Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

PM Formalisation of
Micro Food Processing Enterprises Scheme

HANDBOOK OF PROCESSING OF MIZO CHILLI

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ABBREVIATIONS & ACRONYMS

Sr: No.	Abbreviations &Acronyms	Full Forms
1.	Al	Aluminium
2.	ARIMA	Autoregressive integrated moving average
3.	ARCH	Auto regressive Conditional Heteroscedasticity
4.	BOPP	Biaxially Oriented Polyproplene
5.	CIP	Clean-in-Place
6.	FPOs	Farmer Producer Organizations
7.	FIB	Flexible Intermediate Bulk Containers
8.	FIFO	First in First Out
9.	FSS	Food Safety and Standards
10.	FSSAI	Food Safety and Standards Authority of India
11.	FoScoS	Food Safety Compliance System
12.	GST	Goods and Services Tax
13.	GARCH	Generalized Autoregressive Conditional Heteroskedasticity
14.	HCL	Hydrogen Chloride
15.	HDPE	High-density polyethylene
16.	LIFO	Last in first Out
17.	MoFPI	Ministry of Food Processing Industries
18.	LDPE	Low- density polyethylene
19.	MET	Metalized Polyester
20.	PA	Polyamide
21.	PET	Polyesters
22.	PE	Polyethylene
23.	PLC	Programmable Logic Controller
24.	PP	Polypropylene
25.	SARIMA	
26.	SHE	Safety Health Environment
27.	SHGs	Self Help Groups
28.	UV	Ultraviolet
29.	UPS	Uninterruptible Power Supply
30.	WTP	Water Treatment Plant

CHAPTER – 1

INTRODUCTION

Chilli (*Capsicum annuum* L.) is an indispensible, commercial spice crop native to the tropical America which belongs to the Solanaceae family. Mizo Chilli' or 'Mizoram's Bird Eye Chilli', a Geographical Indication (GI), is grown under completely organic cultivation on Jhum land - High availability of potash in the area gives it a distinctive red color. It is one of the hottest chilli in the world. It is small, about half an inch in length greenish in color before ripening and become bright red when ripe. It has been recognized as a Geographical indication by the Government of India on 23/03/2015. Mizo chilli has three grades. Grade A is only about one centimeter in length - smallest, thinnest, but the most pungent, and the most in-demand. Next is Grade B, slightly thicker and longer. Grade C is similar to Grade B in thickness but a bit longer. It is grown in the hilly slopes of the North Eastern States mainly during shifting cultivation. Several varieties are grown. These include mainly, Arka Lohit, King chilli, Mizo chilli (Bird eye chilli), Dulle chilli and Pant C-1, Pusa Sadabahar. The bird eye chillies have SHU around 50,000-100,000 and King Chillies have known to have a higher SHU count. This them one of the most pungent chillies of India. Harvesting time is between Novembers to March. Clover can offer about 3,000 tons of fresh bird eye chillies and about 400 tons of King Chillies. On request, dried and powder chillies can also be made available. Chilli has many medicinal properties, especially as an anti-cancerous agent, increases metabolism by burning fats, instant pain reliever, helps in digestion, develops blood and reduces insulin spikes in diabetes. Chillies are rich source of ascorbic acid, also contains vitamin A, B1 and B2, iron, calcium, magnesium, phosphorus, protein and beta carotene.

1.1 Chili Industry in India

India is the world's largest producer as well as exporter of dry chillies. . It is grown in the hilly slopes of the North Eastern States mainly during shifting cultivation. Its exports represent 72.93 % of world exports in year 2017 and top importers from India are Vietnam, Thailand, Sri Lanka and Indonesia. According to 2019-20 first advance estimates, Indian chilli occupied an area of 7.33 lakh hectares (18.11 lakh acres) with a production of 17.64 lakh tonnes and productivity of 2400 Kg per hectare (971 Kg per acre). Andhra Pradesh tops among the major chilli producing states contributing about 6.30 lakh tonnes of the total chili production in the country.

There is good demand of chilli hybrid varieties like Teja and 334 in the international market. The demand for value added products is increasing day by day and the chilli industry of the country is trying to meet the present demand. The area under chilli cultivation in Mizoram is around 11000 ha (2016-17) and its production is 10727.35 MT (2016-17). A large portion of Chili production is exported to neighboring states like Assam.

Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka and West Bengal are the major chilli producers in India accounting for 35, 17, 12, 11 and 6 percent of India's total production. Majority of rural population of Guntur, Warangal, Khammam, Mahabubabad, Gadwal, Hindpur, Suryapet districts are chilli growers. In India, these districts are the utmost commercial center of dried chilli and chilli powder. Guntur district (Andhra Pradesh) is considered to be the largest chilli marketing hub in the world. Telangana has assessed 2020-21 *kharif* pre-sowing price forecast of chilli and it is expected that by the time of harvesting (January to March 2021), chilli price will be around Rs. 9500-11000/ quintal. This value gauge depends on the month to month modular cost of chilli got for a long time from Khammam directed market utilizing econometric models like ARIMA, ARCH, ARIMAX, SARIMA and GARCH and furthermore the market overview.

1.2 Chilli growing states in India

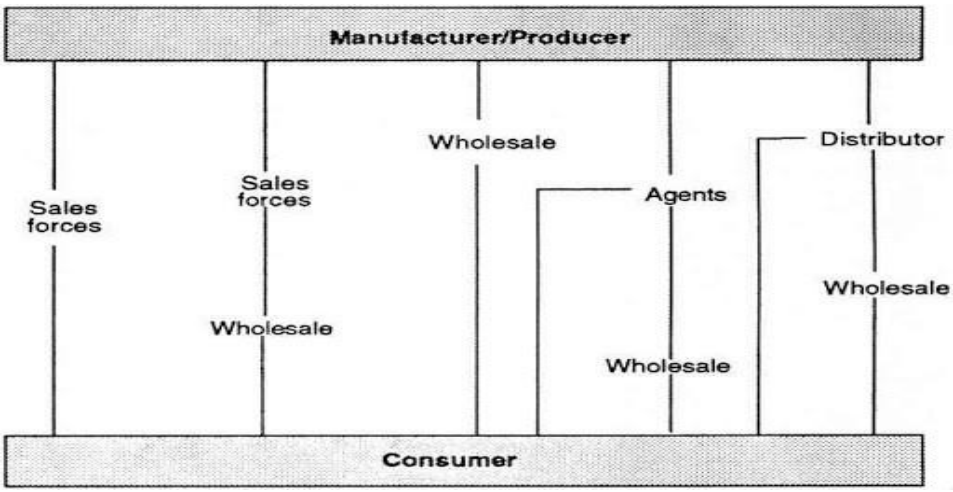
1.3 Gross value added from chilies in Mizoram

Chilies from the state of Mizoram accounted for over 873 million Indian rupees in the Indian economy in fiscal year 2018. This value was higher than the previous year's contribution of chilies from the state. Andhra Pradesh was the largest contributor for chilies to the agricultural gross value added among other states in the south Asian country, followed by Telangana.

