the product actually deteriorates, but because over time there is a gradual loss of colour and flavour.

CHAPTER4
FOOD SAFETY REGULATIONS AND STANDARDS OF CANNED MUSHROOM

4.1. Introduction to FSSAI:

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2. FSSAI Registration & Licensing Process:

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006,Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, whomanufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

Or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

4.3. Food Safety & FSSAI Standards & Regulations:

"2.3.3: Thermally Processed Vegetables"

Drained weight of vegetables shall be not less than the weight given below:—

i) Liquid Pack

- Mushroom- 50.0 percent of net weight of contents
- Mushroom Packed in sauce- 25.0 percent of net weight of contents

ii) Solid Pack

- 70.0 percent of net weight of contents

General packaging requirements for canned products

(i) All containers shall be securely packed and sealed.

(ii) The exterior of the cans shall be free from major dents, rust, perforations and seam distortions.

(iii) Cans shall be free from leaks

***"2.1*: Metal contaminants for canned mushroom"**

Particular	Name of metal contaminant	Qty Ppm (mg/kg or mg/L)
1.	Lead	1.0
2.	Tin	250

Food Safety

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

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.

4.4. Labelling Standards(Regulation 2.5 of FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 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

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre-packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

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 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 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 Labelling) Regulation 2011” and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the

labelling 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 Labelling Regulation 2011, “pre-packaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.

CHAPTER5

OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

5.1. PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are:

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;
II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;
IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.[iii]

Reference:

[i] https://indiagardening.com/a-little-more-than-gardening/types-of-mushrooms-in-india-varieties/

[ii] https://www.nutritionix.com/food/canned-mushrooms/1-cup

[iii] https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf