



# PM Formalisation of Micro Food Processing Enterprises Scheme

## Processing of Mixed Vegetable Pickle



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# CHAPTER 1

## INTRODUCTION

### 1.1 History of Pickles

India is a rich country in horticulture that produces a wide range of fruits, vegetables, spices, ornamental and medicinal plants. It is the world's second-largest vegetable producer. Unfortunately, huge post-harvest losses occur (10-25%) annually. it is mostly due to inefficient post-harvest management activities. Increasing production and productivity is not sufficient to achieve the target of feeding the growing population and meeting the requirements of the processing industry and export trade.



So the reduction in post-harvest losses is an option to complete the feeds need of the country as well as the economy.

## 1.2. Minimization of post-harvest losses

There are two main methods for Reduce post-harvest losses of vegetables.

1. Scientific post-harvest management of vegetables.
2. Loss reduction by processing of vegetables into different value-added products.
  - First approach can be achieved by: Selection of suitable varieties, Proper Harvesting, Sorting/Grading of product, Washing, Trimming, Curing, Waxing, Pre-cooling, Packaging, and storage.
  - Where the second one can be achieved through value added product processing. Various values added Product can be prepared from the fresh vegetables like jam, chutney, souse, ketchup, puree, pickles, dehydrated vegetable etc.

*(In this report we will discuss on processing technology of mix vegetable pickles.)*

## 1.3. What are the pickles?

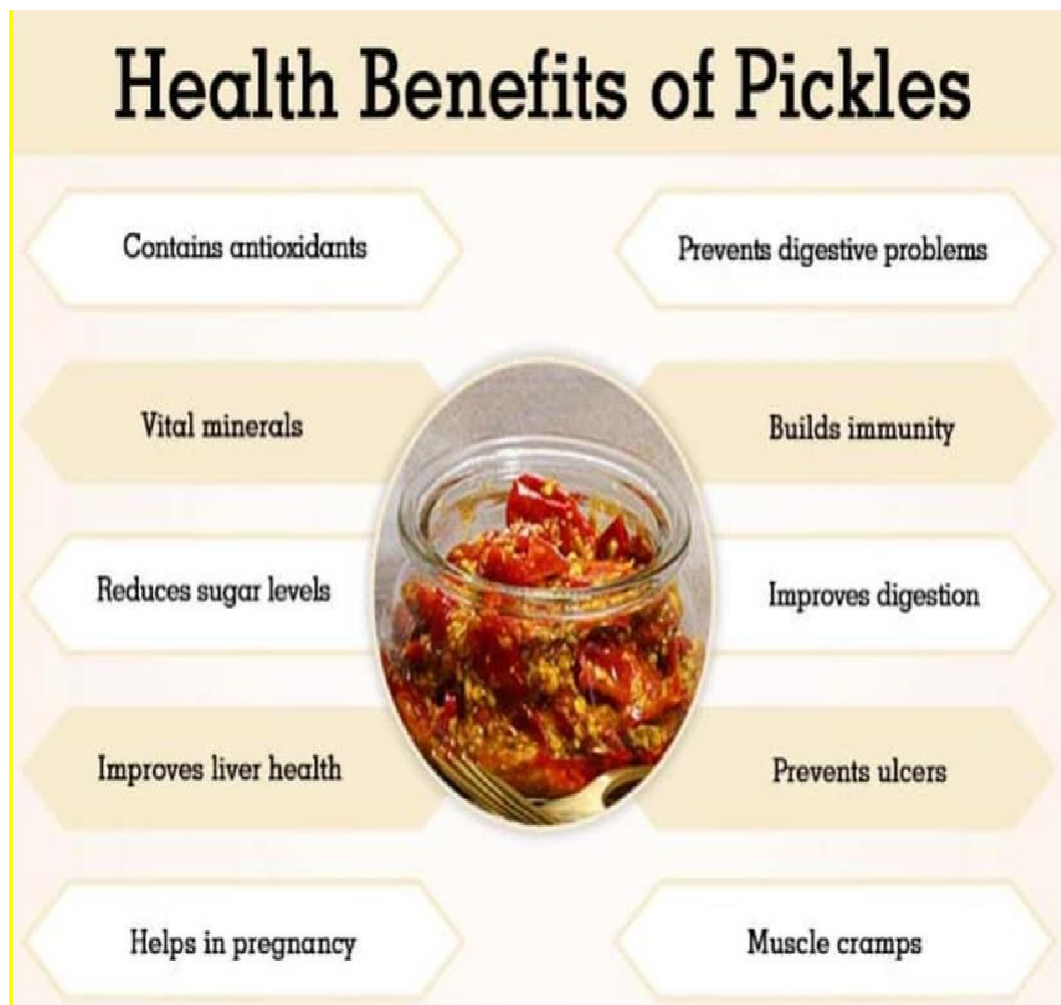
Pickles are a delicacy that is made all around the world. Some people make it with fruits whereas some people use vegetables. Whatever the ingredients may be, it is a famous recipe and liked by all. For making pickles various



equipments are required which includes one of the most important one, which is a pickle jar.

#### 1.4. Importance

- Helps digestion- Fermented pickles are full of good bacteria called pro-biotic, which are important for gut health.
- Fights diseases- Cucumbers are high in an antioxidant called beta-carotene, which your body turns into vitamin A.
- May ease muscle cramps.
- Curb sugar spikes.





## **1.5. Statistics**

### **1.5.1 Global scenario**



Pickles doubles the taste of food adds a spicy flavor and palatable to eat. Pickles comprise energy, moisture, fat, protein, carbohydrate, sugars, and dietary fibers. The consumption of pickles is also advised by health experts in moderate Quantity. Potassium and sodium are found in these

products, which avoid muscle cramping and help improve efficiency. Therefore among all over the world, packed pickle juice has gained popularity.

The global market size of packed pickles was estimated at USD 7.9 billion in 2018 and is projected to rise from 2019 to 2025 at a compound annual growth rate (CAGR) of 3.5 percent.

### **1.5.2 National scenario**

According to a report published in March 2018, the global pickles and pickle products market is expected to register of CAGR of 3.2% during the forecast period, 2018 to 2023. There is a moderate level of competition in the global market as the industry is scattered. Pickles by regional players using local products are preferred in the market. It is relatively easy for new entrants due to the trend of customer shifting from one brand in India include Aachi Foods, MTR foods, NEO Foods & craft foods.

## 1.6. Value Added Products from Handmade Pickles

There are tons of ways you can use pickle juice, from straight up drinking (really) to more adventurous applications.

- It can be brined hard-boiled eggs, onions, garlic, or any other soft veggies (soft canned vegetables work well too, like canned artichokes).
- Pickle juice is a great meat tenderizer. Use it as a marinade for pork chops or steak.
- Boiled potatoes can be a snore. Make them less boring by adding a healthy amount of pickle juice to the water--it will give those taters a vinegary zing. (We add it to our potato salads, too.)
- If store-bought barbecue sauce doesn't do it for you, live it up by adding pickle juice to taste by the tablespoonful.
- Macaroni and cheese is re-born with a dash of pickle juice. Try it in your favorite recipe, or make this Pimiento Mac and Cheese.
- Use it in place of vinegar in gazpacho (or anything, really).
- If your fish or veggies need a lift, drizzle a bit of the brine over them.
- Elevate ho-hum hummus to something punchier with a few dashes of the stuff.
- An easy and flavorful way to poach fish? Use pickle brine.
- As if your meatloaf recipe didn't have enough condiments in it already, throw some pickle juice into the mix.
- We call this "Jewish Deli Bread," since the dough is fortified with a little bit of pickle juice.
- Make a "pickleback," essentially a shot of pickle brine designed to follow a shot of (usually) not-so top shelf whiskey. The flavors are surprisingly *simpatico*, which explains

why you'll find the pickleback offered at many hipster and non-hipster drinking establishments.

- Don't want to consume it? Copper pans are a you-know-what to clean, but you can make them sparkle by cleaning them with pickle juice.
- Weeds are a bummer, so banish them from your garden by dousing them with pickle juice. All that vinegar and salt does a job on them.

### **1.6.1 Pickling: A way of life-**

Pickling is the way to protect and prolong the life of vegetables by anaerobic fermentation or by way of immersion in vinegar. The preservation by using common salt spices and vinegar is a common method for preparation of pickles; it inhibits enzymatic browning/discoloration by acting as an anti-oxidant. The pickling procedure reduces the pH of the food material which comes around to 4.6 or even lower to kill the microorganism. The minimum salt concentration is about 12 percent to serve as a preservative.

- Salt in the food affects the solubility of oxygen and thus growth of aerobic microorganisms is inhibited
- Causing high osmotic pressure and thus suppress the microbial cell Growth.
- Chlorine in sodium chloride is a good oxidizing agent that is toxic to microorganisms.
- Salt Dehydrate the food by tying up the moisture thus make them it unavailable for the growth of microorganisms.
- Salt increases the permeability of the cell wall and thus cause changes in the permeability.
- The addition of spices and edible oil in these products besides improving flavor and taste also helps in preservation.



## **1.7 Scope of Pickle Industry**

The process of pickling is popular all across the world. In the traditional pickling, vegetables and fruits were submerged in brine or salted and shredded. Before transferring the food to vinegar, it may be soaked in brine to reduce the moisture content of the food. In the commercial pickling, preservatives like EDTA or sodium benzoate may be added. This increases the shelf life of the pickles, while in fermentation; the food used for pickling produces preservatives all by itself. Let check out the health benefits of eating pickles of vegetables. It has a lot many health benefits but pickles must be consumed in moderation as there are side effects also.

Pickling procedure reduces the pH of the food material which comes around to 4.6 or even lower to kill the bacteria. This procedure can even preserve foods that are perishable. To prepare pickles or to facilitate pickling procedure, herbs and spices like cinnamon, cloves, garlic and mustard seeds are added.

If there is sufficient moisture in the food content, dry salt may be used to produce pickling brine. Derived from the Dutch word ‘pekel’, pickle means ‘brine’. In New Zealand and Australia, the word ‘pickle’ is used to refer to ‘pickled cucumber’. The term is also used to refer to other pickle kinds like ‘pickle cauliflower’, ‘pickled onion’. In different regions of the world, the word ‘pickle’ is used differently.

## CHAPTER 2

### PROCESSING OF HANDMADE PICKLES

#### 2.1 Pickle Processing

##### *Origin & Cultivation of Pickles*

Pickling is a method of preserving the food shelf-life by anaerobic fermentation in saline solution or vinegar. The cycle of pickling began around 4,000 years prior when the ancient Mesopotamians began to soak cucumbers in acidic brine to preserve them. Since then pickles are a staple in cultures around the world. Pickle was introduced to America by Christopher Columbus.



Pickling influences the food texture, taste and flavour. Pickling is probably the one of the most established techniques to preserve vegetables, organic products, meats, dairy, eggs and fish. Pickling is done to protect the nourishment for a long journey or to consume it in another season.

In ancient times, people used to soak the fruits or vegetables in brine/ vinegar with some salt over it and held it underwater by the flat stone layered on the top. They additionally used the tight lid to release the pressure which may result from carbon dioxide development.

Which eventually can develop a layer of yeast on the top; it is commonly innocuous yet can affect the taste, be that as it may, it very well may be taken out without affecting the cycle. In the

process, fruits or vegetables are put inside the sterilized jar with the vinegar or brine along with the other spices and then the mixture is allowed to rest until the actual taste is obtained.

### 2.1.1 PRODUCT USES

- Pickles are rich in antioxidants
- Rich source of essential vitamins and minerals
- Pickle helps to boost the immunity
- Improves the process of digestion in the body
- Pickles protect your liver



### 2.2. RAW MATERIAL

- Cauliflower, carrot, ginger, garlic, green chili, turnip, cucumber etc. are the primary raw material for the preparation of vegetables pickle.



- The secondary ingredients like salt, red chili powder, turmeric, black pepper, cardamom (large), cinnamon (powdered), cumin, aniseed powder, mustard, vinegar, and mustard oil are required.



- Good qualities of packaging bottle or plastic bags which are suitable for the packaging of pickles are required.

### **2.3. Current trends in Pickle Making**

Pickles and fermented foods have been considered a health food for centuries. Not only do they help improve digestion, but they also strengthen the immune system, promote growth of healthy bacteria in the gut and curb those pesky sugar cravings. They're low in calories and are also meant to be great for your skin and nails.

Of course, the health benefits will vary depending on what you put in your pickles. If the pickles are made in the same way we make our 'Original Pickle Juice' then the salt and vinegar mean that it's full of electrolytes which can help rehydrate your body with nutrient. There's been quite a bit

of press recently about athletes drinking pickle juice to help stop muscle cramps during games. We haven't had our pickle juice scientifically tested so I can't say it's a miracle cure, but we've had a few customers sending emails about how it's been helping them. One is an elderly lady who's now drinking a couple of shots of our pickle juice every evening to stop her night cramps. We also use a blend of different spices one of which is turmeric, which holds a huge host of health benefits including being a great anti-inflammatory.

### 2.2.1 Process of making handmade pickles

Ingredient of 100 kg of vegetable

S. No.	Ingredient	Quantity
1.	Vegetable: <ul style="list-style-type: none"> <li>➤ Cauliflower</li> <li>➤ Carrot</li> <li>➤ Ginger</li> <li>➤ Garlic</li> <li>➤ Green chili</li> <li>➤ Turnip</li> </ul>	100 kg
2.	Salt	12 kg
3.	Ginger (chopped)	2 kg
4.	Red Chilli powder	1 kg
5.	Turmeric	1 kg

6.	Black pepper	1 kg
7.	Cardamom (large),	1 kg
8.	Cinnamon (powdered)	1 kg
9.	Cumin	1 kg
10.	Ani seed powder	1 kg
11.	Mustard seed	1 kg
12.	Mustard oil	35 liter



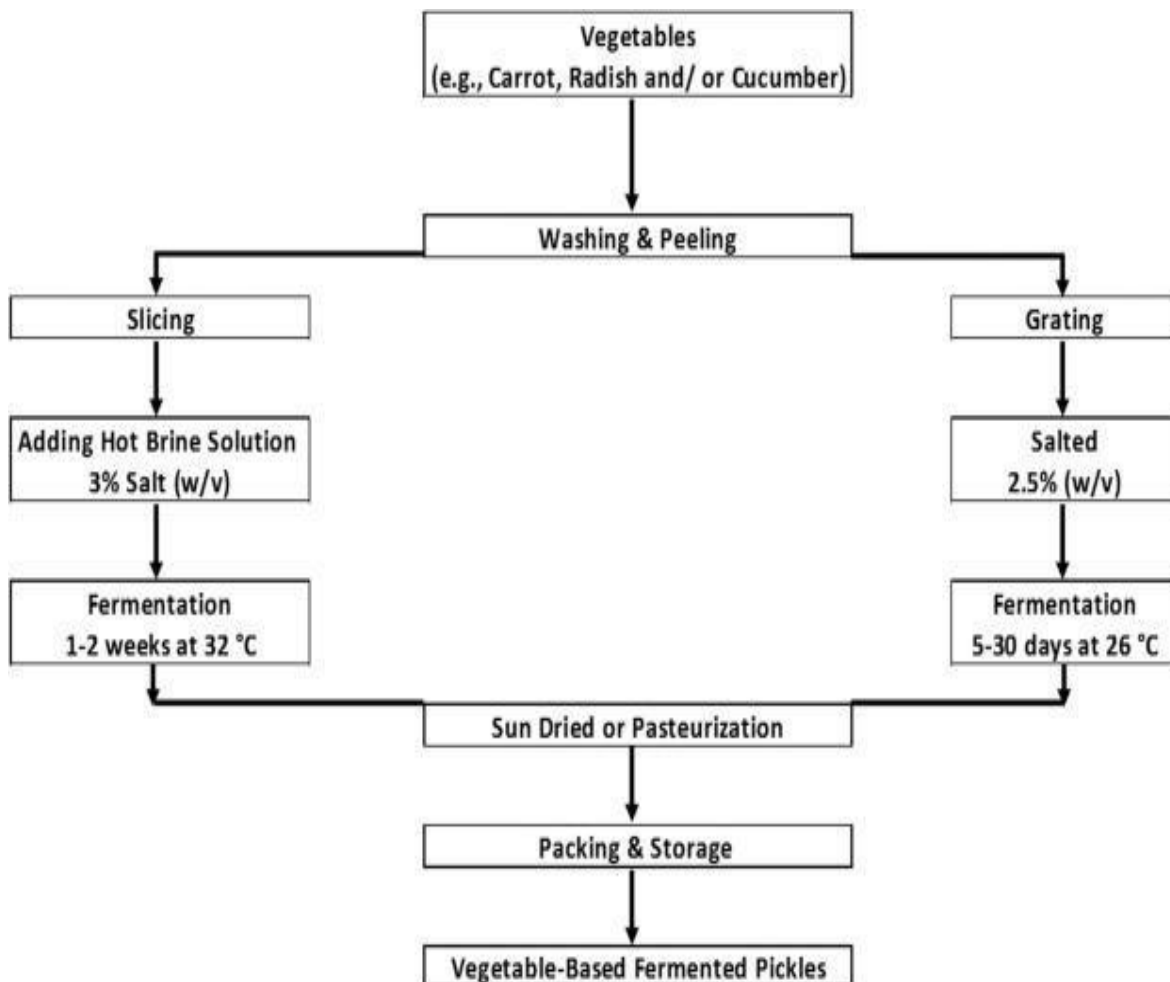
***Process:***

- Fresh and healthy vegetables are selected for pickle processing.
- Washing, trimming, and peeling are done to remove rough and thick skins.
- Vegetables are cut into equal pieces of 1-1.5cm thickness.



- Blanch the cut pieces of vegetables in for 5 minutes, drain the water and dry in shade to remove moisture.
- Fry the spices in a little oil separately
- Mix the vegetable slices with spices and salts (9%) thoroughly.
- Fill in the jar and keep in sun for a week.
- Add oil after heating and cooling to keep the pickle for a longer time. Sodium benzoate @ 250 ppm can be added as a preservative (If required for long time preservation).
- Storage the pickles at ambient temperature.

## 2.4 Types of Pickle making



## ***Equipment***

- **For Pickling Liquids-** For heating pickling liquids, use un-chipped enamelware, stainless steel, aluminum or glass pots. Do not use copper, brass, iron or galvanized utensils. These metals may react with acids or salts and cause undesirable color and flavors, or even form toxic compounds in the pickle mixture.
  
- **For Brining or Fermenting-**A 1-gallon container holds 5 pounds of fresh cucumbers and a 5-gallon container holds 25 pounds. Glass and food-grade plastic containers are excellent substitutes for stone crocks. Other 1- to 3-gallon food-grade containers may be used if lined inside with a clean food-grade plastic bag. Do not use garbage bags or trash liners. A large sealed food-grade plastic bag containing 4½ tablespoons of salt and 3 quarts of water may be used as a weight to hold cucumbers under the surface of the brine. A plate and jars of water also may be used. Select a pie or dinner plate just small enough to fit inside the fermentation container. Cover the weight and container top with a heavy, clean bath towel to reduce mold growth on the brine surface.
  
- **Preparation-** Wash fruits and vegetables and sort according to size when they are used whole. Cut 1/16 inch off the blossom end of cucumbers.  
  
If especially firm pickles are preferred, mix 1 cup of pickling lime and ½ cup of salt to 1 gallon of water in a 2- to 3-gallon crock or enamelware container. Do not use aluminum. Avoid inhaling the lime-water solution while mixing it. Soak cucumbers in lime water for 12 to 24 hours. Remove the cucumbers from the lime solution, rinse and resoak one hour

in fresh, cold water. Repeat the rinsing and soaking steps in fresh water two more times. Handle carefully because slices will be brittle. Drain well.

- **Canning Procedure-**Wash jars. Prepare lids according to the manufacturer's instructions. Fill jars uniformly with the product. Avoid packing so tightly that the brine or syrup cannot surround and cover the food. Remove the air bubbles by running a rubber scraper or nonmetal spatula between the food and the jar. Wipe the sealing edge of the jars with a clean, damp paper towel. Add lids and tighten the screw bands. Process jars in a boiling-water canner or use the low-temperature pasteurization treatment.

**To process in a boiling-water canner-**

Fill the canner halfway with water and preheat to 180 F for hot packs or 140 F for raw packs. Load sealed jars into the canner rack and lower with handles or load one jar at a time with a jar lifter onto a rack in the canner. Cover the canner and turn the heat to high. Add water if needed to a level of 1 inch above the jars. When the water boils vigorously, lower the heat to maintain a gentle boil and process the jars for the time.

**To process using the low-temperature pasteurization treatment-**

Place the jars in a canner filled halfway with warm (120 F to 140 F) water. Add hot water to a level of 1 inch above the jars. Heat the water and maintain a 180 F water temperature for 30 minutes. Use a candy or jelly thermometer to be certain that the water temperature is at least 180 F during the entire 30 minutes. Temperatures higher than 185 F may cause unnecessary softening of pickles. This treatment results in a better product texture but must be managed carefully to avoid possible spoilage.

**Caution: Use only when the recipe indicates.**

After processing is completed, remove the jars from the canner with a jar lifter and place them on a towel or rack. Do not retighten screw bands. Cool the jars 12 to 24 hours and remove the screw bands. Check the lid seals. If the center of the lid is indented, the jar is sealed. Wash, dry, label and store sealed jars in a clean, cool, dark place. If the lid is unsealed, examine and replace the jar if defective, use a new lid and reprocess as before. Wash the screw bands and store separately. Pickles are best if used within a year but are safe as long as the lids remain vacuum sealed.

#### **2.4.1. Preservation methods**

- **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**

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.

### **2.3.1. Precautions should be taken during the making of pickles:**

- It should be protected from, moisture, and oxygen.

- It judges by good aesthetic appearance.
- Contaminated jar are discarded immediately.
- The expiry date should be mentioned clearly weight and type of pickle should be mentioned on the jar.

## 2.4. Formulation of Pickle Processing

Select fresh, firm fruits or vegetables that are free of spoilage. Use a pickling variety of cucumber because the table or slicing varieties may result in a poor-quality pickle. Plan to pickle fruits or vegetables within 24 hours after the harvest for highest quality. If produce cannot be used immediately, refrigerate it and use it as soon as possible.

A bushel of cucumbers weighs 48 pounds and yields 16 to 24 quarts, an average of 2 pounds per quart. Choose the appropriate size. Use cucumbers about 1½ inches long for gherkins and 4 inches for dills. Odd-shaped and more mature cucumbers can be used for relishes and bread-and-butter style pickles. Measure or weigh produce carefully. Weighing gives the most accurate measures.

- **Salt-** Use a canning or pickling salt. Noncaking material added to other salts may make the brine cloudy. Do not reduce salt in fermented pickles because proper fermentation depends on the correct proportions of salt and other ingredients. Flake salt varies in density and is not recommended for use.

Some fresh-pack pickles can be prepared safely with reduced or no salt. Use only tested recipes formulated to produce the proper acidity. Both the texture and flavor of these pickles may be noticeably different than expected. The quick pickle recipes in this



publication may be made with reduced-sodium salts, such as light salts. Use of salt substitutes is not recommended.

**Caution: The use of reduced-sodium salt in fermented pickle recipes is not recommended.**

- **Vinegar-** White distilled or cider vinegars of 5 percent acidity (50 grain) are recommended. White vinegar usually is preferred when light color is desirable, as for fruits and cauliflower.

Do not dilute vinegar unless the recipe so specifies. If a less sour pickle is preferred, add sugar rather than decrease vinegar.