1.4 Key deterrents to the growth of the market

Despite having a significant chilli production, India lacks in terms of good processing facility and availability of cold storages which results in wastage of dairy output. Aside from the creation related issues, speculation for the improvement of advertising, stockpiling and cold stockpiling foundation is contacting the sky. Chilli markets are influenced by generally creation in the country occasional value vacillations, world interest, stocks accessible in cool stockpiles and supporting among the different assortments of chillies. Lack of adequate storage, vacuum packing facilities and meager distribution channels are hampering the growth of the Indian chilli processing industry. Atypical climate conditions, high seed cost, Low yield and non-accessibility of value seeds are the significant limitations across chilli producing states. Precariousness in yield and costs has likewise represented a genuine danger in producing pay soundness of the chilli cultivators. Indian chilli trades are dealing with issues of value regarding shading esteem, right sharpness, yield just as aflatoxin substance and leftover of pesticide. By satisfying quality needs of the worldwide market, chilli fares can be improved further

Chilli marketing channels in India



Reference: FAO

1.5 Need for Processing Chilli

Chilli is considered as an indispensable condiment consumed in Indian diet because of its nutritional and nutraceutical properties. It has to be processed to;

- Increase the storage life, because it is highly putrescible.
- Value added products compose of chilli like dehydrated chilli, powder, paste; pickle, sauce etc. obtain higher returns. Real return in chilli comes only from processed products.
- Provide consumers with an incentive to make purchase.
- Create profit and enhances income by attracting more customers.
- Generate employment opportunities, accordingly building financially strong Nation.

1.6 Nutritional Value of Chilli

In general, nutritional composition of chilli is influenced by genotype/variety, maturity, growing conditions, and losses after processing

Table 1. Nutritional Value of Chilli

Values (Per 100 gms)		
Parameters	**Chillies Dry**	**Chillies Green**
Moisture	10.000 gm	85.700 gm
Protein	15.000 gm	2.900 gm
Fat	6.200 gm	0.600 gm
Minerals	6.100 gm	1.000 gm
Fibre	30.200 gm	6.800 gm
Carbohydrates	31.600 gm	3.000 gm
Energy	246.000 K cal	29.000 Kcal
Calcium	160.000 mg	30.000 mg
Phosphorus	370.000 mg	80.000 mg
Iron	2.300 mg	4.400 mg
Vitamins		
Carotene	345.000 µg	175.000 µg
Thiamine	0.930 mg	0.190 mg
Riboflavin	0.430 mg	0.390 mg
Niacin	9.500 mg	0.900 mg
Vitamin C	50.000 mg	111.000 mg
Minerals & Trace Elements		
Sodium	14.000 mg	-
Potassium	530.000 mg	-
Phytin Phosphorus	71.000 mg	7.000 mg
Magnesium	-	272.000 mg
Copper	-	1.400 mg
Manganese	-	1.380 mg
Molybdenum	-	0.070 mg
Zinc	-	1.780 mg
Chromium	-	0.040 mg
Oxalic Acid	-	67.000 mg
Caloric values		
Chilli (Dry)	297	
Chilli (Green)	229	

Reference: The National Institute of Nutrition, Hyderabad.

CHAPTER-2

PROCESSING AND MACHINERY

2.1 Introduction

Primary Processing of chili powder starts with drying cleaning. De seeding, drying either traditional sun drying or mechanical drying, coarse grinding/blending, conveying, fine milling, sifting, packing are intermediate process.

2.2 Different Departments in a unique Chilli Processing Plant

Production is the main body of any food processing unit. Based on the capacity and product variants, different supporting departments made to deliver right product at right time to the consumer and consequently generate revenue. Departments are majorly categorized into;

1. Production and Operation: Production planning, Scheduling, managing seasonal production.
2. Quality Assurance and Regulatory: Assure quality of the product, Establish food safety, organizing internal audits, Certifications (FSSAI, FSSC 22000, Agmark, BRC etc.) and updating of food safety manual.
3. Research and Development: New Product development
4. Engineering

    a. Engaged in new projects

    b. Maintenance of the machinery and infrastructure

    c. Managing water treatment plant (WTP)

    d. Managing power supply unit (UPS, Generators, Solar panels, and coordination with electricity board)

5. Procurement: Engaged in procurement of raw material, packing material, engineering items, vendor development etc.
6. Store: Maintaining the inventory and alarm procurement, maintaining first in, first out (FIFO), last in, first out (LIFO) etc.
7. Logistic and Supply Chain: Deliver products to the consumer at right time

8. Deals and Marketing: Manager is answerable for exploring and creating showcasing openings and arranging and executing new deals plans.
9. Safety Health and Environment (SHE): Ensure safety personnel, premises and environment, coordinating with Pollution control board.
10. Human Resource and Legal

Role and Responsibilities:

- Recruitment: To ensure that right people are recruited for right position and in right number to meet the requirement.
- Medical examination and health card record keeping: Medical examination of the employee is carried out to ensure that they are medically fit to carry out their work.
- Contract labour engagement: To describe a procedure for contract labour engagement.
- Attendance and leave policy: To describe a procedure for monitoring the employees the punctuality and discipline.
- Training for Roll and contractual labour employees: To describe a procedure for carrying out training for all employees and to ensure proper training records are maintained at plant level.
- Skill matrix: To ensure the effectiveness of occupational/working skill for employee.

2.3 Different operations in chilli processing unit

Methods employed in drying chilles for market purpose

Good-quality, ripened chillies with no signs of damage or decay are selected for drying purpose. Proper drying of chillies helps in retaining and gaining intense aroma and spiceness.

a) Air drying: Traditionally, matured gathered chillies are dried in the open yards for 15 to 20 days. The cycle includes dunking the red chillies in an uncommonly arranged "Dipsol" arrangement followed by sun drying. Dipsol is a water-based emulsion containing potassium carbonate, refined groundnut oil, gum acacia and butylated hydroxyanisole. This cycle holds the sharpness and normal tone bringing about better yields. The method guarantees a steady finished result. This cycle is unhygienic, tedious (requires a week) and gives low yield inferable from loss of seeds through breakage. A solar drier requires 5 days for drying chillies.

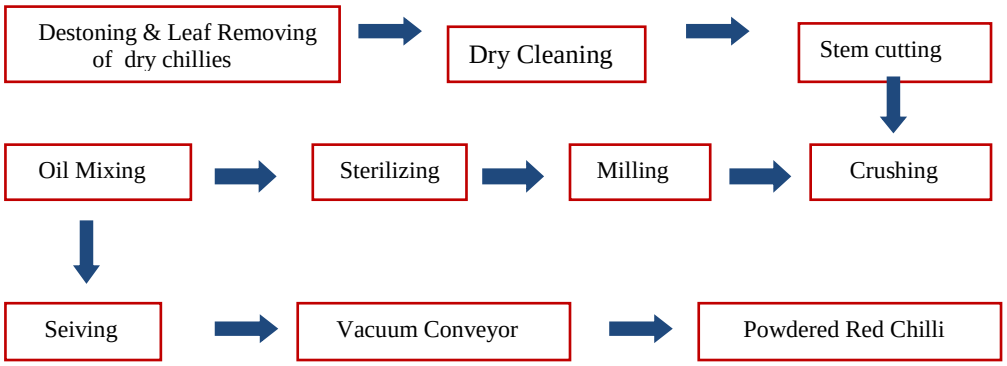
Sun drying of chillies

b) Oven drying: Depending upon the type and size of chilli, drying time varies.

Wash chillies thoroughly under running tap water. Wipe off the water droplets and arrange chillies lengthwise on the baking tray. Turn on the oven the put it on a low temperature around 100^{o}C. Keep turning the pods every hour for uniform drying. Ideal temperature for drying is 80^{o}C for 8 hours for most of chilli varieties. After drying store them in an airtight container in cool and dark place.

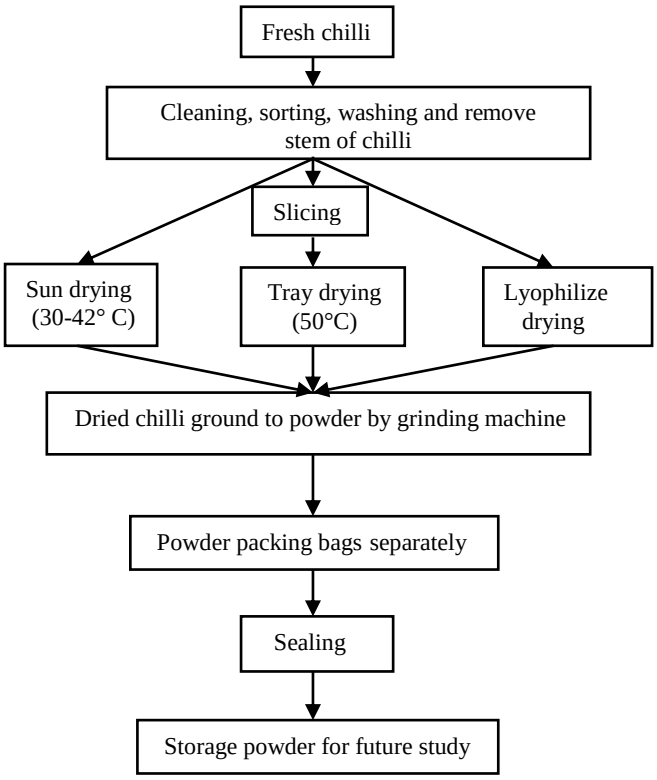
Hot air oven drying

Chilli processing line

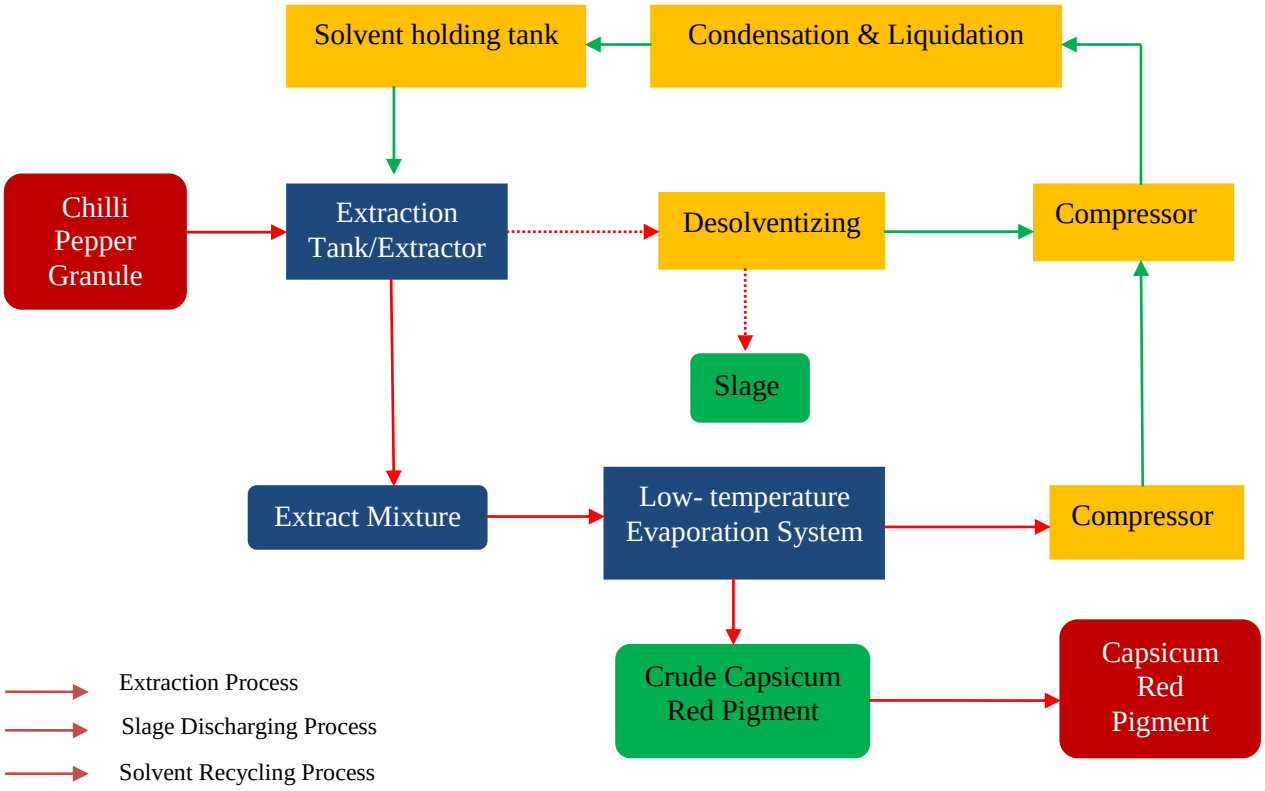


Quality assessment in chilli

Crude materials utilized for chilli powder and chilli paste formation incorporate dried red chillies (*Capsicum annuum*), water and palm oil (cooking oil). Chilli paste machine involves a bunch of sharp edges that empower blending or mixing of chilli paste during mixing and cooking measures, a warming plate is introduced for warming the chilli paste. The entire activity is constrained by a Programmable-Logic-Controller (PLC) Unit which permits mechanized control of the ideal temperature and speed boundaries. There are two cycle boundaries (edge speed R1 and R2) of the model machine which impacts the nature of chilli paste. At the point when the temperature is set lower (T1), the mixing time will be more limited which prompts coarser stew molecule size. At higher temperature, mixing time will be longer and better chilli molecule size will be gotten.



Diagrammatic representation for processing of Green Chilli powder



Flow chart of Capsicum Red Pigment extraction from Red Chilli

Capsicum Red Pigment Extraction Machinery (5 tons/day)

2.4 Chilli Dry Cleaning

Modern dryers are used to diminish the drying time, give uniform and clean handling conditions to improve the nature of dried chilli. Drying of chilli at high temperature lead to the deficiency of supplements, unstable compound and shading. Chillies have a moderately low unstable substance, which is needy upon species and phase of development. Chillies are dried to make chilli powder and to store it for both short and long haul stockpiling.

This machine cleans the residue on the outside of the hot pepper, pepper leaves and crude material containing pollutions, for example rope, plastic pieces, little sand to accomplish water wash standard. It receives the standard of pneumatic passing on, great fixing, dust after dissipated breeze channel sack, improved working conditions. It embraces dry strategy for cleaning, pollution like residue, leaves, fag end, plastic material, and little stone/sand and so forth, the cleaning productivity can arrive at wet technique cleaning standard.

Chilli Dry cleaning machine

2.5 Chilli Deseeding

It cut the chilli into sections and then separates the seeds from the chilli with strong winds. It's basically used to isolate chili seed from whole chilli. It is suitable for all kind of chilies. Operator can put total chilli straightforwardly, isolating effectiveness is high, completed chilli is clear off seeds. The seeds can be stuffed straightforwardly. Yield shifts from 400kg-1000kg/hr. It is a significant machine for chilli further handling work.

Chili Deseeding Machine

2.6 Chilli drying

If the moisture content of raw chili is too high, drying operation is required to decrease the moisture content. Drying is a major step during the chili processing. After drying, the chili is easier to reserve, or it can be milled by grinding machine to reach higher efficient use value. During this process, chili keeps moving on the belt and both side of the material is fully contacted with the hot air. Consequently uniform drying is achieved.

Chilli Dryer Machine

2.7 Chilli Milling and Sifting system

This system is comprised of processing, filtering and dust gather part. It has high programmed degree, simple activity, low work force, low power utilization, high limit and so on.

a. Processing part- It can be isolated into coarse processing and fine processing part. Crude material is processed by relative-move rollers, chilli color won't be changed by high working temperature.

b. Filtering part- It receives Quantitative screw transport to take care of, taking care of speed can be changed. In coarse plant machine, chilli will be broken by turning hammer, at that point material will be lifted to filtering machine to filter and grade. Coarse material and fine material will be passed on to various mill operators to crush once more, at that point rehash the filtering work until standard fine flour get out.

c. Residue gatherer- This plant receives yearning transmission, fixing impact is superb, dust is sifted by high pressing factor beat deduster, this generally brought down the sharp smell and residue, working climate is grown significantly.

Chili Powder Sifting Machine

2.8 Packing

DCS arrangement weighing and sacking machine gives high velocity packing. It is broadly utilized in little, center and enormous flour plant, starch and substance industrial facility. This machine is of two sorts: twofold screw transport and mono screw transport. Mono screw type is utilized in little and center manufacturing plant while twofold screw type is utilized in center and huge limit plant. This machine embraces superb regulator, consequently can guarantee high accuracy, security and long time administration. This machine is worked with acceptable plan and pleasant design, works at high velocity and simple to work. Sewing machine can cut string consequently.

Semi-auto Packing Machine

2.9 Different tests carried out to assure the quality of processed chilli

Color degeneration in powdered chilli has been credited to oxidation of carotenoid colors which is fundamentally impacted by temperature, dampness content, air, light and capacity. The moisture content of the chilli powder has all the earmarks of being critical for shading confinement during

capacity. Lower level of moisture prompts the shading fade of chilli while at more elevated levels there was darkening by browning responses yet no progressions happen in carotenoid content. High moisture content aides in development and endurance of the mold.

Powder should be put away under cool conditions and out of light. Prepared chilli powder ought to be liberated from development of molds, living or dead creepy crawlies, bug sections and rat tainting.

Quality assurance test includes:

1) **Moisture test:** The moisture content of the chilli needs to be reduced to optimum level in order to prevent the occurrence of micro-flora and consequently loss in quality or complete spoilage.

   It is determined by hot air oven method.

   5g of the chilli into weighed moisture box and dried in an oven at 100±1° C for 16 hours and cooled in desiccators. The weight of the dried sample was recorded. Moisture content is calculated by formula:

   Moisture content (%) = $w_1 – w_2/w_3$ x 100

   Here, w_1 = sample initial weight (g), w_2 = sample final weight of (g), w_3 = sample dried weight (g)

   Maximum moisture content of chilli powder should be 11.0%, according to Indian Standards.

2) **Ash test**

   It is determined by muffle furnace method.

   5g of the sample weighed into crucible (heated to about 600°C and then cooled before). Place crucible on a clay pipe triangle and heat first over a low flame till all the material is completely charred, followed by heating in a muffle furnace for about 3-5h at 600°C. Cool in desiccators and weigh. Ash content is calculated by expression:

   Total ash (%) = w_1/w_2 x 100

   w_1= weight of ash (g), w_2 = Weight of sample (g)

   Maximum ash content of chilli powder should be 8.0%, according to Indian Standards.

3) **Acid insoluble ash content**

   Add 25ml of dilute HCl in a dish containing ash, boil covering the dish with a watch glass to prevent spattering. Cool and filter contents of dish through an ash less filter paper. Wash filter paper with hot water until it is free from HCl as tested by silver nitrate solution, return it to dish. Evaporate carefully on water bath and ignite at 550±25°C for 1hour in a muffle furnace. Cool the dish in desiccators and weigh. Repeated the operation of igniting for an hr, cooling and weighing till the difference in weight between two successive weighing is less than 0.001gm. Record the lowest weight.

   Maximum value of acid insoluble ash content of chilli powder is 1.3%, according to Indian Standard.

4) **Volatile fat Content**

Volatile fat of Chilli powder was determined by Soxhlet method. About 3g of sample weighed in a round bottom flask using thimble. Then the flask is poured with N-Hexen and placed in a Soxhlet apparatus for complete extraction of the volatile fat. After removing N-Hexen from the fat the weight was taken and calculation was done.

Usually Chilli powder contains less than 0.5% of volatile oil. Variation may occur due to difference in treatments, preparation and drying methods.

5) **Refractive Index**

The refractive index of a substance is the ratio of the speed of light in a vacuum to the speed of light in the substance. There is a fixed degree of refraction present for each substance, when light passes through a substance. Each substance turns the light in a particular direction and degree, by observing which substance is identified. This principle is used during identification of oil characteristics. Generally Abbe refractometer is employed as it determines refractive index directly requiring only a few drops of liquid.

6) **Microbiological parameters**

Faulty food handling techniques especially storage of food at improper temperature for longer time results in microbial proliferation in contaminated food. Salmonella in chilli powder must be absent according to Indian Standard.

2.10 Packing Machines

Different types of packing machines are used for packaging chilli. In market, chilli is normally available in two forms.

1. Green chilli
2. Dry red chilli

Fresh harvested and sorted green chillies as well as well dried chillies are usually packed in Thermocol boxes, plastic trays, carton board, sacks, plastic trays etc for export purpose. Materials used for packing depends on the export place and distance to be travelled to avoid any damage to the product.

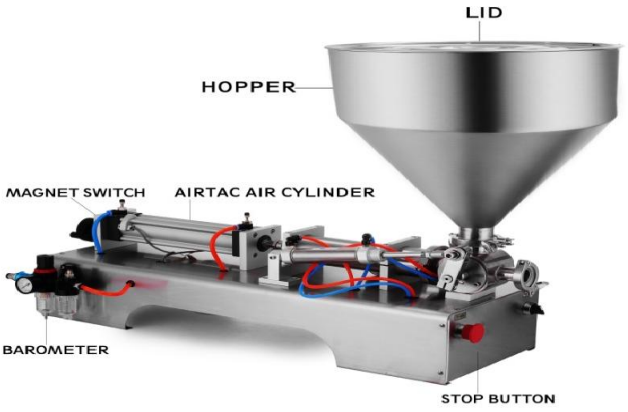
Machine used

Different machines used are used for different purposes like filling chilli powder, sauce, pickles in sachets, glass/plastic jars, cans and packaging freshly plucked green or dried chillies.

Red chilli packing machine

Green chilli packing machine

Chilli sauce bottle filling equipment



Chilli paste filling machine

Chilli sauce packing machine

Chilli powder packing machine

2.11 Mizo Chilli Pickle

Pickling is one of the most ancient methods of preservation. Pickles are good appetizers and add to the palatability of a meal. They stimulate the flow of gastric juice and thus help in digestion. They are eaten as a savoury, spicy accompaniment to a meal. Pickles are preserved by a combination of increased acidity(reduced pH), added salt, reduced moisture and added spices. Many types of pickles can be prepared from red cherry pepper. Most popular types of pickle are vinegar pickle and oil pickle.

Mizo Chilli Vinegar Pickle

Fig. 2.7 shows the process flowchart for production of mizo chilli vinegar pickle. In the manufacture of pickle, fresh mature healthy mizo chillies are selected and washed. The cleaned chillies are destemmed manually. The destemmed chillies are then dipped in 5% brine solution for 2-3 days. For pickling, any type of common salt is suitable as long as it is pure. Iodized table salt darkens pickles. Salt that contains chemicals to reduce caking should be avoided as the chemicals will make the brine cloudy. Salt with lime impurities can reduce the acidity and shelf life of the product. Salt with iron impurities can cause blackening of the vegetables. Salt with magnesium gives a bitter taste tothe pickles. Salt containing carbonates can result in pickles with a soft texture. For long term preservation, sodium benzoate @ 0.02% may be added.

The soaked chillies are then drained and sorted for selecting whole round unshrivelled Chilli. The mozo chilli are then filled in pre-cleaned dry PET/glass bottles or jars with vinegar @ 2-5%. The vinegar used for pickling should have an acidity standard of 5 %. The pickling vinegar is white distilled vinegar. Coloured vinegar should be avoided as it imparts colour to the pickle. The bottles are then capped and labelled.

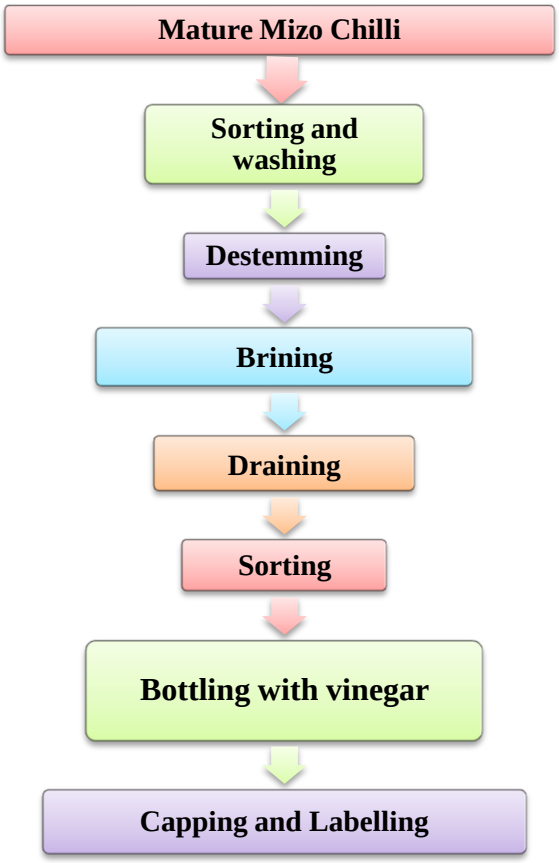


Fig. 2.7Process flow chart for Mizo Chilli vinegar pickle

Mizo Chilli Oil Pickle

In oil pickles, vegetable oil is added to the pickle. It is often mixed with the spices to make a paste. Top quality vegetable oil should be used. In India, mustard oil is commonly used. Fig. 2.8 shows the process flowchart for production of Mizo Chilli oil pickle. In the manufacture of mizo chilli oil pickle, fresh mature healthy chillies are selected and washed. The cleaned mizo chillies are destemmed manually. The destemmed chillies are then dipped in 5% brine solution for 2-3 days. For long term preservation, sodium benzoate @ 0.02% may be added. The soaked chillies are then drained and mixed with spices (turmeric powder, mustard seeds, fennel seeds or saunf, carom seeds or ajwain) and oilin a mixer. Spices used should be good quality, clean and free of mould and insects. They can be roasted or fried before adding to the pickle mixture. After mixing, vinegar and salt are added to the pickle mix and mixed thoroughly. The mizo chilli pickle is then filled in pre-cleaned dry PET/glass bottles or jars. Oil is also poured onto the top of pickles to form a barrier against oxygen. The bottles are then capped and labelled.

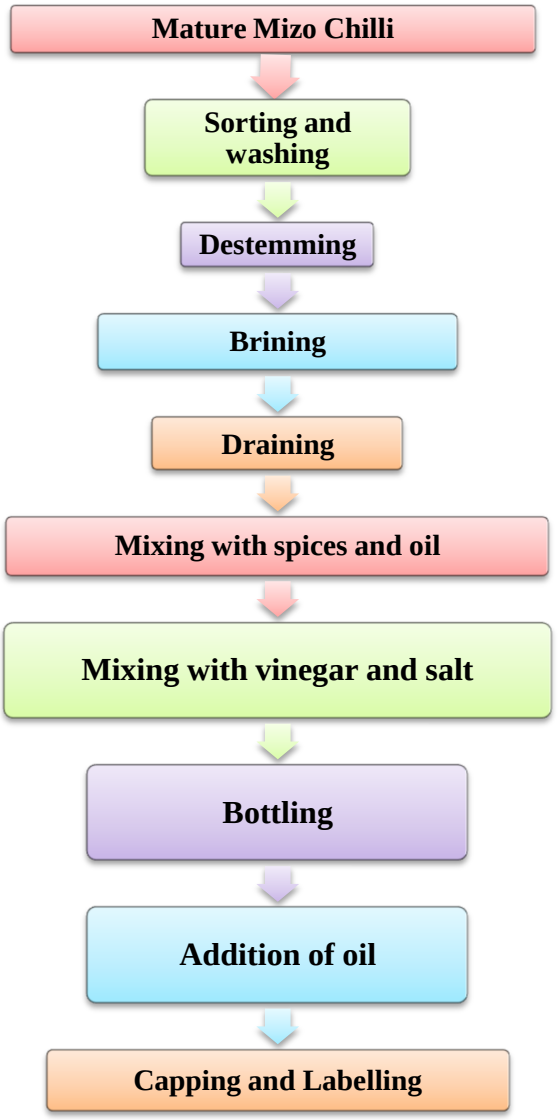


Fig. 2.8 Process flow chart for Mizo Chilli oil pickle

CHAPTER 3
PACKAGING OF PROCESSED MIZO CHILLI

For a long time packaging plays an active role in preservation and retention of quality of processed products. Due to increased demands on product safety, shelf-life extension, cost efficiency, environmental issues and consumer convenience, packaging has gained prominent role in recent years. The shelf life of processed Mizo Chilli products is dependent up on the type of packaging materials. In order to select a suitable packaging material for mizo chilli powder and pickle, it is essential to know which factors affect their quality. Following are some of the factors which affect the quality of these products.

3.1 Factors affecting quality of processed Mizo Chilli products

Moisture Content

Moisture content is an important factor for deciding the quality of packaged mizo chilli powder. Improperly packed Mizo Chilli powder is hygroscopic in nature and absorbs moisture from the surroundings resulting in sogginess and lump/cake formation powder. This reduces the flow ability and hence, the market value of the product.

