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FICSI
Food Industry Capacity and Skill Initiative

Participant Handbook

Sector
Food Processing

Sub-Sector
Packaged Foods

Occupation
Processing-Packaged Foods

Reference ID: **FIC/Q8504, Version 1.0 NSQF level: 3**

Traditional Sweets and Savoury Maker

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> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

FOOD INDUSTRY CAPACITY & SKILL INITIATIVE

for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **'Traditional Sweets and Savoury Maker'**
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We also wish to extend our gratitude to all authors who reviewed the content and provided valuable inputs for improving the quality, coherence, and content presentation in chapters.

The preparation of this participant Handbook would not have been possible without the support of the Food Processing Industries. The Industry feedback has been extremely encouraging from inception to conclusion & it is with their inputs that we have tried to bridge the skill gaps existing today in the Industry.

This participant handbook is dedicated to all the aspiring youth who desire to achieve special skills which would be a lifelong asset for their future endeavors and help them make a bright career in the Food Processing Sector.

About this book

This book is designed to provide skill training and/ or upgrade the knowledge and basic skills to take up the job of 'Fish and Sea Food Processing Technician' and 'Traditional Sweets and Savoury Maker' in 'Food Processing' sector. All the activities carried out by a specialist are covered in this course. Upon successful completion of this course, the candidate will be eligible to work as a Fish and Sea Food Processing Technician.

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational Standards (NOS) is covered across Unit/s.

Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS.

- FIC/N9026 Introduction to the job role and overview of the Food Processing Industry
- FIC/N8516 Carry out production of sweet and savoury products
- FIC/N9901 Ensuring Food Safety and Personal Hygiene
- DGT/VSQ/N0101: Employability Skills (FIC/Q4002)

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The book on New Employability Skills is available at the following location:
https://www.skillindiadigital.gov.in/content/list
Scan the QR code below to access the eBook

1. Introduction to the job role and overview of the Food Processing Industry

Unit 1.1 - Introduction to the Food Processing Industry

Unit 1.2 - Roles and Responsibilities of Traditional Sweet and Savoury Maker

FIC/N9026

Key Learning Outcomes

At the end of this module, you will be able to:

1. Describe the food processing sector in brief
2. Discuss the career opportunities available within the food processing sector

Unit 1.1 – Introduction to Food Processing Industry

Unit Objectives

At the end of this unit, you will be able to:

1. Discuss the size and scope of the food processing industry in brief
2. Discuss the future trends and growth opportunities available for Traditional Sweet and Savoury Maker

1.1.1 Food Processing

Agriculture is India's mainstay industry. Most of the products from various agricultural occupations are consumed within the country and exported to different countries worldwide. Agriculture produce is also used as a raw material in the food processing industry. Food processing is the process of transforming raw materials into finished goods. They could be processed foods, ready-to-eat foods, food additives, or ingredients used to make other foods. The following figure explains the different levels of food processing.

Primary Food Processing

- Primary Processing relates to the conversion of raw agricultural produce, milk, meat, and fish into a commodity that is fit for human consumption
- It involves steps such as cleaning, grading, sorting, packing, etc.

Secondary Processing

- Secondary food processing is the conversion of ingredients into edible products -
- This involves combining foods in a particular way to change properties. E.g. - Preparing of orange juices from oranges

Tertiary Food Processing

- Tertiary food processing is the commercial production of what is commonly called processed food
- These are ready-to-eat (RTE) or heat-and-serve foods.

Fig. 1.1: Level of Food Processing

1.1.2 Journey of food from Harvest to Consumer

The flowchart below explains the process by which food material becomes a final, consumable product for various customers.

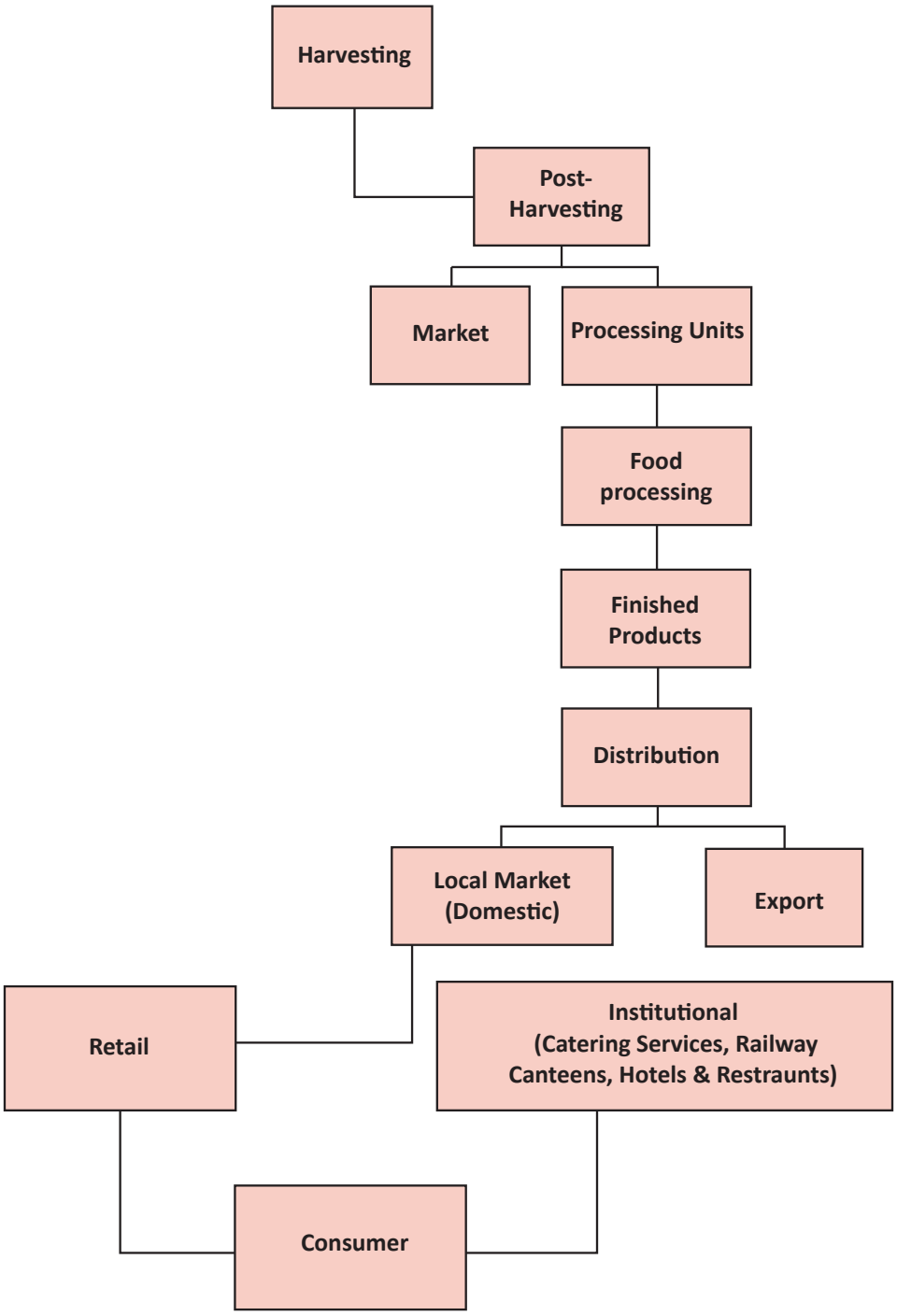

Fig. 1.2: Journey of Foods from Farm to Consumer

1.1.3 India's Food Processing Industry

- The major segments in the Food Processing sector comprise of Fruits and Vegetables, Dairy, Edible Oils, Meat and Poultry, Non-alcoholic beverages, Grain-based products, Marine products, Sugar and sugar-based products, Alcoholic beverages, Pulses, Aerated beverages, Malted beverages, Spices, and Salt.
- In India, the food processing industry is divided into several sub-sectors.

Dairy	• Whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese etc.
Fruit and Vegetable Processing	• Beverages, juices, concentrates, pulps, slices, frozen and dehydrated products, potato wafers, pickles and pastes etc.
Grains and Cereals	• Beverages, juices, concentrates, pulps, slices, frozen and dehydrated products, potato wafers, pickles and pastes etc.
Fisheries	• Flour, bakeries, starch glucose, cornflakes, malted foods, vermicelli, beer and malt extracts, grain-based alcohol etc.
Meat and Poultry Processing	• Fish oil, frozen and canned products
Bread and Bakery	• Biscuits, breads, buns, cakes, confectionery, pastries, cookies, etc.
Consumer Foods	• Snack foods,namkeen, biscuits, ready-to-eat foods, alcoholic and non-alcoholic beverages

Fig. 1.3: Sub-Sectors of the Food Processing Industry

1.1.4 Overview of the Indian savoury snacks and sweets market

Indian Savoury Snacks market is valued at INR 728 Billion in 2021 and is expected to reach INR 1,185 Billion by 2025 at CAGR 13%.

Indian savoury snacks market can be broadly segmented into western snacks and traditional snacks. The traditional snacks market, valued at INR 348 Billion, contributes around 48% to the total savoury snacks market. Traditional snacks market comprises namkeens, bhujia and ethnic snacks such as dry samosa, kachori, chakli, etc.

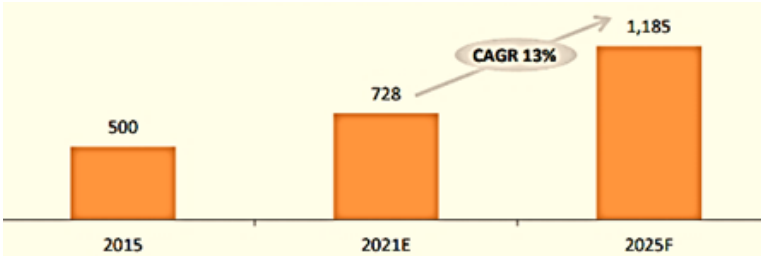

Fig. 1.4

Source: Frost & Sullivan Analysis

Snacking in between meals has always been traditional in Indian culture. Further, the Covid- 19 forced lockdown has increased this habit of snacking multifold and is driving the growth of this industry. This trend seems to continue in the Indian market. The Indian savoury snacks market is estimated to reach INR 1185 Billion by 2025 with the organized players capturing major market share due to increased hygiene and safety concerns.

Sweets Market in India

Indian Sweets Market in, INR Billion

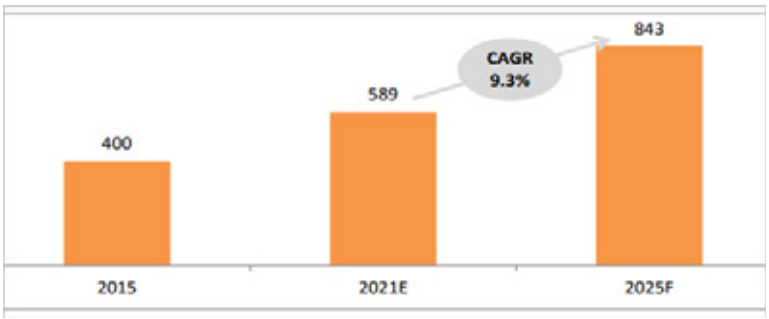

Fig. 1.5

Source: Frost & Sullivan Analysis

Sweets have been a very traditional and popular cultural aspect in Indian households. Not only traditional sweets are indispensable and a staple part of religious and festive occasions and family functions within the country, but they also appeal to Indians and NRIS on foreign shores which is sort of an emotional-cultural bonding with the motherland.

The Indian sweet market is valued at INR 589 Billion with a major share coming from unorganized players. The market is predicted to reach INR 843 Billion by 2025 owing to the sweet tooth of Indians.

Based on fruits, dairy, pulses and cereals or different combinations of different ingredients, the traditional Indian sweets, boast a nearly inconceivable range. Adding to this diversity, the majority of the sweets have been nurtured and relished for ages in different regions of the country signifying regional specialities and tastes.

India Sweets Market – Market Share by Type, INR, 2021

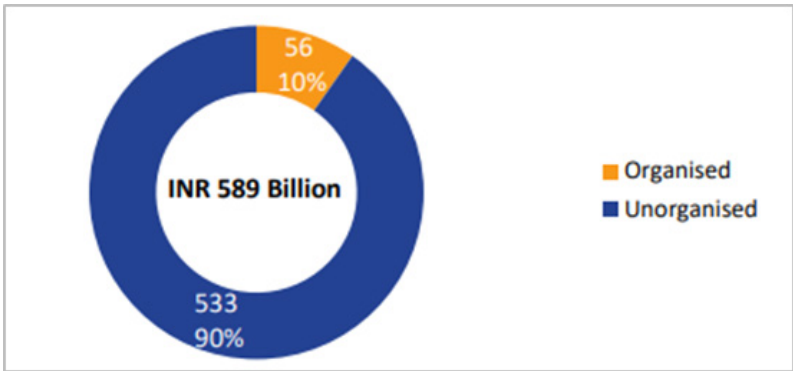

Fig. 1.6

Source: Frost & Sullivan Analysis

Indian sweets market is largely unorganized with INR 533 Billion market value and a share of almost 90%. Standalone sweet shops are spread across the geography of India and sell regional as well as traditional sweets such as Gulab-Jamun, Rasgulla and a plethora of Barfis. Organized players in the sweet market have product offerings such as tinned Gulab Jamun, Rasgulla, Bengali mithai etc. Gradually there has been an increase in demand for packed sweets owing to the pressing issues of hygiene and safety because of the Covid-19 pandemic.

The popularity of traditional sweets coupled with increasing consumer awareness of cleanliness and hygiene has assured that packaged sweets have acquired a good amount of traction. Moreover the open sweets or unorganized market constantly faces the threat of rising prices of milk and other raw products leading the seller to resort to adulteration. Shelf life increase is only possible with packaged sweets.

Also, neat packaging with all the ingredients mentioned on the label for packaged sweets has gained the trust of consumers. Authorities such as FSSAI are also tightening the norms related to food labelling and general safety.

Organized Indian Sweet- Market Size by Type, 2021

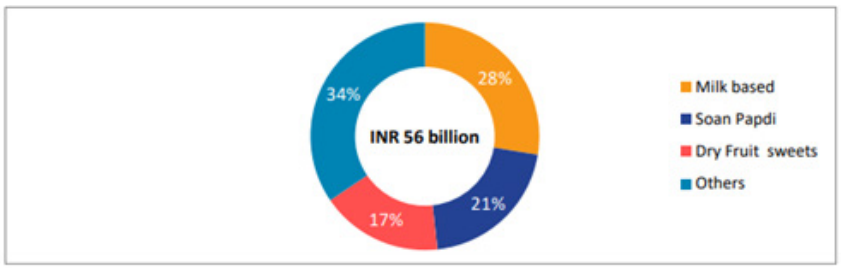

Fig. 1.7

Source: Frost & Sullivan Analysis

Source: Frost & Sullivan Analysis

The INR 56 Billion organized sweet market is segmented into milk-based sweets, Soan Papdi, dry fruit sweets and other sweets such as ladoos, etc. Haldiram, Bikaji, and Bikano are the major players in the organized sweet industry which offer a wide range of packed sweets

Organized Indian Sweet- Market Growth by Type, INR Billion

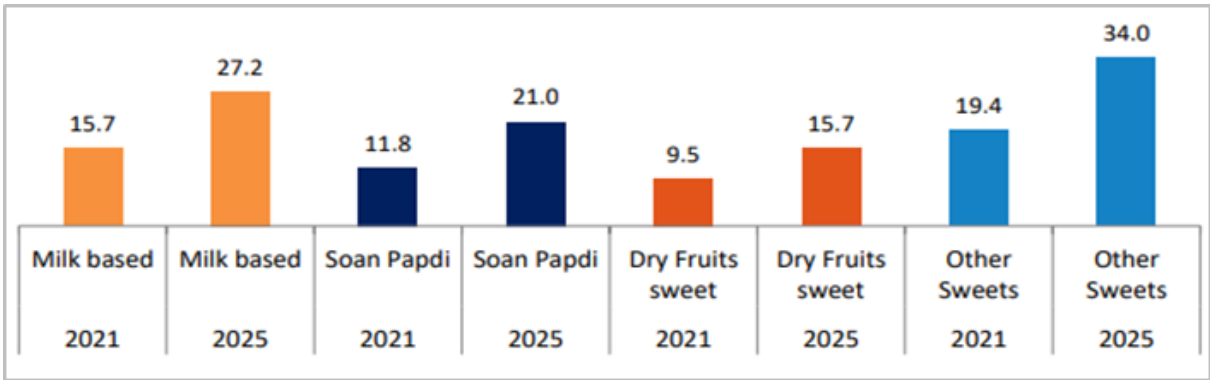

Fig. 1.8

Source: Frost & Sullivan Analysis

Milk-based sweets are growing at a CAGR of 14.7% and are expected to reach INR 27.2 Billion by 2025. Similarly, Soan Papdi and Dry fruits sweet segments are growing at CAGR of 15.6% and 13.2% respectively.

1.1.5 Split of the industry by Region

Demand for savoury snacks is high in North India followed by West India. These regions are the major consumers of namkeen, especially in Rajasthan and Gujarat where namkeen forms an integral part of food habits. Hence, the majority of the namkeen varieties originate from these regions. Consumption of savoury snacks is considerable in East India along with street food in between meals, travels, etc. The trend shows that consumption of ethnic savouries is about to increase gradually as companies such as Bikaji, and Halidram looks to penetrate the market with their wide product offerings.

India Savoury Snacks, Sweets and Papad Market – Split by Region, 2021

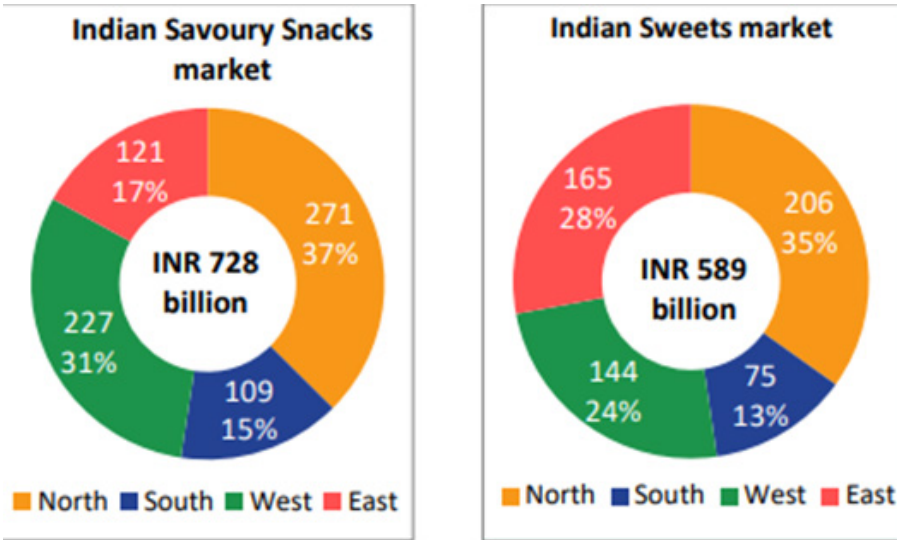

Fig. 1.9

Source: Frost & Sullivan Analysis

The sweets market is driven by North India with a 35% share owing to UP, Delhi NCR, Punjab and Haryana. It is followed by East India with Bengali mithais dominating the market. South India and West India contribute around 13% and 24% to the sweets industry.

1.1.6 Key growth drivers for the Industry

- Innovation flavours and new segments
- Traditional snacking culture
- Increasing per-capital income and disposable income
- Demand for nutritious, ready to eat or ready-to-go food because of the fast-paced lifestyle
- Increasing consumption because of munching habits, working from home etc.
- MNCs and domestic companies trying to scale up operations and increase their presence
- Growing FDI and collaboration
- Increasing exports

1.1.7 Key restraints for the Indian Savoury Snacks and Sweets Industry

- Increasing prices of raw materials
- Availability constraints for some raw materials due to some seasonal crop
- Lack of infrastructure (cost of power, lack of cold chains, storage etc)
- High cost of packing
- Long and fragmented supply chains
- High-cost and low-quality distribution
- Inadaptability of technologies for production, distribution etc
- Adulteration by unorganized players
- Low shelf life of products

Exercise

Answer the following questions:

1. Explain different levels of food processing.
2. Write a short note on market and future trends of the Traditional Sweet and Savoury Making industry.
3. Give any two examples of sweet and savoury products.

Unit 1.2 – Roles and Responsibilities of Traditional Sweet and Savoury Maker

Unit Objectives

At the end of this unit, you will be able to:

1. Summarize the key roles and responsibilities of 'Traditional Sweet and Savoury Maker.'
2. List the various terminologies used in the process of sweet and savoury products.

1.2.1 Role and Responsibilities of Traditional Sweet and Savoury Maker

The following are the role and responsibilities of the Store Assistant:

- Cook Indian Sweets & Desserts like Gulab Jamun, Ras Malai, Moong Daal Halwa, Gajar Halwa, Badam Kheer, Jalebi, Kaju Burfi, Khoya Burfi, Laddu, etc
- Cook Indian Snacks like Vegetable Samosa, Pakoras, Paani Poori, Chaat Items, Dahi Bhalla, Poori, Bhatura, Pav Bhaji, Papdi etc
- Ensure the food quality and the presentation of the prepared dishes Ensure the prompt and speedy delivery of orders
- Check the quality of raw and cooked food products to ensure that the standards are met
- Take stocks and liaise with the purchase & catering managers to ensure adequate food items are available to produce the appropriate menu items.
- Receive goods and supplies after checking the quality and quantity.
- Store raw materials and ingredients and ensure that all the food storage and preparation of all food items meet the temperature guidelines.
- Ensure personal hygiene and safety requirements.
- Ensure the cleanliness of the kitchen, cooking utensils and equipment.
- Monitor the performance of kitchen helpers and trainees.
- Ensure that all products used for dishes are of a high standard.
- Ensure that all health and safety legislation and guidelines are implemented, adhered to and reviewed regularly.
- Maintain cleanliness of all areas after service.
- Responsible for preparing kitchen cleaning rosters.
- Wear the proper safety equipment
- Communicate and collaborate with other team members

Key Competencies

- Ability to handle all the sweet and savoury-making equipment, moulds, oven, etc.
- Knowledge of the safety and hygiene standards to be followed in the cooking area
- In-depth knowledge of traditional sweet and savoury-making procedures followed in India
- Ability to develop new sweet and savoury making recipes
- Skilled in decorating sweets to make them more presentable
- Knowledge of the criticality of temperature to be maintained while cooking different types of sweets and savoury
- Manual dexterity

1.2.2 Terminologies used in Food Manufacturing Facility

The following table explains a few terms used in the food manufacturing facility.

Terminology	Meaning
Blanch	A process to loosen skins on fruits and vegetables and kill enzymes before preserving. Submerge food in boiling water for the amount of time indicated, then remove and plunge it into ice water to stop cooking.
Boiling Water Bath Canner	The specialized pot is used for water bath canning. Comes with a rack to hold jars off the bottom of the canner.
Botulism	Type of food poisoning that may be fatal. Pressure canners are the only canning method that will reach the high heat needed to prevent it.
Yeast	Microscopic fungi that cause fermentation
Aseptic packaging	a technique for creating a shelf-stable container by placing a commercially sterile product into a commercially sterile container in a commercially sterile environment. The sealed container is designed to maintain product sterility until the seal is broken.
Can	a receptacle generally having less than 1-gallon capacity (consumer or institutional sizes); also means to pack a product in a can or a wide-mouth glass container for processing, shipping or storage.
Fiberboard can	a rigid container constructed almost completely of lightweight fibre stock; may be lined, treated or coated; ends of the can may be made of paperboard or metal (composite can). (examples: packaging used for juice concentrates, potato sticks and onion rings)
Flexible container	bags, envelopes, pouches or wraps which can be changed in shape or bent manually; made of materials such as paper, plastic film, foils, etc., or combinations of them.
Cold packed	(Sometimes called raw pack) means the food is raw when it's packed in jars. The hot liquid is added to the raw food. "Raw packed" is a better term. You never want to put cold jars in your hot canner. The jars may break
Head Space	The space between the top of the food product and the lid

Table 1.1

The following table explains a few terms used in the food manufacturing facility.

Terminology	Meaning
Cross-contamination	The transfer of harmful substances or disease-causing microorganisms to food by hands, food-contact surfaces, sponges, cloth towels, and utensils that touch raw food, are not cleaned, and then touch ready-to-eat foods. Cross-contamination can also occur when raw food touches or drips onto cooked or ready-to-eat foods.
Adulterated Food	Generally, impure, unsafe, or unwholesome; products found to be adulterated cannot enter into commerce for human food use.
Deterioration	The process of food decaying or losing freshness
Daily Value (DV)	A Daily Value is the daily nutrient requirement for the average consumer. Daily Values are based on a 2,000-calorie diet and indicate the amount of each nutrient in a single serving of the food relative to what the FDA has determined to be the recommended Daily Value.
Sugars, Added	Added sugars include sugars that are added during the processing of foods (such as sucrose or dextrose), foods packaged as sweeteners (such as table sugar), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices.
No Added Sugar	No sugars were added during processing.
Sugar-Free	Contains fewer than 0.5 grams per serving.
More Fiber or Added Fiber	Contains at least 2.5 grams more fibre per serving than the reference food.

Table 1.2

1.2.3. Sweet and Savoury Production Planning

Production planning has the purpose of ensuring all necessary preparation is completed before a production cycle begins, so it can run smoothly. This involves allocating resources effectively so that everything is in place for each stage of production to start.

With a food production plan, the culinary team knows the quantities needed for each day's operation. Production planning also ensures that staffing is adequate, that food is in-house, early preparation steps are done, foods are thawed properly, and that many other functions are completed.

Production Planning success is linked to several key functions of a food service operation:

- Menu development
- Date of event
- Number of guests
- Standard of service
- Recipe development
- Ingredient sourcing
- Food orders
- Staffing requirements
- Preparation timeline
- Plating diagrams
- Service line set-up diagram
- Posted job/task schedules

Exercise

Answer the following questions:

1. List the roles and responsibilities of Traditional Sweet and Savoury Product Makers.
2. Define FIFO.

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=5VlYw38hCxU

Scope of food processing in India with National and International perspective

https://www.youtube.com/watch?v=J-2EiMVNtpM

Overview of Food Processing Industry

2. Prepare for Production

Unit 2.1 – Plan for Production

Unit 2.2 – Maintain Cleanliness at Workplace

FIC/N9026

Key Learning Outcomes

At the end of this module, the participants will be able to:

1. Plan and organize for production of the traditional sweet and savoury maker
2. Demonstrate the tasks to be performed at the workplace for planning the production
3. Maintain cleanliness at the food processing area as per SOP
4. Discuss the standards to be followed for handling hazards and ensuring a clean work area.

Unit 2.1 – Plan for Production

Unit Objectives

At the end of this unit, you will be able to:

1. Identify different raw materials used in different traditional sweets and savoury
2. Plan and prioritize production activities of traditional sweets and savoury making
3. Define resource management for sweet and savoury making
4. Define ways to plan capacity utilization of machinery

2.1.1 Introduction to Indian Sweets

Mithai is the most accepted word used for sweets in India. They are eaten at all festivities and are an important part of every major meal. They are a way of conveying greetings in all forms of celebrations. A chef expert in preparing Indian sweets is termed Halwai. The shops' sweets are found in every city and the chef uses locally sourced ingredients in preparing delectable sweets. A variety of ingredients are used in the preparation of sweets:

The main ingredients used in Indian Sweets:

- Milk: Usually from cows or buffalos. At times pre-packaged condensed milk may also be used.
- Khoya / Mawa: It is prepared by boiling and reducing milk to a semi-solid stage. Depending on the fat content in the milk and the method of preparation one can have a variety of khoya such as Batti ka khoya, Daab ka khoya, or Danedar khoya.
- Chenna: Fresh cottage cheese made by curdling cow milk.
- Other ingredients: Gram flour, Coconut, Pulse such as moong dal, refined flour, pumpkin, carrot, fruits such as apricot, etc.

Other ingredients used in Indian Sweets:

- Sweetening agents – Sugar (Refined sugar, Boora), Jaggery (from sugarcane or palm)
- Flavouring agents – Nuts such as almonds, pistachio, cashew, cardamom, nutmeg, cloves, rose water, etc.
- Garnish – Slivers of dry fruits, Silver or gold vary (thin leaves of silver or gold), rose petals, coating of ingredients such as sesame seeds, coconut powder, etc.
- Fats & Oils – Desi ghee, refined oils, and Vanaspati (partially hydrogenated vegetable oil) is used to provide texture and flavour and as a cooking medium for many sweets.

2.1.1.1 Sugar cookery

Sugar syrup is an important ingredient for preparing most sweets. Sugar for Indian sweets is used in various forms such as Boora or Jaggery. However, many times one needs to prepare sugar syrup (chashni) to the required consistency. The sugar syrup can be prepared by taking two cups of refined sugar and one cup of water in a thick bottom pot. Begin to cook the mixture while stirring to dissolve the sugar completely. As water evaporates, the concentration of sugar keeps increasing.

Stage	Temperature Range	Use in Indian Sweets
Half thread	100°C	Rasgulla
One thread	104°C - 106°C	Thin coat on sweets such as gujiya
Softball	112°C - 116°C	Variety of Burfi, Gajak
Two & half thread / Firm ball	118°C - 120°C	Soan papdi
Hardball	121°C - 130°C	Chikki

Table 2.1

Though the sugar can be cooked beyond this stage too such as caramel, usually these are the only stages used in the preparation of most Indian sweets. One can use a candy thermometer to measure the stages precisely. However, many Halwais use the above method to check the stage of sugar cookery while preparing sweets.

2.1.2 Introduction to Indian Snack and Savoury

A snack is a food that is generally eaten between meals and is smaller in portion size than major meals of the day. Snacks come in a variety of forms – freshly made at home, bought from street vendors or shops or as packaged food (Ready to eat such as chips, wafers, namkeens etc. or convenience foods such as frozen fries). These food items are usually portable, quick to eat and satisfying hence also termed comfort food. They can be sweet, salty, sour and spicy. In Indian culture, it is hospitable to offer some snacks to guests with tea/coffee or other regional beverages.

Globalization has led to many food items from other countries being prepared or sold in Indian markets as snacks. These include sandwiches, burgers, spring rolls etc. that are now quite popular in the Indian market. At the same time, we must appreciate the wide variety of traditional snacks in India.

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Traditional Indian snacks are prepared with a vast variety of ingredients. These include:

- Flour – Refined flour (Maida), wheat flour, rice flour, gram flour etc.
- Pulses – Green gram, Black gram etc.
- Vegetables – Potato, onion, brinjals, green chillies, green coriander, lemon etc.
- Flavouring agents - Coconut, Tamarind, Kokam etc.
- Spices & condiments – Salt (Table salt, Black salt etc.), chilli powder, turmeric powder, carom seeds, cumin seeds, mustard seeds, coriander powder, garam masala, chaat masala and a vast variety of spice blends.
- Nuts – Peanuts, Cashews etc.

The methods of cooking these snacks also vary from frying, steaming, roasting, sautéing, griddling etc. Many snacks have crossed regional boundaries and are relished all across the nation.

2.1.3 Production Planning

Food production planning is one of the most important functions of a food service operation. This function directly impacts operational costs.

Production planning means taking the resources of your foodservice operation and turning out products and services. There are many decisions to be made and this requires a manager who can handle planning, organizing, and controlling the various aspects of production. Balancing quantity, quality, and cost objectives usually involves several layers of management and must also include consideration of the customer's needs and wants.

Pre-production or production planning includes all food handling activities completed before production or heating, such as thawing, pre-processing, and preliminary assembly, sometimes called "pre-prep." Controlling the number of ingredients processed and using correct food handling techniques during this step can be critical.

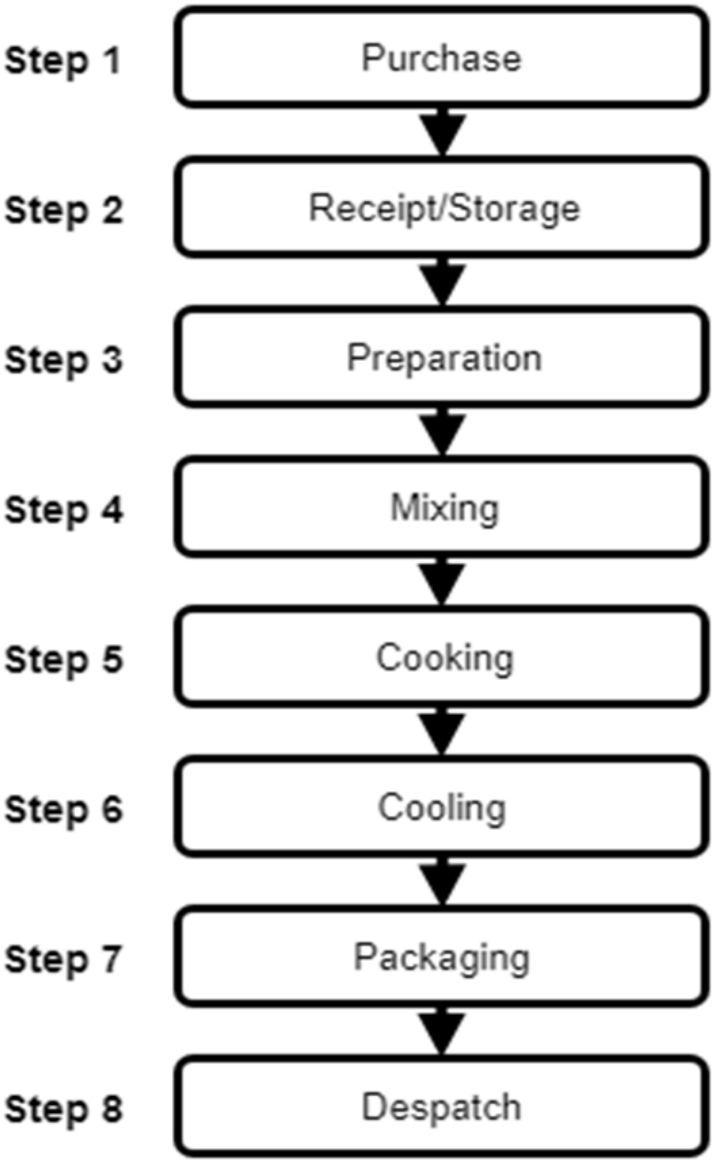


Fig. 2.1 Production Process Flow Diagram

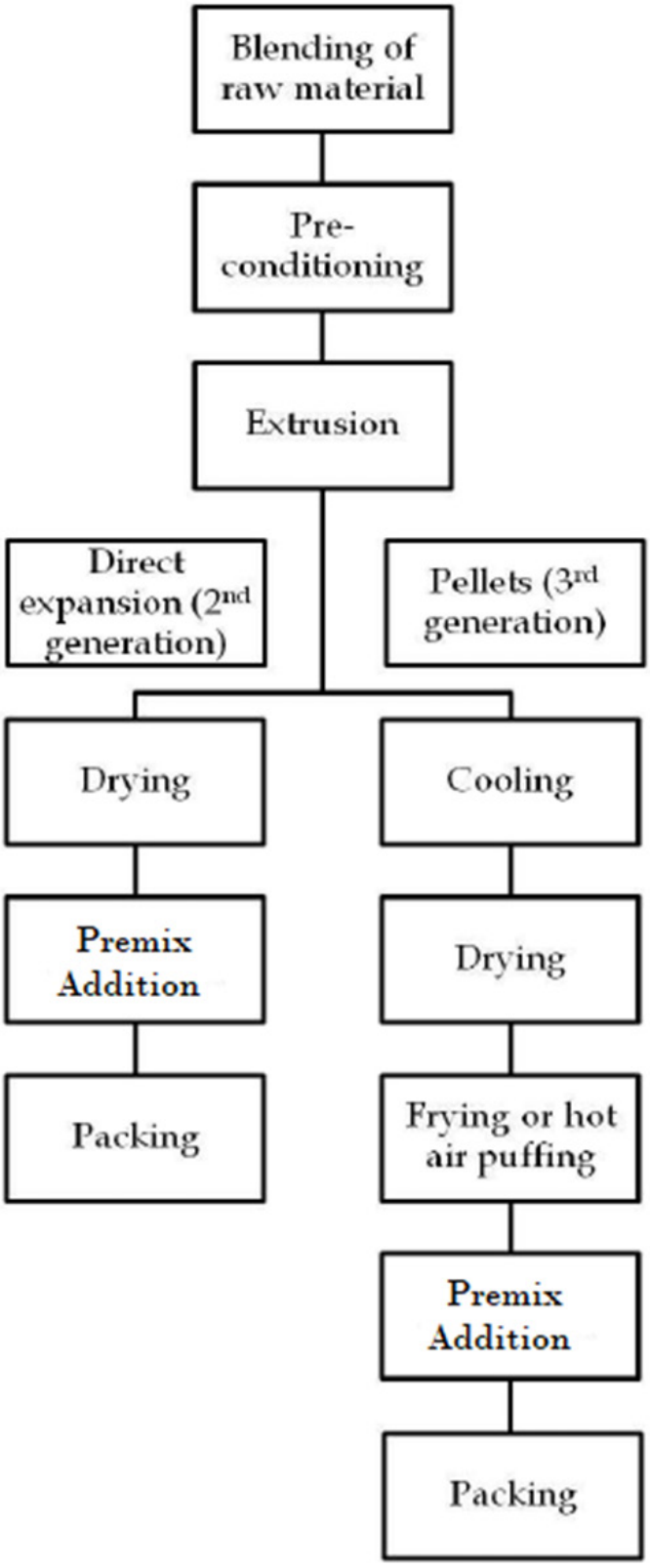


Fig. 2.2 Production Plan of Savoury Products

In addition to the finished product, raw materials and other input, packaging, load carriers/pallets used for transportation and storage of the finished product are also included in the production process.

The goal of the production plan is to use the various points of production to help guide future business decisions. Those decisions can include:

- when production cycles are scheduled,
- raw materials and packaging materials required as per the work schedule
- the size of the team required,
- what positions need to be filled along with several areas outside of production including purchasing, inventory and sales.

To set up an effective production schedule, one needs to have accurate data from the purchasing, inventory and sales teams. Once completed, a production schedule can be referenced by all departments, informing planned production yield so that future purchasing orders can be planned accordingly and sales know how much-finished product they can work with.

2.1.3 Production Planning

Food production planning is one of the most important functions of a food service operation. This function directly impacts operational costs.

Production planning means taking the resources of your foodservice operation and turning out products and services. There are many decisions to be made and this requires a manager who can handle planning, organizing, and controlling the various aspects of production. Balancing quantity, quality, and cost objectives usually involves several layers of management and must also include consideration of the customer's needs and wants.

Pre-production or production planning includes all food handling activities completed before production or heating, such as thawing, pre-processing, and preliminary assembly, sometimes called "pre-prep." Controlling the number of ingredients processed and using correct food handling techniques during this step can be critical.

2.1.4 Resource Management

Resource management is the process of pre-planning, scheduling, and allocating your resources to maximize efficiency. Nobody likes waste, especially in business. Resource management is centred around optimization and efficiency. When you know what you need to make a project successful, you can effectively understand how to plan resources efficiently.

Advantages of resource management

- **Avoids unforeseen hiccups:** By understanding your resources upfront and planning how to use them, you can troubleshoot gaps or problems before they happen.
- **Prevents burnout:** Effective resource management allows you to avoid "over-allocation" or "dependency" on resources by gaining insight into your team's workload.
- **Provides a safety net:** Let's say the project was not successful due to a lack of resources (it happens). Resource planning and management establish that you did everything you could with what you had.
- **Builds transparency:** Other teams can gain visibility into your team's bandwidth, and plan accordingly if your team is at maximum capacity or available to take on new projects.
- **Measures efficiency:** With a high-level understanding of what's needed to manage and execute an upcoming project, you can effectively plan and measure ROI and utilization vs efficiency.

2.1.4.1 Resource Management Techniques

Now that you understand what resource management is, let's discuss how one can start implementing it across projects.

1. Resource Allocation

Resource allocation helps you get the most from the available resources. Based on team members' skills and capacity, resource allocation is the process of tackling projects using the resources you have at your disposal in the most efficient manner possible.

2. Resource Leveling

This technique aims to discover underused or inefficiently used resources within the organization and work them to your advantage.

3. Resource Forecasting

Having a resource management plan is critical to optimizing people, materials, and budget efficiency. Resource forecasting allows one to predict future resource requirements before a project begins. During the planning stages of a project, one could consider resource management software that forecasts the project's scope, possible constraints, unforeseen costs, and potential risks.

2.1.5. Capacity Utilization Planning of Machines

Capacity planning considers the number of machines, the size of the employee base needed to operate those machines, available hours or shifts, the mix of products to be made, equipment utilization and overall efficiency. These factors are calculated to allow an operation to know whether they have the capacity required to meet the demanded forecast. If the capacity plan is right, managers can proactively add or subtract resources to meet commitments.

Capacity utilization is one of the most crucial parts of production planning. Several parameters such as speed, feed, material, process, loading & unloading time, tool setup, preventive maintenance etc. influence the utilization. Each machine could have different parameters influencing its non or low utilization.

Benefits of Capacity Planning

- Monitor and Reduce Costs
- Plan for Growth
- Improved Human Capital Management
- Continuous Improvement

2.1.5.1. Capacity Utilization Planning

To plan for capacity without the use of an MRP system, companies must restrict themselves to rough-cut capacity. Generally, rough-cut capacity uses manual methods to analyze production, equipment and staffing factors to identify potential bottlenecks.

For rough-cut planning that can be done without an MRP, there are several options:

- Capacity Using Overall Factors – This is a manual planning technique using a master schedule and production standards. Together, these two elements convert finished good units to historical loads on work centres.
- Capacity Bills – Bills of capacity use Bills of Material (BOM and routing sheets to determine where it is made and the setup and run time of the work centre.
- Resource Profiles – Resource profiles are like capacity bills but with lead time added
- Capacity Requirements Planning – Capacity requirements planning can only be used in systems using automated software such as MRP or ERP systems. It automates information using one of the three above techniques and integrates data such as inventory, lot size and other real-time production values available through the automated system.

2.1.6 Standard Practices for Handling Hazards and Cleaning Work Area

Every employee is concerned about their health and safety. As a result, following safety guidelines is required to avoid hazards and accidents. Similarly, sanitization and hygiene are the most important factors to consider when working in the food processing industry. The figure below depicts the standard practices for dealing with hazards, risks, and cleaning work areas:

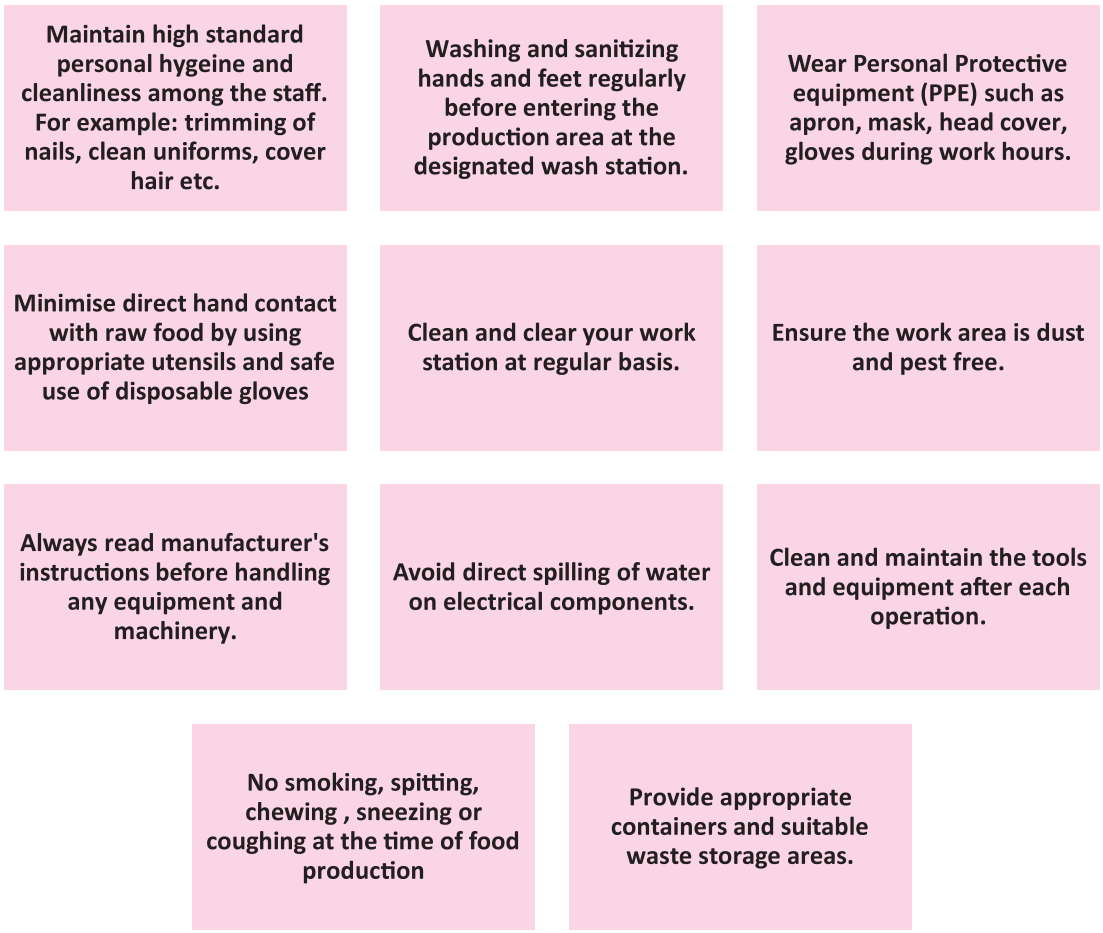


Fig. 2.3 Standard Practices for Handling Hazards and Cleanliness

Unit 2.2 – Maintain Cleanliness at Workplace

Unit Objectives

At the end of this unit, you will be able to:

1. Maintain and clean the work area as per organizational procedures
2. Maintain and clean the machines and tools and sanitize them as per the organization's specifications and standards
3. Identify ways to dispose of the waste material at the designated place safely

2.2.1 Cleaning and Sanitization Procedures

Maintaining a clean work environment is critical in preventing foodborne illness. Bacteria can grow on unsanitary surfaces and then contaminate food. Just because a work surface looks clean does not mean that it is sanitary. Always ensure that you clean and sanitize a work area before starting to prepare food.

Fig. 2.4

The Purpose

The ultimate goal of cleaning and sanitizing equipment are as follows :

- Physically remove dirt and particles from the equipment (you want your equipment to look spotless to the naked eye)
- Remove residues from the equipment you may not be able to see, but can smell
- Destroy bacteria and microorganisms, including COVID-19

A sanitation plan is important in any food service preparation area. It ensures that all surfaces are cleaned regularly and reduces the risks of transferring bacteria or other pathogens from an unclean surface to clean equipment such as cutting boards or tools. A sanitation plan has two components:

- A list of cleaning and sanitizing agents or supplies with instructions on their safe use and storage
- A cleaning schedule, outlining how each item needs to be cleaned, who is responsible, and how frequently it happens

2.2.1.1 Types of Cleaning

- **Manual Cleaning:** As the name suggests, this is the most time-intensive type of cleaning where your employees will use rags, brushes, mops and other tools to clean machinery that isn't waterproof or needs to be dismantled.
- **Foam Cleaning:** This is the most common way to apply a detergent on most food processing equipment, and can be used on large areas like floors, walls, and production equipment.


Fig. 2.5

- **Fogging:** Aerial fogging is used alongside other cleaning methods to release a mist of disinfectant into the air to kill airborne particles and reduce bacteria on equipment.

2.2.1.2 Steps to Cleaning and Sanitizing Equipment

Remove product residue from your food processing equipment: This means scraping off the residue or using water or compressed air if your equipment surface doesn't tolerate scraping.

- Pre-rinse with water to get rid of loose soil and deposits: This type of soil can include fats, oils, greases, proteins, algae, or fungi
- Clean with industrial-grade detergent to remove chemicals and residue not visible to the naked eye: Detergents can contain up to 15 components and the type of detergent you use depends on a lot of different factors, including soil type, equipment surface, temperature, and water hardness.
- Use a disinfectant to kill off any other dangerous microorganisms: Detergent works to remove soils and residue, but dangerous microorganisms that can lead to food contamination are oftentimes left behind. Disinfection picks up where the detergent is left off to remove these microorganisms.

When considering how best to clean your manufacturing equipment, keep in mind sanitisers that serve as both a detergent and disinfectant. With the added concern over COVID-19, it's important to work with your team, talk with suppliers, and check out product reviews to determine if a sanitiser or the two-step approach with a separate detergent and disinfectant is best for your food processing equipment.

2.2.2 Sanitary and Hygienic requirements for Food Manufacturer/ Processor/ Handler

The place where food is manufactured, processed or handled shall comply with the following requirements:

The food business premises should be clean, adequately lighted, and ventilated and have sufficient free space to maintain an overall hygienic environment.

- Floors, Ceilings and walls must be maintained in a sound condition.
- The floor and skirted walls shall be washed as per the requirement with an effective disinfectant the premises shall be kept free from all insects.

- Continuous supply of potable water shall be ensured on the premises.
- Any container or other equipment which is likely to cause metallic contamination injurious to health shall not be employed in the preparation, packing, or storage of food.
- All equipment shall be kept clean, washed, dried, and stacked at the close of business to ensure freedom from the growth of mould/ fungi and infestation.
- There should be an efficient drainage system and there shall be adequate provisions for the disposal of refuse.
- The workers working in processing and preparation shall use clean aprons, hand gloves and head wears.
- Persons suffering from infectious diseases shall not be permitted to work.
- All food handlers shall keep their fingernails trimmed, and clean, and wash their hands with soap and water before commencing work and every time after using the toilet.
- Eating, chewing, smoking, spitting and nose-blowing shall be prohibited within the premises, especially while handling food.
- All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
- The vehicles used to transport food must be maintained in good repair and kept clean.
- Foods while in transport in packaged form or containers shall maintain the required temperature.

2.2.3 Personal Hygiene

It is imperative for safe food-handling outcomes for all workers to be familiar with standard sanitation and hygiene practices. The figure below shows the cycles of transmission of micro-organisms. One of the basic principles is to break the cycle by avoiding cross-contamination, which can be achieved by ensuring personal hygiene practices are followed.

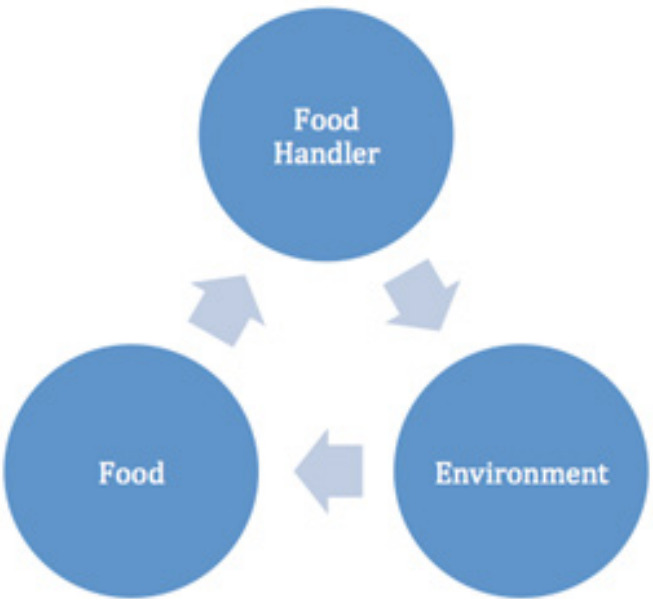


Fig. 2.6 The cycle of bacterial transmission

Proper personal hygiene is critical in any food service premise. Personal hygiene includes:

- Showering and bathing regularly
- Keeping hair clean hair and covered or tied back
- Keeping clean clothing and footwear that is used only at work
- Handwashing regularly
- Using clean utensils for tasting food
- Using separate cloths for cleaning and wiping plates

2.2.3.1 Handwashing

Proper and regular handwashing is a critical part of any food safety system. You must always wash your hands after:

- Sneezing, coughing, or touching your mouth or nose
- Using the bathroom
- Smoking or using toothpicks
- Handling raw foods
- Cleaning and wiping tables, food preparation surfaces, or equipment
- Handling soiled objects, garbage, or money

The steps for proper handwashing are as follows:

- Wet hands with warm water.
- Apply liquid soap and lather for at least 20 to 30 seconds.
- Scrub the backs of hands, wrists, all fingers, and under nails.
- Rinse under running water, pointing down toward the drain.
- Dry with a paper towel.
- Turn off the taps and open the bathroom door using the paper towel.

2.2.4 Equipment Maintenance

1. **Routine Equipment Maintenance**

   Most processing equipment is intended to be disassembled for cleaning. Refer to the manufacturer's instructions and training provided by your employer or instructor on how to do this safely. Some equipment is intended to be cleaned in place. This should be identified in the sanitation plan and cleaning schedule.

   All equipment must be routinely cleaned and inspected. Older equipment may have nooks and crannies where dirt and bacteria can hide, which can be difficult to clean effectively. Proper cleaning procedures must be established and followed at all times with regular review to ensure that procedures are working. If equipment is replaced or cleaning materials change, the process may have to be adjusted. If you notice any safety concerns with the equipment while cleaning it, such as a frayed cord, missing guard or loose parts, let the supervisor know immediately.

2. **Periodic Equipment Maintenance**

   It refers to checking and resolving any fault in the machinery at scheduled intervals. These could be every day, week, month, and/or year.

3. **Breakdown Equipment Maintenance**

   It refers to checking and resolving any fault in the machinery if they break down.

4. **KAIZEN**

   Kaizen is an approach to creating continuous improvement based on the idea that small, ongoing positive changes can reap significant improvements.

2.2.5 Waste Management

The food processing industry around the world is making serious efforts to minimize by-products, compost organic waste, recycle processing and packaging materials, and save energy and water. The three R's of waste management – Reduce, Reuse and Recycle – can help food manufacturers in reducing the amount of waste sent to landfills and reusing waste.

Food Recovery Hierarchy

Food Recovery Hierarchy is an excellent resource to follow for food processors and beverage producers as it guides them to start a program that will provide the most benefits for the environment, society and the food manufacturer.