- **Sugar-** White granulated and brown sugars are used most often. Brown sugar gives a darker color and distinct flavor. Corn syrup and honey may alter the flavor.
- **Water-**A soft water is recommended for pickle making. Very hard water may have an undesirable effect on the color and flavor of pickled products. However, some hard water might produce a firmer pickle.

Hard water may be softened somewhat by the following method: Boil the water for five minutes. Skim off the scum and let the water sit for 24 hours. Then ladle off the water without disturbing the sediment in the bottom. Another option is to dilute hard water with soft water. To dilute, mix one part hard water with two parts soft water.

- ***Spices-*** Use fresh, whole spices for the best flavor in pickles. Powdered spices may cause the product to darken or become cloudy. Tying whole spices loosely in a cheesecloth bag, putting the bag in the pickling liquid and then removing the bag before canning is best.  
  
If desired, add individual spices, such as a cinnamon stick, from the bag to each jar. Spices deteriorate and quickly lose their pungency in heat and humidity. Store opened spices in an airtight container in a cool, dark place.
- ***Firming Agents-*** Alum may be used safely to firm fermented pickles. However, it is unnecessary and is not included in the recipes in this publication. Alum does not improve the firmness of quick-processed pickles. The calcium in lime definitely improves pickle firmness. Food-grade lime may be used as a lime-water solution for soaking fresh cucumbers before pickling them. Excess lime absorbed by the cucumbers must be removed to make safe pickles. To further improve pickle firmness, you may process cucumber pickles for 30 minutes in water at 180 degrees Fahrenheit (F). This process also prevents spoilage, but the water temperature should not fall below 180 F. Use a candy or jelly thermometer to check the water temperature.

#### 2.4.1 Flow chart for Hand Made vegetable processing:



Selection of fresh vegetable like (cauliflower, carrot, ginger, garlic, green chili, turnip, cucumber etc.)



Washing done to remove impurities



Peeling for remove the outer skin of vegetables



Cutting into suitable slices



Blanching for inactivating the enzyme reaction



Preparation of spices by frying followed by grinding



Mixing the spices and salts with the vegetable and filling in a suitable jar



Put the jar under Sun Light for 7 day



Add the heated mustard oil after 7 days and pack the pickles for marketing

### **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 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 laboratory equipments 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 ShriNulsiWadia 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.
    - 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 be 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

- Spice grinder- A spice grinder is a tool used to grind up hard, dried whole spices. There are a few types of spice grinders which are dedicated to one spice alone, such as pepper mills, and nutmeg graters.



- Trolley- A trolley is traditionally used to transport or move the no. of pickle jars.



- Vegetable slicer- Vegetable slicers are used for cutting vegetables, such as zucchinis (to make zoodles), potatoes, cucumbers, carrots, apples, parsnips, beetroots etc.



- SS knife- Larger chef's knives are used for cutting meat, dicing vegetables, disjointing some cuts, slicing herbs, and chopping nuts.



## CHAPTER 3

### PACKAGING OF HANDMADE PICKLES

#### 3.1 Characteristics of Pickles

Pickling of plant and animal foods is a relatively old method of food preservation. It is estimated that the first pickles were produced over 4,000 years ago using cucumbers native to India. The ancient Egyptians and Greeks both have written



about the use of pickles for their nutritive value and healing power. Pickles were a common food during the time of the Roman Empire and they soon spread throughout Europe. While there are many different types of pickles, some characteristics are common to all. In general, pickled cucumbers are crisp vegetables, which can be described as having a strong, biting flavor caused by the vinegar in which they are stored. Different pickle manufacturers normally add spices to give their pickles a unique flavor.

##### 3.1.1. The factors that lead to spoilage of the pickles are highlighted as below:

- In the absence of oxygen, radiolysis of lipids leads to cleavage of the interatomic bonds in the fat molecules, producing compounds such as carbon dioxide, alkanes, alkenes, and aldehydes. In addition, lipids are highly vulnerable to oxidation by free radicals, a process that yields peroxides, carbonyl compounds, alcohols, and lactones. The consequent rancidity, resulting from the irradiation of high-fat foods, is highly destructive to their sensory quality. To minimize such harmful effects, fatty foods must be vacuum-packaged and held at subfreezing temperatures during irradiation.

- Proteins are not significantly degraded at the low doses of radiation employed in the food industry. For this reason irradiation does not inactivate enzymes involved in food spoilage, as most enzymes survive doses of up to 10 kilograys. On the other hand, the large carbohydrate molecules that provide structure to foods are depolymerized (broken down) by irradiation.
- This de-polymerization reduces the gelling power of the long chains of structural carbohydrates. However, in most foods some protection against these deleterious effects is provided by other food constituents. Vitamins A, E, and B1 (thiamine) are also sensitive to irradiation. The nutritional losses of a food product are high if air is not excluded during irradiation.