Loss of Colour

The bright red colour of Mizo Chilli powder is its unique characteristics. This colour is due to its natural pigments. Packaging the powder/flakes in transparent packages which transmit light may lead to loss of these colouring pigments leading to discolouration of the powder. Loss of colour in mizo chilli pickles is not observed in a properly packed product.

Loss of Aroma and Flavour

The unique pungency and aroma of mizo chilli powder is attributed to the volatile oils present in mizo chilli. Losses in these volatile oil content or oxidation of some aromatic compounds due to higher temperature of storage may lead to loss of aroma and flavour. In case of mizo chilli pickle, the flavour/aroma is attributed to both the mizo chilli and the spices added into it. Proper packaging and normal storage temperatures are essential to prevent loss of aroma and flavour of pickles.

Insect Infestation

Mizo chilli powder is prone to spoilage due to insect infestation, which can be further accelerated due to high humidity, heat and oxygen. In pickles, insect attack is not prevalent.

Microbial Contamination

In humid regions having relative humidity of 65% and above, moisture absorption occurs in mizo chilli. The increase in moisture content of the powder also increases its water activity. Microbial growth occurs when water activity becomes more than 0.6. In mizo chilli pickles, the oil and vinegar protects the quality of the product in terms of microbial spoilage. However, fungus growth may be observed if the product is

not properly packed and exposed to air.

3.2 Packaging Materials for MIzo Chilli Powder

Mizo Chilli powder should be packed in clean, sound and dry containers. These containers can be made of metal glass, food grade polymers, wood or jute bags. The packing material shall be free from any fungal or insect infestation and should not impart any foreign smell. Each container shall be securely closed and sealed. Depending up on the type of packaging viz., bulk packaging, consumer packaging etc. the packaging quantity and material are selected.

Bulk Packaging

In bulk packaging, the current trend is to use Flexible Intermediate Bulk Containers (FIBCs) commonly known as Jumbo bags. These bags have a capacity of up to 1 tonne. In general these bags are made from cloth, but at present mainly from plastic (PP) fabric, which can be laminated or provided with an inner plastic liner bag. The PP fabric is stabilized against UV degradation. The bags are provided with filling and discharge spouts and slings for hanging during loading/ unloading operations.

Advantages of Jumbo Bags

- ✓ Bags are light in weight and, so transportation costs are reduced
- ✓ Bags are flexible, collapsible and durable
- ✓ Can be used for packaging of powder and flakes
- ✓ Product wastage / spillage and tampering is minimum
- ✓ Less labour is required due to minimum handling
- ✓ Saving in time for loading and unloading

Institutional Packaging

The capacity of institutional packs ranges from 2kg to 10kg. The traditional materials that were used such as tinplate containers and jute bags are currently being replaced by materials such as laminated flexible pouches and plastic woven sacks. The sacks are usually Biaxially oriented polypropylene (BOPP)multi colour printed laminated PP Woven bags. These bags may be gusseted to provide enforcement and have window and micro perforation.

Consumer Packaging

Consumer packaging is used for both domestic and international marketing. The selection of the correct packaging material depends upon a number of factors, which are broadly listed below:

- ➢ Desired shelf-life
- ➢ Climatic conditions during storage, transportation and distribution
- ➢ Type/ sector of market
- ➢ Consumer preferences
- ➢ Printability and aesthetic appeal

Types of Consumer Packaging

- Glass bottles of various sizes and shapes with labels and provided with metal or plastic caps. The plastic caps have added inbuilt features of tamper evidence, dispensing, grinding etc.
- Printed tinplate container with/without dispensing systems
- Composite containers with dispensers
- Plastic containers with plugs and caps with dispensing and tamper evidence features
- Printed flexible pouches – pillow pouch, gusseted pouch, stand-up pouch.
- Lined cartons

The printed flexible pouches have recently become very popular due to their easy availability, excellent printability, light weight, machinability and cost-effectiveness. Also, depending upon the functional and marketing requirements, the laminate/film can be tailor made to serve a specific need.

The printed flexible pouches are generally laminates of various compositions. Some of the commonly used laminates are:

- Polyester/ metallised polyester/LDPE
- BOPP/LDPE
- BOPP/ metallised polyester/LDPE
- Polyester/Al foil/LDPE

3 ply laminates such as 12μ PET/ Print/ 12μ Met. PET/ PE can avoid delamination and prevents smudging and de-figuring of the print. Polyester and BOPP based laminates are generally more popular for spice packaging due to certain advantageous characteristics of each of these two films.

Polyester used for lamination is generally 10 or 12μthick. The film is highly transparent with excellent clarity, gloss and printability thus enhancing the sales appeal. The film has very low moisture and gas permeability and, therefore, ensures prolonged shelf life of the contents with aroma, flavour and taste retention. The very high mechanical strength (tear, puncture, burst and flex) minimises damage to the contents during handling and transportation. The film has good machinability as well as printability. The latest printing technologies help in improving sales promotions. The film is free from additives and, therefore, does not impart any odour or taint to the sensitive spice product that is packed.

BOPP films may be heat sealable or non-heat sealable. The film has high yields, is stable under climatic changes and has excellent moisture barrier. This film is smooth, glossy, crystal clear and has high mechanical strength and non-contamination property for food contact applications.

Table 3.1 shows the packaging specifications for flexible packs of ground consumer spices, framed by the Indian Institute of Packaging.

Table 3.1 Packaging specifications for flexible packages of ground consumer spices

Co-extruded films (up to 500 grams capacity)	**Laminates/Co-extruded films (up to 1000 grams capacity)**
12µ PET / 37.5µ LD-HD (30% HD)	12µ PET/50µ LD-HD (30% HD)
12µ MET PET / 37.5µ LD-HD (30% HD)	12µ MET PET / 50µ LD-HD (30% HD)
12µ PET / 50µ PP	12µ PET / 62.5µ PP
12µ MET PET / 50µ PP	12µ MET PET / 62.5µ PP
10µ PET / 9µ Al. foil / 37.5µ LD-HD (30% HD)	10µ PET / 9µ Al. foil / 50µ LD-HD (30% HD)
12µ Al. foil / 37.5µ LD-HD (30% HD)	12µ Al. foil / 50µ LD-HD (30% HD)
25µ BOPP / 37.5µ LD-HD (30% HD)	25µ BOPP / 50µ LD-HD (30% HD)
25µ MET BOPP / 37.5µ LD-HD (30% HD)	25µ MET BOPP / 50µ LD-HD (30% HD)
35µ BOPP / 25µ BOPP	35µ BOPP / 35µ BOPP
30µ LD – 7.5µ Tie - 25µ PA – 7.5µ Tie - 30µ LD-HD (30% HD)	30µ LD – 7.5µ Tie - 30µ PA – 7.5µ Tie - 40µ LD-HD (30% HD)
The LD or LD-HD layer could also be LLD (outer) or LLD-HD (inner or outer) or EAA layer (outer)	The LD or LD-HD layer could also be LLD (outer) or LLD-HD (inner or outer) or EAA layer (outer)

3.3 Packaging Materials for Mizo Chilli Pickle

Clean glass jars with lids are the preferred type of packaging material for mizo chilli pickles. Glass bottled pickles are almost double in cost because of heavy packing and transportation costs. Glass jars can be used for both consumer and bulk packaging.