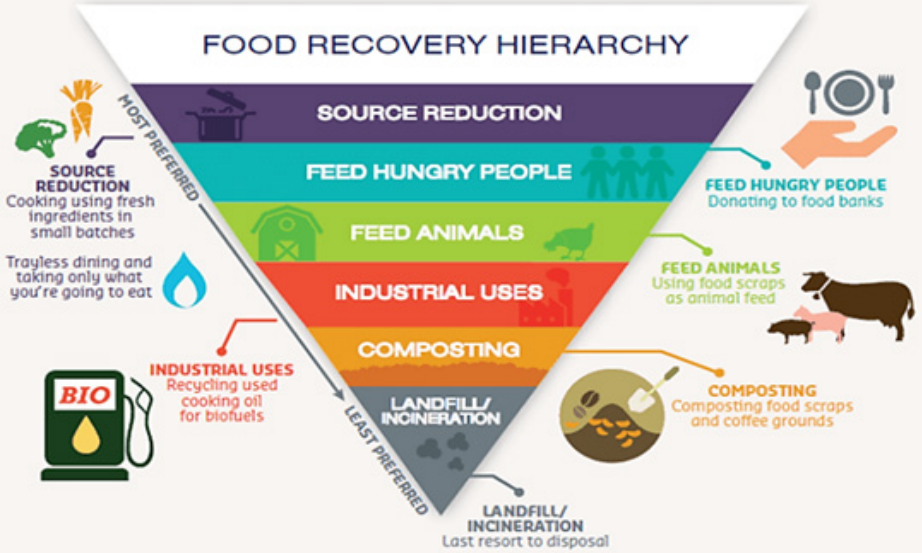


Fig. 2.7

Notably, landfill is the least favoured disposal option for waste generated by food and beverage producers worldwide. There are sustainable, effective and profitable waste management options including:

- making animal feed,
- composting to create nutrient-rich fertilizers,
- anaerobic digestion to produce energy-rich biogas,
- recycling/reusing waste for utilization by other industries,
- feeding surplus food to needy people

2.2.5.1 Waste Management Options

Food manufacturers have a unique problem – excess product usually has a relatively short shelf life while most of the waste is organic. Food waste created during the production process can be turned into animal feed and sold to goat farms, chicken farms etc. As far as WWTP sludge is concerned, top food manufacturers are recycling/reusing it through land application, anaerobic digestion and composting alternatives.

Organic waste at any food processing plant can be composted in a modern in-vessel composting and the resultant fertilizer can be used for in-house landscaping or sold as organic fertilizer at attractive prices.

Another plausible way of managing organic waste at the food manufacturing plant is to biologically degrade it in an anaerobic digester leading to the formation of energy-rich biogas and digestate. Biogas can be used as a heating fuel in the plant itself or converted into electricity by using a CHP unit while digestate can be used as a soil conditioner. Biogas can also be converted into biomethane or bio-CNG for its use as vehicle fuel.

Items such as cardboard, clean plastic, metal and paper are all commodities that can be sold to recyclers. Lots of cardboard boxes are used by food manufacturers for supplies which can be broken down into flat pieces and sold to recyclers.

Cardboard boxes can also be reused to temporarily store chip packages before putting them into retail distribution boxes. Packaging can be separated in-house and recovered using "jet shredder" waste technologies which separate film, cartons and foodstuffs, all of which can then be recycled separately.

2.2.5.2 Categories of Waste

1. Wet Waste

Wet Waste is biodegradable waste and includes Cooked and uncooked food, fruits, vegetable peels, flower waste, and other organically decomposable waste. This waste is collected daily and can be handed over in a green bin. We have classified the following streams as wet waste:

- Vegetable/fruit peels
- Cooked food/Leftovers
- Eggshells
- Rotten fruits/vegetables
- Tissue paper soiled with food
- Tea bags/Coffee grinds

2. Dry Waste

Dry Waste is typically defined as any waste which will not rot or disintegrate over time and has little or no moisture content. Dry waste can also be described as inorganic or non-biodegradable waste given its lack of food products. Most dry waste is recyclable and below is a list of common dry waste items:

- Metal
- Glass
- Plastic
- Wood/Wooden Objects
- Paper & Cardboard
- Fabric/Textiles
- Aluminium Foil

3. Hazardous Waste

Hazardous Waste is waste with properties that make it dangerous or potentially harmful to human health or the environment.

- Chicken/fish bones
- Chemicals
- Flavours
- Untreated water

2.2.5.3 Waste Segregation

Garbage bins are categorised into different colours- green and blue, to differentiate the type of waste put into them. It is essential to separate them from other types of waste, to be safely processed.

Several different colours indicate different types of waste. These colours also define the level of caution that needs to be taken when handling such materials.

Wet Waste	Dry Waste
Fruit & Vegetable Peels and pieces	Plastics bags, bottles, packing item
Leftover food	Food packets, milk sachets
Used tea leaves/ Coffee Powder	Tickets, Newspapers
Match Sticks	Computer printouts
Used/ Soiled tissue papers	Disposable Crockery, Pamphlets
Shredded newspapers	Glass bottles and jars,
Flowers, Plant leaves, Compostable ma-terials	Tetra pack, Aluminium cans, etc.
Meat and Poultry waste	Thermocol

2.2.5.4 Techniques of Waste Disposal

Between the range and variety of items that are in the store and the growing amounts of trash dumped in landfills each year, effective waste disposal is a necessity. Being aware of all the possible methods will make the task of disposing of waste much easier.

1. 3 R's

The principle of reducing waste, reusing and recycling resources and products is often called the "3Rs."

- **Reducing** means choosing to use items with care to reduce the amount of waste generated.
- **Reusing** involves the repeated use of items or parts of items that still have usable aspects.
- **Recycling** means the use of waste itself as a resource.

Waste minimization can be achieved efficiently by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle." The waste hierarchy refers to the "3Rs" i.e., reduce, reuse and recycle, which classify waste management strategies according to their desirability. The 3Rs are meant to be a hierarchy, in order of importance. The waste hierarchy aims to extract the maximum practical benefits from products and generate the minimum amount of waste.

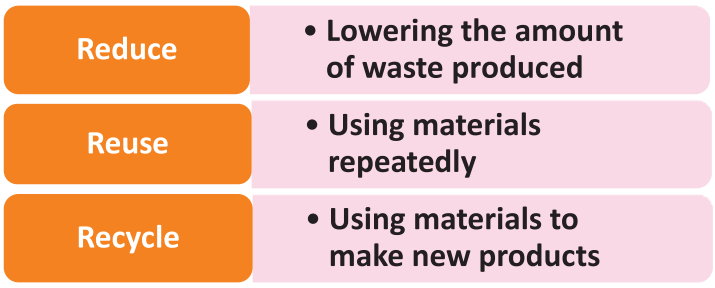


Fig. 2.8 Waste Hierarchy

2. Some other techniques

i. **Composting:** Composting involves the breakdown of organic waste in the presence of microorganisms, heat and moisture. Three types of microorganisms are involved in the process of composting—bacteria, fungi and actinomycetes that act upon the waste to convert it into sugars, starch, and organic acids. These, in turn, are acted upon by high-temperature bacteria, which prevail in the compost heap and help to promote the stabilized compost.

Composting has the following advantages:

- Recycling of waste by the generation of useful manure, which is organic.
- Reduction in volume of waste to be disposed of on land.
- No requirement for any high-end technical expertise.

ii. **Vermicomposting:** This is a process, in which food material and kitchen waste including vegetables and fruit peelings, papers, etc., can be converted into compost through the natural action of worms. An aerobic condition is created by exposure to organic waste in the air.

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=Q9lgpwRLDoA

Introduction to Indian sweets

https://www.youtube.com/watch?v=MiUgOzXfUYs

Procedure for Production Planning

https://www.youtube.com/watch?v=K6ppCC3lboU

Waste management

3. Carry out Production of Sweet and Savoury Products

Unit 3.1 – Raw Materials used in Food Processing Industry

Unit 3.2 – Processing of Sweet and Savoury Products

Unit 3.3 - Canning, packaging, labelling and post-production maintenance of equipment

FIC/N8516

Key Learning Outcomes

At the end of this module, you will be able to:

1. Illustrate raw materials used in the food processing industry
2. Demonstrate canning, packaging, labelling
3. Identify various food processing equipment and machinery

Unit 3.1 – Raw Materials used in Food Processing Industry

Unit Objectives

At the end of this unit, you will be able to:

1. Determine the use of different raw materials required in making sweet and savoury
2. Prepare raw materials required in making sweet and savoury
3. Demonstrate modern and traditional methods of Khoa making
4. Define the use of steam jacketed kettle in Khoa making
5. Illustrate the process of making sugar syrup and its various stages
6. Discuss various processes involved in sweet and savoury production
7. Identify different equipment and machinery used for Traditional sweet & savoury making

3.1.1. Food Industry Processes

The term food industries cover a series of industrial activities directed at the processing, conversion, preparation, preservation and packaging of foodstuffs. The main raw materials for the production of sweets and savoury products are flour, sugar, fats, milk and egg products. In addition, fruits and fruit-profitable semi-finished products, nuts, baking powder (yeast and chemical baking powder), aromatic substances (essences), food dyes and gelling agents (gelatin, agar, fur collar etc.) are also used, as well as various improvers.

3.1.1.1 Characteristics of raw materials

- **Flour -** Flour is the finely ground meal of wheat and is one of the most important ingredients used in bakery products. Therefore, flour quality has a major influence on the quality of the finished baked products. It is important for the following reason
    - o It acts as a binding agent and an absorbing agent.
    - o It affects the keeping quality of products.
    - o It is important to the flavour of products.
    - o It adds nutritional value to the baked product.
- **Besan flour-** Besan is a product obtained by grinding, drying and cuticle Bengal Gram. Snacks made of Besan (Bengal gram flour) are widely consumed in India. It is yellowish and possesses characteristic Bengal gram taste and smell. Examples: Namkeen, Patisa, Dhokla
- **Rice -** Broken rice and ground rice can be used as ingredients in expanded or puffed snack products. Explosion-puffed and oven-puffed rice, which are sold for breakfast cereals, can serve as bases for snack foods, through either the addition of flavours or forming into aggregates or cakes. Sugar-coated puffed rice breakfast cereal is frequently used as a sweet snack by children.
- **Salt -** Salt is an indispensable flavouring for all snacks, sweet or savoury. In many varieties of these foods, it is the predominant flavour note.

When practical, salt should be applied to snacks as a topping rather than as an ingredient that is distributed throughout the snack piece. This ensures a quickly sensed saltiness that is a primary determinant of consumer acceptability.

Most potato chip manufacturers will add from 1.5 to 2.5% salt (basis total weight). The actual amount used in a specific case will depend on several factors, such as the size of the salt crystals, type of salt, amount of oil, and sweetness of the chip (related to the maturity and storage history of the potato).

- **Water** - Although ingredient water is often less of a quality factor in snacks than in other foods because only small percentages of water are added to many snack ingredient mixtures, it can affect flavour, appearance, and texture under certain circumstances and for this reason is worthy of consideration.
- **Milk -** The milk solids have a binding effect on the flour proteins, creating a toughening effect. They also contain lactose which helps to regulate crust colour. They improve the flavour and are important moisture-retaining agents. It contributes towards eating qualities.

Milk is concentrated to make khoa, which is then mixed with sugar and other ingredients to make different types of sweets like peda, burfi etc.

Milk is also used to make curd which could further be hung to remove whey to prepare channa. Channa is used for making different types of sweets like gulab jamun, ras malai, etc.