### **3.1.2. Selection of Packaging Material**

In the absence of oxygen, radiolysis of lipids leads to cleavage of the interatomic bonds in the fat molecules, producing compounds such as carbon dioxide, alkanes, alkenes, and aldehydes. In addition, lipids are highly vulnerable to oxidation by free radicals, a process that yields peroxides, carbonyl compounds, alcohols, and lactones. The consequent rancidity, resulting from the irradiation of high-fat foods, is highly destructive to their sensory quality. To minimize such harmful effects, fatty foods must be vacuum-packaged and held at subfreezing temperatures during irradiation.

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### 3.1.3. Water Vapor 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.

	WVTR, g/m <sup>2</sup> , 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

**Effect of Folding and Crumpling on the WVTR of Dates**

### 3.1.4. Gas Transmission Rate

Permeability to gases like oxygen decides the shelf-life of oxygen sensitive eatable 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 /m <sup>2</sup> , 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 pickles packaging. Polyolefins have high values, whereas plastics such as polyester, nylons, ethylene vinyl alcohol (EVOH) have good barrier properties for transmission of volatiles.

### 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

#### 3.1.5. Tensile Strength & Elongation

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

#### 3.1.6. 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.

### **3.1.7. 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.

### **3.1.8. 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.

## **3.2 Packaging Materials used for Pickles**

A very high quantum of polymeric materials, glass jars, besides cellulosic and Aluminium foils 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 on 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 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 Pickles.

There are many changing trends in the packaging of Pickles. Plastic films and their laminates are increasingly replacing waxed papers due to better properties and aluminium foil laminates due to price and better flex crack property. Depending on the type of package i.e. twist wrap, pillow pack and vertical flow pack or roll pack, the plastic based packaging films used for Pickles are listed below.

➤ **Polyethylene (PE)**

It is considered to be the backbone of packaging films. Since one of the greatest threats to the integrity of Pickles comes from moisture, polyethylene with its low water vapour 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 flavours/volatiles, poor grease resistance and are limp. High-density polyethylene (HDPE) is stiffer, more translucent and has better barrier properties but needs higher temperature for sealing.

Later additions include high molecular weight high-density polyethylene (HM HDPE) and linear low-density polyethylene (LLDPE). HM HDPE is a paper like film with high physical strength and barrier properties, but is less transparent than ordinary polyethylene. HM HDPE is available in twist-wrap grades. Polyethylene films are also suitable for making bags and pouches. A

copolymer of polyethylene and poly vinyl alcohol, and EVOH has outstanding gas barrier properties especially when dry.

➤ **Polypropylene**

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

➤ **Poly Vinyl Chloride (PVC)**

PVC is a stiff and clear film having low gas transmission rate. PVC can be used as small wraps, bags and pouches. PVC when co-polymerised 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 sealability. 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.

➤ **Glasses-**

Pickles should be stored in glass and not plastic containers as they have high salt and acid content and thus will react with the plastic. Such eatables should be kept in glass containers to avoid any chemical reaction. Glass jars have wide mouths and hence the processes of filling and emptying the jar contents are easy. These glass jars have plastic or metal band lids which are very to open and close. Also they are air tight which helps in preserving the pickle for a longer time. These lids are easy to clean and hence prevent any possible contamination.

#### ➤ **Metallised Films**

When polymeric films are metallised there is an improvement in their barrier properties. Metallisation is also used for decorative purposes and aesthetics. The films, which are used for metallisation are PVC, PET, PP and polyamides. To safeguard the interest of the consumer the Standards of Weights & Measures (Packaged Commodities) Rules, have imposed a limit on the weight of the wrapper. Under this, it is essential that in the case of twist wrap and pillow wrap candies, where the weight of the individual pieces is less than 10 grams, the size of the wrapper and the type of wrapping material selected is such that it meets the limit on weight of wrapper, under the above rules.

### **3.2.1 Types of Packages**

#### ➤ **Pillow Bags and Pouches**-Another common type of packaging is a pillow pouch or 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 mini chocolate bars and individually wrapped dates.

- **Reclosable Zipper Bags and Pouches**-Reclosable bags and pouches are essential for Date products because they give customer convenient access to their goodies while preserving freshness. Zipper closures let customers use portion control or take their dates on the go.
- **Flexible Pouches**-Flexible pouches are a great option for holding processed Dates and other Fruits. 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.
- **Earthen Pots**-Clay pot's porous nature lets both moisture & heat to circulate through the food those results in slow yet aromatic dish. Earthen pots also retain the nutrition of the food that is usually lost in other types of utensils. The thermal inertia in earthen pots keeps the meat tender and soft for long.
- **Glass Jars**- Using a pickle glass jar has its advantages and health benefits. Pickle glass jars have been a popular choice over the years and are found in different colours and styles. This is a huge advantage when it comes to storing pickles. Glass is a non-porous which resists dirt and hence is easily cleaned. Pickles remain fresh longer in the glass jars than if you store them in plastic or metal jars. Glass is inert hence you will not ingest chemicals unlike when you store these pickles in plastic or metal jars or bottles.