HDPE (High density polyethylene) and PET(polyethylene terephthalate) jars are usually used for packing pickles of 1kg and more. HDPE jars are opaque, convenient and break proof. They do not provide visibility. The PET jars are transparent, with good eye appeal and safe for pickle. PC (polycarbonate) bottles are best for pickles but they are still very costly.

Now-a-days, consumer packaging of pickles is done in flexible pouches. The capacity of the pouches ranges from 200 g to 1 kg. The pouches could be flat pillow type or stand-up pouches for shelf display. These are light in weight and hygienic. However, in flexible pouches, the sealant layer selection is very critical, as the contact layer needs to be acid and oil resistant. Failure of seals or surface stickiness can render the pack ineffective and un-saleable.

The flexible packaging of pickles in simple LDPE (low density polyethylene) pouch, does not provide protection from oxygen. It also does not give an effective heat seal, as LDPE is not compatible with oil,

causing failure of pouches. Hence, cost effective flexible pouches of co-extruded and laminated structures are now gaining more attention for packing mizo chilli pickles. The typical structures of these laminated packages are:

- 100 µ HD – LD – HDPE
- 140 µ LD – HDPE
- 110 µ LLDPE – BA – Nylon – BA – LLDPE
- 20 µ BOPP / 50 µ LD – HD (or Cast PP or EAA)
- 12 µ Polyester / 75 µ LD – HD
- 12 µ Metallised Polyester / 100 µ LD – HD

CHAPTER – 4

FOOD SAFETY REGULATIONS AND STANDARD

4.1 Registration and Licensing of Food Business

All Food Business Operators in the country will be registered or licensed in accordance with the procedures laid down.

Registration of Petty Food Business

a. Every petty Food Business Operator shall register themselves with the Registering Authority by submitting
b. An application for registration in Form A under Schedule 2 of these Regulations along with a fee as provided in Schedule 3.
c. The petty food manufacturer shall follow the basic hygiene and safety requirements provided in Part I of Schedule 4 of these Regulations and provide a self-attested declaration of adherence to these requirements with the application in the format provided in Annexure-1 under Schedule 2.
d. The Registering Authority shall consider the application and may either grant registration or reject it with reasons to be recorded in writing or issue notice for inspection, within 7 days of receipt of an application for registration.
e. In the event of an inspection being ordered, the registration shall be granted by the Registering Authority after being satisfied with the safety, hygiene and sanitary conditions of the premises as contained in Part II of Schedule 4 within a period of 30 days.
f. If registration is not granted, or denied, or inspection not ordered within 7 days as provided in above sub regulation (3) or no decision is communicated within 30 days as provided in above sub regulation (4), the petty food manufacturer may start its business, provided that it will be incumbent on the Food Business Operator to comply with any improvement suggested by the Registering Authority even later.
g. Provided that registration shall not be refused without giving the applicant an opportunity of being heard and for reasons to be recorded in writing.
h. The Registering Authority shall issue a registration certificate and a photo identity card, which shall be displayed at a prominent place at all times within the premises or vehicle or cart or any other place where the person carries on sale/manufacture of food in case

of Petty Food Business.

i. The Registering Authority or any officer or agency specifically authorized for this purpose shall carry out food safety inspection of the registered establishments at least once in a year.

4.2 Hygienic and Sanitary Practices

a) Cleaning and maintenance

(i) Cleaning and maintenance of all machinery and equipment to be done as per schedule specifying areas & equipment to be cleaned, frequency of cleaning, cleaning chemicals used and their dozes

(ii) Cleaning chemicals to be handled carefully and stored properly with identifiable containers

(iii) Raw chillies are cleaned, sorted, and/or inspected in such a manner as to reduce biological, physical and chemical contamination and to prevent contamination of the finished product.

(iv) Adequate cleaning, sorting and/or inspection are necessary to prevent, reduce or remove contamination with biological, chemical and/or physical hazards. Proper cleaning, sorting and inspection reduce the initial microbial load, ensuring the efficacy of the antimicrobial treatment step (if applicable).

(v) The sanitation program is carried out in a manner that does not contaminate food or packaging materials during, or subsequent to, cleaning and sanitizing (e.g. no contamination by aerosols or chemical residues).

(vi) Effectiveness of the sanitation program is monitored and verified (e.g. by a pre-operational inspection of premises and equipment or, where appropriate, by microbiological sampling) and where necessary, the program is adjusted accordingly.

(vii) A vacuum cleaner can be used for cleaning up fine dust as brushing tends to push dust into the air for it to settle elsewhere.

b) Pest control

(i) The food establishment to be kept in good repair so as to deny entry and harbor of rodents, pests and insects

(ii) Holes and drainages to be adequately sealed to prevent entry of rodents

(iii)Treatment with permissible pesticides and insecticides with appropriate limits shall be carried out carefully to ensure safety of food and person who handle the chemicals

Personal hygiene

(a) Health status:

(i) No person suffering from infectious disease is allowed to work in food processing establishment

(ii) Workers shall be medically examined before employed for work in processing operations (iii) All workers and factory staff shall be inoculated against enteric group of diseases once in a year.

Personal cleanliness

(i) All food handlers to be provided with clean and protective clothes, hand gloves and foot wear.

(ii) Their personal cleanliness to be maintained at all the times, they should wash their hands with soap and disinfectant before every entry to processing premises and after use of toilets.

(iii) Supervisors shall ensure that their nails cut regularly and hair trimmed.

(iv) No ornaments, except marriage bangles/ chains or such ornaments with proper covering shall be allowed during food handling.

(v) Workers shall refrain from bad habits like chewing, smoking, scratching parts of body, sneezing, coughing etc. during food handling.

4.3 Packaging and labeling

Packaging is a significant function for each produce as is in marketing of Chili. It is a practice to shield the produce from any harm during capacity, transportation and other promoting angles. The Packaging design and materials will give security to items to prevent contamination, harm and oblige required marking as set down under the FSS Act and the Regulations there under. Only food grade packaging materials shall be used as primary packaging material. Good packaging of chilli not only facilitates convenience in transportation and storage but also attracts consumer to pay more. Packaging materials like aluminum, tin and plastic shall conform to the Indian standards as mentioned under the FSS Regulations from time to time. The food packaging materials shall be inspected before use to avoid using damaged, defective or contaminated packaging, which may lead to contamination of the product. Inadequate control of packaging materials may result in the use of damaged, defective or contaminated packaging, which may lead to contamination of the product.

- The manufacturer has an effective system in place to prevent the use of contaminated, damaged or defective containers.

- Containers are inspected immediately before use to ensure that they are in a satisfactory condition and where necessary cleaned and/or disinfected; when washed they are well drained and dried before filling.
- Only packaging materials required for immediate use are kept in the packaging or filling area.
- Packing is done under hygienic conditions that preclude the introduction of contamination into the product.
- Containers are used only for their intended purpose.