- **Sweetening agents**
    - **Jaggery:** It is obtained mostly from sugarcane and also from palmyra, date palm and coconut. The harvested sugarcane is crushed to obtain juice. The sugarcane juice so obtained is freed from coarse suspended impurities and boiled in open pans. Jaggery has a light colour, good flavour, hardness and crystalline structure with good keeping quality. It contains about 65-85% sucrose, 10-15% inverted sugar and 2.5% ash. Jaggery finds use in the preparation of non -crystalline candies and a variety of sweets.
    - **Sugar:** It is manufactured from sugarcane juice in three different forms, raw sugar, refined sugar and white sugar.
- **Yeast -** In food manufacture, yeast is used to cause fermentation and leavening. The two types of yeast are compressed yeast and dry yeast. The ideal storing temperature for yeast is 300-45OF. When yeast is mixed with flour into dough, the yeast plants begin to grow and multiply very fast. This growth produces the leavening gas, or carbon dioxide, which forms the small bubbles that cause the dough to rise. Yeast in food products increases the volume and improves the grain, texture, and flavour.
- **Vegetable Oil and Fats** – Oils are pressed or extracted from the seeds or other parts of fruits. Sunflower and corn oil - are used in the manufacture of certain types of flour confectionery. Ghee is used in various Indian sweets like laddu, soan papdi, besan burfee etc. Ghee or Groundnut oil is also used to fry gulab jamun balls, and savoury products like namkeen, chips and pakoras. Coconut oil is also used for spraying finished snack pieces of many kinds (including crackers), and it often serves as the carrier for powdered flavours applied to corn curls.
- **Nuts -** Nuts are a very important ingredient in the preparation of sweets like gulab jamun, ras malai, cakes and pastries. Savoury products such as roasted peanuts, roasted cashews, and namkeens also use a wide variety of nuts. The commonly used nuts in sweet and savoury products are, Peanuts, almonds, cashews, walnuts, Pistachio, Raisins
- **Vegetable Ingredients -** It should be no surprise that potatoes are the principal vegetable ingredient in snacks. Potatoes are the most used vegetable ingredient in the snack industry which is used in the production of famously consumed potato chips.

Onions are important constituents of imitation onion rings made by the extrusion process and are used as a flavouring material in many other kinds of snacks.

Oil-roasted or dry-roasted soybeans, salted or with added flavours, have been extensively promoted but are seldom found except in health food stores.

- **Seasonings and flavourings -** Many ingredients are used to enhance the taste of foods. These ingredients can be used to provide both seasoning and flavouring. Before adding any seasoning or flavouring to the product, one must understand the quantity and particle size of the seasoning to be sprinkled.

- Seasoning means to bring out or intensify the natural flavour of the food without changing it. Seasonings are usually added near the end of the cooking period. The most common seasonings are salt, pepper, and acids (such as lemon juice). When seasonings are used properly, they cannot be tasted; their job is to heighten the flavours of the original ingredients.
- Flavouring refers to something that changes or modifies the original flavour of the food. Flavouring can be used to contrast a taste such as adding liqueur to a dessert where both the added flavour and the original flavour are perceptible. Or flavourings can be used to create a unique flavour in which it is difficult to discern what the separate flavourings are. Spice blends used in pumpkin pies are a good example of this.
- **Spices -** Spices are aromatic substances obtained from the dried parts of plants such as the roots, shoots, fruits, bark, and leaves. They are sold as seeds, blends of spices, whole or ground spices, and seasonings. The aromatic substances that give a spice its particular aroma and flavour are essential oils. The flavour of the essential oil or flavouring compound will vary depending on the quality and freshness of the spice.

- **Food colourings -** To give various colours to confectionery products and separate semi-finished products, several dyes are used. Food dyes are divided into natural, derived from plant or animal objects of natural origin, and synthetic, derived from organic synthesis products

The most common natural dyes used in the sweet and savoury industry are carmine and turmeric.

The most common synthetic dyes are indigo carmine and tartrazine.

Indigo carmine enters the confectioneries in the form of fine crystalline powder of blue colour or in the form of a paste, which when dissolved in water gives a solution of a blue colour.

Tartrazine is an orange-yellow crystalline powder that gives the product a yellow colour.

In recent years, beet dye obtained from beets has become widespread. It is a natural high-quality raw material and colours the cream in red.

3.1.2 Handling of Raw Materials

Handling raw materials is important as it prevents cross-contamination from the raw material to ready-to-eat food. Contaminants can be biological, chemical, or physical hazards, and once introduced into the raw material they can remain in the food throughout the preparation and processing procedure. Contamination can also be introduced into the food by raw material handlers.

Important precautions to follow while procuring raw material

In the food processing industry, the most important precaution one must always follow is to use only good-quality raw materials and never use low-grade raw materials. Make sure to -

- Procure raw material only from licensed dealers and never from unauthorized dealers
- Check the raw materials for any signs of deterioration or unpleasant odour.
- Segregate those materials that show signs of being unfit for human consumption.
- Check for signs of thawing and deterioration in frozen food like water droplets on the product or any change in texture.
- Thoroughly examine the product to ensure no physical hazard or contamination has taken place.
- Purchase only that amount of raw material for which you have adequate capacity to store and keep preserved.
- Check all packaged food for 'expiry date'/ 'best before' /'Use by date and ensure correct packaging and storage conditions have been maintained by the supplier.

An important procedure to follow when raw material has been procured

Even after the raw material has been procured unwanted contaminants can enter accidentally or if precautions have not been taken during storage or transportation.

- Transport and store consumable materials with covers separately.
- Ensure pathogen growth and toxin formation is negligible during transportation. Control time, and temperature, minimize exposure and use safe water for cleaning so that contamination is prevented.
- Receive and store chilled & high-risk foods at below 5°C temperature and frozen food at -18°C or below.
- Use containers made of food-grade material to store raw paste and sauces. Keep these properly covered and check them regularly for fungal growth, deterioration, etc.
- Rotate raw materials as well as finished food materials systematically either on a FIFO (First In First out)

3.1.3 Preparation of raw materials for processing

The preliminary preparative operations in food processing include cleaning, sorting, and grading of food raw materials.

3.1.3.1. Cleaning of food raw Materials

All food raw materials are cleaned before processing. It is important to note that the removal of contaminants is essential for the protection of process equipment as well as the final consumer

There are several cleaning methods available, classified into dry and wet methods, but a combination would usually be used for any specific material. Selection of the appropriate cleaning regime depends on the material being cleaned, the level and type of contamination and the degree of decontamination required.

(a) Dry Cleaning Methods

The main dry-cleaning methods are based on screens, aspiration, or magnetic separations. Dry methods are generally less expensive than wet methods

Screens: Screens are essentially size separators based on perforated beds or wire mesh by which larger contaminants are removed from smaller food items (e.g., straw from cereal grains, or pods and twigs from peas). This is termed ‘‘scalping’’. Alternatively ‘‘de-dusting’’ is the removal of smaller particles (e.g., sand or dust) from larger food units. The main geometries are rotary drums (also known as reels or trommels) and flatbed designs. Screening gives incomplete separations and is usually a preliminary cleaning stage.

Fig. 3.1 Screening of dry materials

Fig. 3.2 Destoners

Aspiration - It is widely used in the cleaning of cereals but is also incorporated into equipment for cleaning peas and beans. The principle is to feed the raw material into a carefully controlled upward air stream. Denser material will fall, while lighter material will be blown away. In this process, very accurate separations are possible, but large amounts of energy are required to generate the air streams. The system is limited by the size of raw material units but is particularly suitable for cleaning legumes and cereals. Airstreams may also be used simply to blow loose contaminants from larger items such as eggs or fruit.

Fig. 3.3

Magnetic cleaning - This is the removal of ferrous metal using permanent or electromagnets. Metal particles derived from the growing field or picked up during transport or preliminary operations constitute a hazard both to the consumer and to processing machinery. The geometry of magnetic cleaning systems can be quite variable: particulate foods may be passed over magnetized drums or magnetized conveyor belts, or powerful magnets may be located above conveyors. Electromagnets are easy to clean by turning off the power.

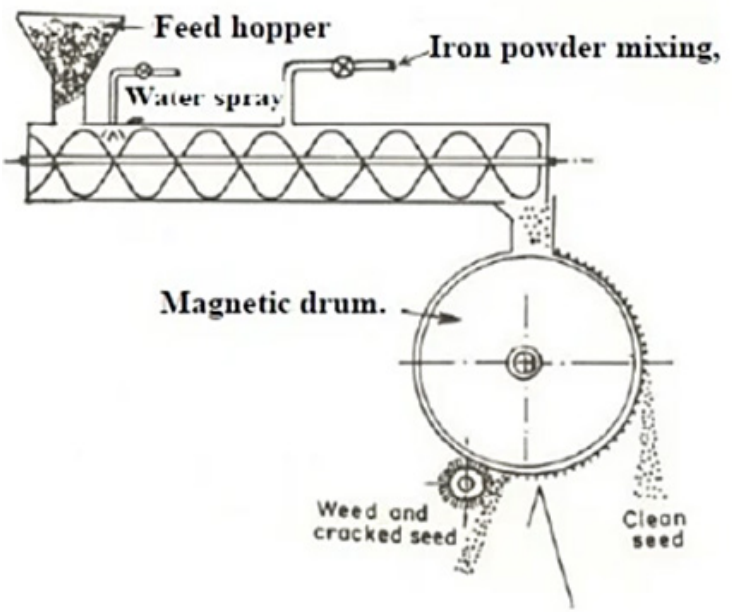


Fig. 3.4 Magnetic Cleaner

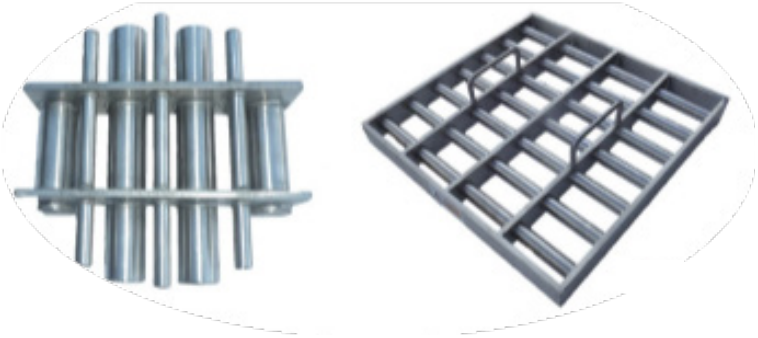


Fig. 3.5 Magnetic Grids

Fig. 3.6 The door closed and door opened showing "bullet magnet" Magnetic Rollers

The door closed and door opened showing "bullet magnet" Magnetic Rollers

(b) Wet Cleaning Methods

Wet methods are necessary if large quantities of soil are to be removed, and are essential if detergents are used. They are, however, expensive as large quantities of high-purity water are required in the process.

Common wet cleaning methods are:

- **Soaking -** Soaking is a preliminary stage in cleaning heavily contaminated materials, such as root crops, permitting softening of the soil and partial removal of stones and other contaminants. Metallic or concrete tanks or drums are employed; and these may be fitted with devices for agitating the water, including stirrers, paddles, or mechanisms for rotating the entire drum. The use of warm water or including detergents improves cleaning efficiency, especially where mineral oil is a possible contaminant, but adds to the expense and may damage the texture.
- **Spray washing -** Spray washing is very widely used for many types of food raw materials. Efficiency depends on the volume and temperature of the water and the time of exposure. As a general rule, small volumes of high-pressure water give the most efficient dirt removal, but this is limited by product damage, especially to more delicate produce. With larger food pieces, it may be necessary to rotate the unit so that the whole surface is presented to the spray.

Fig. 3.7

- **Floatation-** The Floatation Washer is designed to separate unwanted debris, and silk from vegetables such as peas and corn. The principle is that the product when entering a tank of reclaimed water will sink to the bottom of the tank, whereas the unwanted material will float on the water and be screened off at the top of the tank. A disadvantage is high water use, thus recirculation of water should be incorporated.

Fig. 3.8

- Filtration - Contaminants from fresh milk, fruit juices and syrups are normally removed by filtration.