### 3.3. Quality considerations during packing

Quality control of packed products is the last time the item is checked before reaching the customer. Documented checking of the packages entails:

- Weight of the package;
- Weight of the pickle;
- Presence of adequate amount of oil/vinegar.
- Uniformity of the Pickle;
- Damage to the Pickle;
- Defects; and
- Moisture content.

***The surrounding area is also checked:***

- Cleanliness of the conveyer belts;
- 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

### **3.4 Future Trends**

Pickles are in their own category of mouth-puckering: Pickle juice is sour, but not in the same way that, say, blue raspberry flavoring is sour. It's sour in the way that vinegar is sour. And just thinking about pickle juice (whether you're a pickle lover or hater) is enough to induce that familiar saliva-producing mouthfeel. Pickles and pickle products vary as per local taste and

preferences and thus, many international, as well as regional players, are succeeding in this market by catering to the personalized needs of the citizens of a country. Large varieties, flavors, and major ingredients make this a huge market.

Vegetable pickles are prepared using one among these main methods: lactic acid fermentation of vegetables, and with or without the addition of salt for the preservation of vegetables in vinegar. Vegetables, such as cucumber, cabbage, olive and onion are fermented by lactic acid bacteria which can grow in low concentrations of salt. Vegetables pickled in acetic acid (vinegar) would include addition of salt and sugar. As they do not ferment, they possess unique flavor and texture.

Also, vegetable pickles with claims, such as gluten-free, kosher, etc., are gaining more popularity among the global population. Hence key players are coming up with an extended product portfolio. Hotties Spicy Sriracha Pickle Chips were launched by Rick's Picks in March 2012. This shelf-stable product is made with in-season vegetables from local farms and claims to be low in sodium, cholesterol-free, fat-free, and gluten-free. These pickles are perceived to be natural and healthy food as a side dish, especially in North American and European countries. The price variation of raw materials and ingredients added to the preparation of pickles is one among the restraints in the pickles market. Therefore, in developing countries, like India, people are preferring more home-made pickles or pickles prepared by unorganized pickle industry, as it includes pure ingredients and can be customized on the basis of ingredients and packaging.





## CHAPTER 4

### FOOD SAFETY REGULATIONS AND STANDARDS OF HANDMADE PICKLES

#### 4.1 Standards

As per Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011, pickles mean the preparation made from fruits or vegetables or other edible plant material including mushrooms free from insect damage or fungal infection, singly or in combination preserved in salt, acid, sugar or any combination of the three. The pickle may contain onion, garlic, ginger, sugar, jaggery, edible vegetable oil, green or red chilies, spices, spice extracts/oil, lime juice, vinegar/acetic acid, citric acid, dry fruits, and nuts. It shall be free from copper, mineral acid, alum, and synthetic colors, and shall show no sign of fermentation.

SL. No.	Particular	
1.	Pickles in Citrus juice or Brine conforming to the following requirements:	
	Drained Weight	Not less than 60.0 per cent
	Sodium Chloride content when packed in Brine	Not less than 12.0
	Acidity as Citric Acid when packed In Citrus Juice	Not less than 12.0

<b>2.</b>	<b>Pickles in Oil</b>	
	Drained Weight	Not less than 60.0 %
	Fruit and Vegetable pieces shall be practically remaining submerged in oil	
<b>3.</b>	<b>Pickles in Vinegar</b>	
	Acidity of vinegar as acetic acid:	Not less than 2.0 %
	Drained Weight	Not less than 60.0 %
<b>4.</b>	<b>Pickles may contain preservatives (single or in combination)</b>	
	Benzoic acid and its sodium and potassium salt, or both (calculated as benzoic acid)	250 ppm maximum
	Sulphur dioxide	100 ppm maximum
	Pickles shall conform to the microbiological requirement as follows	
	Mould count Absent in 25 grams/ml	

#### **4.1.2 Processed Pickles:**

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

- Pickling is the process of preserving edible products in an acid solution, usually vinegar, or in salt solution (brine). In the latter case, the acid that does the preservative action (lactic acid mainly) is produced by fermentation.
- Most major vegetables can be preserved by pickling, either commercially or in households. Cucumbers, cabbage, and green olives account for the largest volume of vegetables and fruits commercially pickled in Western countries. Capers, garlic, onions, carrots, cauliflower, beans, and other vegetables are also pickled, albeit in lesser quantities.
- Pickling imparts unique characteristics to fruits and vegetables. Desirable changes in flavor, texture, and color take place in fermented, pasteurized, and refrigerated pickles, and are carefully monitored.
- Pickling is the process of soaking food in a solution containing salt, acid, or alcohol. It can be used with most foods, including fruits, vegetables, meats, seafood, and eggs.

## **4.2 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.

#### **4.3 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 contain the following**

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of coloring material. Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

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

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

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

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





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