4.4 Selection of Packing Material

1) Bamboo box
2) Thermocol box
3) Plastic pouch
4) Net bags
5) Plastic container
6) Gunny bags

Bamboo board

Plastic package

Gunny bags

Plastic box **Gunny bags**

4.5 Coding and labeling of packaging material

i. Pre-packaged chillies (spices) are identified with code marks or lot numbers on the label or container to allow for product identification in the event of a recall.

ii. Coding control permits products to be traced through the distribution chain and could provide manufacturing details. Coding is not a mandatory labeling requirement; however, this practice is recommended under Section 8.2.1 (Recall Procedure) to enhance the effectiveness of a recall.

iii. Products are permanently marked with a legible code or lot identification on the label, the package or the container. The coding system identifies where the product was manufactured (facility, line, etc.) and when (shift, day, month, year, etc.).

iv. Labeling of chilli or any other food products is very important to avoid potential health hazard. Incorrect labels could mislead the consumer and could pose a potential health hazard to segments of the population with allergies (e.g. sesame).

Minimum Mandatory labeling of pre-packaged foods must have the following details

a. Name

b. Name of the product

c. Net weight

d. Name and address (manufacturer, packer, distributor, importer, exporter or vendor)

e. Batch number

f. Date manufacturing /packing

g. Best before use date

h. Veg /non-Veg Logo

i. FSSAI registration number

j. Ingredient declaration

k. Nutritional value

4.6 Exemptions from labeling requirements

Where the surface area of the package is not more than 100 square centimeters, the label of such package shall be exempted from the requirements of list of ingredients, Lot Number Or Batch Number or Code Number, nutritional information and instructions for use, but this information shall be given on the wholesale packages or multi piece packages, as the case may be.

1) The 'date of manufacture' or 'best before date' or 'expiry date' may not be required to be mentioned on the package having surface area of less than 30 square centimeters but this information shall be given on the wholesale packages or multipiece packages, as the case may be;
2) In case of food with shelf-life of not more than seven days, the 'date of manufacture' may not be required to be mentioned on the label of packaged food articles, but the 'use by date' shall be mentioned on the label by the manufacturer or packer.
3) In case of multi piece packages the particulars regarding list of ingredients, nutritional information, Date of manufacture/ packing, best before, expiry date labeling of irradiated food and, vegetarian logo/non vegetarian logo, may not be specified.

4.7 Date of manufacture or packing

The date, month and year in which the commodity is manufactured, packed or pre-packed, shall be given on the label:

Provided that the month and the year of manufacture, packing or pre-packing shall be given if the “Best before Date” of the products is more than three months:

Provided further that in case any package contains commodity which has a short shelf life of less than three months, the date, month and year in which the commodity is manufactured or prepared or pre-packed shall be mentioned on the label.

Best Before and Use by Date

i. the month and year in capital letters up to which the product is best for consumption, in the following manner, namely:

"BEST BEFORE..... MONTHS AND YEAR

OR

"BEST BEFORE..... MONTHS FROM PACKAGING

OR

"BEST BEFORE .....MONTHS FROM MANUFACTURE

(Note: — blank be filled up)

ii In case of package or bottle containing pickle, chutney, sauce or any uncanned package of fruits, vegetable, meat, fish or any other like commodity, the declaration be made as follows,

"BEST BEFORE..... DATE/MONTH/YEAR"

OR

"BEST BEFORE..... DAYS FROM PACKAGING"

OR

"BEST BEFORE..... DAYS FROM MANUFACTURE"

Note:

(a) blanks be filled up

(b) Month and year may be used in numerals (c) Year may be given in two digits

iii On packages of Aspartame, instead of Best Before date, Use by date/recommended last consumption date/expiry date shall be given, which shall not be more than three years from the date of packing.

4.8 Documentation and Record Keeping

Every organization has to maintain records of raw material procurement, production processes, and sales. This is to ensure that the business runs effectively and is profitable. Listed below are some reasons why there is a need for documentation:

1. It gives detailed knowledge about running the business.
2. It helps to control product quality.
3. It helps to keep track of the money invested in the business.
4. It helps to identify the separate costs of raw material or product ingredients.
5. It helps to identify the production cost of a particular process.
6. It helps to make sure that all the quality assurance practices were followed during the production.
7. It helps to make sure that the production equipment is running smoothly/effectively.
8. It works as an evidence for legal procedures.
9. It helps to set an appropriate product price.
10. It helps to take corrective measures at the right time.

How to Keep Records

Every food processing organization follows a more or less similar way of keeping records. Production records keep a log of the following:

- The quantity and type of raw materials received
- The quantity and type of ingredients used during processing
- The processing conditions in which production took place (e.g. the temperature set or the air pressure applied)
- The product quality produced

Product quality can be maintained only when:

- The same quantity and quality of ingredients and raw materials are mixed in every batch
- A standard formulation is used for every batch
- Standard process parameters are applied for every batch

Every batch of food is given a batch number. This number is recorded in:

- Stock control books (where raw material procurement is noted)
- Processing logbooks (where production process is noted)
- Product sales records (where sales and distribution is noted)

The batch number must correlate with the product code number, which is printed on labels. This helps the processor to trace any fault found in a batch back to the raw material used or the production process.

4.9 Cleaning and CIP

Cleaning

Cleaning is the mother of all nozzle applications. The point of cleaning is to eliminate bothersome particles from the actual item without adversely influencing the item.

CIP (Clean-in-Place) is a bunch of techniques used to appropriately clean preparing hardware without eliminating channeling or gear. The components grouping and term of cycles fluctuates from framework to framework however some common steps are associated with majority of the cycles.

- Sanitary process lines
- Vessels
- Equipment commonly used in process plants

CIP Systems pump cleaning, rinsing, and sanitizing solutions through the same piping path as the product to eliminate product soil from all internal surfaces.

4.10 Advantages of a CIP system

4.10.1 **Minimizes Mistakes:** Automating cleaning reduces the chance of human error that can contribute to an unsafe product.

4.10.2 **Keeps Employees Safe:** Reduces chemical exposure by containing cleaning solutions within the system.

4.10.3 **More Production Time:** As less production time is lost to cleaning, more time is spent making product.

4.10.4 **Product Quality:** Reliable and repeatable cleaning means sustainable product

quality and consistency. Less contamination means fewer product recalls and higher brand confidence.

4.10.5 **Utility Savings:** Water and energy usage is reduced through repeatable cycle control.

4.11 Steps involved in a CIP cycle

4.11.1 **Pre-rinse** - Eliminates the excess buildup in the product offerings. Breaks down sugar and somewhat dissolves fat.

4.11.2 **Caustic wash** - It helps in mellowing fats. Alkali which is utilized in caustic wash has a high pH centralization of 0.5-2%. Commonly the caustic wash can go back to its tank and can be reused on numerous occasions further.

4.11.3 **Intermediate rinse** –Following the caustic wash, this process removes out the evidence of remaining detergents.

4.11.4 **Final rinse** - This cycle helps in flushing out the excess purifying agent. Numerous times the last flush water can be recuperated and re-utilized as pre-wash solution for the following cleaning cycle.

4.11.5 **Sanitizing rinse** - This progression helps in killing microorganisms before the following production use.

Since each cycle has its novel boundaries, some facilities choose to do some or all of these optional steps.

- ⌀ **Push out:** Prior to pre-flush, pushes out residual product in lines with a projectile- type product recovery system. Improves cleaning and saves item from going down the channel.
- ⌀ **Acid wash:** It can happen after middle of the flush. . Breaks down mineral scale from hard water stores and protein buildups. It helps in neutralizing framework pH.
- ⌀ **Air blow:** It eliminates remaining moisture in the line after definite wash utilizing air blow check valves. CIP'able valves are suggested.

CHAPTER 5
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.