3.1.3.2 Sorting and Grading of Raw Materials

Sorting is the separation of foods into categories based on a measurable physical property. Like cleaning, sorting should be employed as early as possible to ensure a uniform product for subsequent processing. The four main physical properties used to sort foods are size, shape, weight and colour.

- **Shape and size sorting:** The particle size distribution of a material is expressed as either the mass fraction of material that is retained on each sieve or the cumulative percentage of material retained. Size sorting is the separation of solids into two or more fractions based on differences in size.

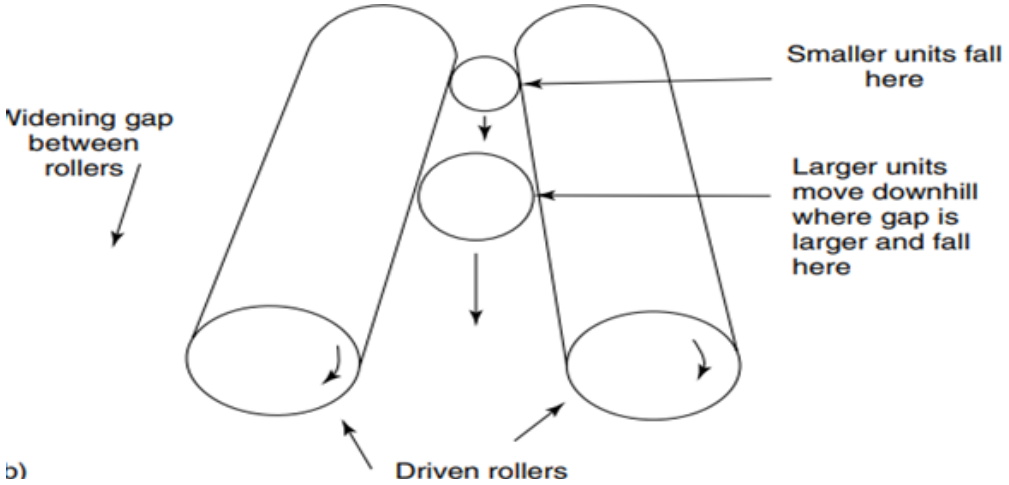


Fig. 3.9

- **Colour sorting:** Small particulate foods may be automatically sorted at high rates using microprocessor-controlled colour-sorting equipment. Particles are fed into the chute one at a time. The angle, shape and lining material of the chute are altered to control the velocity of pieces as they pass a photodetector. Photodetectors measure the reflected colour of each piece and compare it with pre-set standards, and defective foods are separated by a short blast of compressed air.
- **Weight sorting:** Weight sorting is more accurate than other methods and is therefore used for more valuable foods. Meat cuts, fish fillets, fruits such as apples, pears, and citrus fruits, and vegetables such as potatoes, carrots, onions and eggs are sorted by weight using a spring-loaded, strain gauge, or electronic weighing devices incorporated into conveying systems.

3.1.3.3 Grading

Grading is often used interchangeably with sorting but strictly means 'the assessment of the overall quality of food using several attributes. Grading is carried out by machines or operators who are trained to simultaneously assess several variables.

For proper grading, the raw material must be presented singly before the human grader or machine for assessment. These devices may be roller or vibratory tables or rotating wheels equipped peripherally with devices that pick up food pieces, rotate them for viewing and then release them at a given signal.

Manual grading is done by trained operators who can assess several grading parameters simultaneously. For example, eggs are graded manually by candling.

3.1.3.4 General Food Processing steps

Most sweet and savoury products which are manufactured go through several common steps. The specific details of each may differ, but the basic principles are the same:

Fig. 3.10

3.1.4 Production Processes

Operations in processing food products are extremely varied and can be described only after individual study of each industry, but the following procedures are used: fermentation, cooking, dehydration and distillation.

Fermentation, obtained usually by the addition of a micro-organism to the previously prepared product, is practised in bakeries, breweries, the wine and spirits industry and the cheese products industry.

Cooking occurs in many manufacturing operations: canning and preserving of meat, fish, vegetables and fruits; ready-to-serve meat-processing plants (e.g., chicken nuggets); in bakeries, biscuit-making, breweries; and so on. In other cases, cooking is done in a vacuum-sealed container and produces a concentration of the product (e.g., sugar refining and tomato-paste production).

Besides the drying of products by the sun, as with many tropical fruits, dehydration can be carried out in hot air (fixed dryers or drying tunnels), by contact (on a drying drum heated by steam, such as in the instant-coffee industry and the tea industry), vacuum drying (often combined with filtering) and lyophilization (freeze drying), where the product is first frozen solid and then dried by vacuum in a heated chamber.

Distillation is used in the making of spirits. The fermented liquid, treated to separate grain or fruit, is vaporized in a still; the condensed vapour is then collected as liquid ethyl alcohol.

3.1.5 Bottled and canned products processing

Bottling and canning are essentially similar processes in that food are filled into a container and heated to destroy enzymes and micro-organisms. Fruits can be packed into jars with hot, sugar syrup and vegetables can be packed into a hot brine. The filled jars are sealed and pasteurized so that an internal vacuum forms when they are cool. The sealed container then preserves the food by preventing re-contamination and excluding air and sometimes light. Preservation depends on adequate heat treatment and an air-tight (or 'hermetic') seal.

Process chart for production of fried fruits

Stage in process Essential Optional	Quality Assurance	Equipment Required	Notes
Fruit ↓ Peel ↓			Select fruit that is slightly under-ripe and having a firm texture
Slice	Thickness of slices	Slicer	Manual slicing is possible but a thinner, more uniform product is achieved using small manual or electric slicing machines.
↓ Wash	To separate slices	Wash tank	Citric acid or sodium metabisulphite can be added to the wash water to better retain the colour of the fruit and prevent darkening.
↓ Drain ↓ ↑ Dry			
Fry	To correct colour Check oil quality	Heat source and pan or deep fat fryer	Care is needed when adding fruit to hot oil (at 180-200°C) to prevent splashing. Heat for 5-10 minutes until a uniform colour is produced. The quality of the oil has a direct effect on the shelf life and quality of the product as well as the economics of the process (see text).
↓ Drain/cool		Racks or mesh	Cool to prevent condensation inside the package
↓ Pack ↓	Check that the seal is adequate.	Heat sealer	Ensure that the seal is complete because the product shelf life is substantially reduced if air or moisture enter through a poorly formed seal.
Store			Store away from heat and sunlight to avoid rancidity

Table 3.1

3.1.6 Equipment and Machinery used for Traditional Sweet & Savory Making

The process of changing raw ingredients into food, in a way, that can be consumed by humans or animals is termed food processing.

The equipment in food processing refers to processing machines, components, and systems used to cook, handle, package, prepare or store food and food products. Although this equipment is primarily aimed towards consumability, preservation, and palatability, a few pieces of equipment also perform auxiliary or main functions such as preparation, handling and packaging. To execute the various unit operations necessary during a complete production cycle, such as separating, mixing, freezing, washing, and sealing, a wide range of food processing equipment is available. The food processing equipment can be designed and constructed to handle solid, semi-solid and liquid products, batch-wise or continuously, depending on the demands of the operation.

The optimal design and construction of the food processing equipment depend on the specifications and requirements of the food processing application.

Following are the different types of food processing equipment that are categorized depending on the common functions used in the food processing industry.

3.1.6.1 Preparation Equipment

1. Cleaning

Cleaning, grading, sorting, peeling or skinning are some of the unit operations employed by manufacturers during the preparation of raw material.

The cleaning process divided into wet and dry is done to remove contaminants and foreign matter from the surface of raw food material. The food processing equipment employed during this process is -

Wet Process:

Fig. 3.11

- Sterilizers (Sterilizing)
- Soak/Floatation Tanks (Soaking)
- Washing Systems (Washing)
- Spray Washers (Spray washing)

Dry Process:

Fig. 3.12

- Screening Separators
- Air Classifiers
- Magnetic Separators

2. Grading

This type of food processing is closely related to sorting and often precluding. We can determine the overall quality by assessing several food matter characteristics. The food processing equipment employed during this process is -

- Image Processors
- Tungsten Lights
- Laboratory Equipment

Fig. 3.13

3. Peeling/skinning

To increase the overall quality or appearance of the final food product, inedible or undesirable materials are removed by this food processor. The food processing equipment employed during this process is -

- Carborundum Abrasive Rollers/Bowls (Abrasion peeling)
- Pressure Vessels (Flash steam peeling)
- Stationary/ Rotating Blades (Knife peeling)
- Conveyors and Furnaces (Flame peeling)

Fig. 3.14

4. Sorting

The operation is quite similar to the dry cleaning process. Based on a measurable physical characteristic, sorting classifies and separates contaminants and foreign matter from raw food material. Food processing equipment used during this process are:-

- Sieves/Screens (Size sorting)
- Sorting Machinery
- Machine Vision Sorting Systems
- Sorting Conveyors
- Disc Separators (Shape sorting)
- Equipment used in a dry process in cleaning.

Fig. 3.15

3.1.6.2 Mechanical Processing Equipment

Now that we have a brief idea about the preparation equipment, let's go to the next step of food processing i.e. mechanical processing operations which also has numerous unit operations such as grinding/crushing, cutting and forming.

1. Size reduction

Raw materials often occur in sizes that are too large to be used and, therefore, they must be reduced in size. This size-reduction operation can be divided into two major categories depending on whether the material is a solid or a liquid. If it is solid, the operations are called grinding and cutting, if it is liquid, emulsification or atomization. All depend on the reaction to shearing forces within solids and liquids.

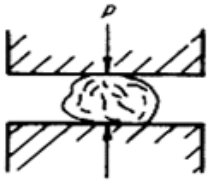
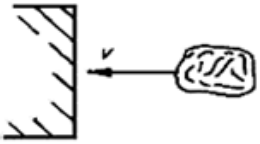
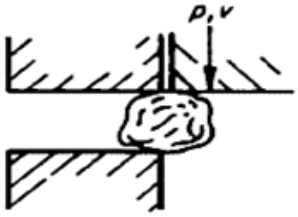
Force	Schematic diagram	Principle	Example of equipment
Compressive		Nutcracker	Crushing rolls
Impact		Hammer	Hammer mill
Attrition		File	Disc attrition mill
Cut		Scissors	Rotary knife cutter

Table 3.2

2. Grinding/Crushing:

- Roll Crushers
- Jaw Crushers
- Hydraulic crusher
- Pressure Mills
- Impact Mills
- Strainers/Pulpers
- Attrition Mills

Fig. 3.16

Crushers: (a) Jaw, (b) Gyratory

Crushing rolls consist of two horizontal heavy cylinders, mounted parallel to each other and close together. They rotate in opposite directions and the material to be crushed is trapped and nipped between them being crushed as it passes through. In some cases, the rolls are both driven at the same speed. In other cases, they may be driven at differential speeds, or only one roll is driven. A major application is in the cane sugar industry, where several stages of rolls are used to crush the cane.

Hammer mills

In a hammer mill, swinging hammerheads are attached to a rotor that rotates at high speed inside a hardened casing.

The material is crushed and pulverized between the hammers and the casing and remains in the mill until it is fine enough to pass through a screen which forms the bottom of the casing. Both brittle and fibrous materials can be handled in hammer mills, though with a fibrous material, projecting sections on the casing may be used to give a cutting action.

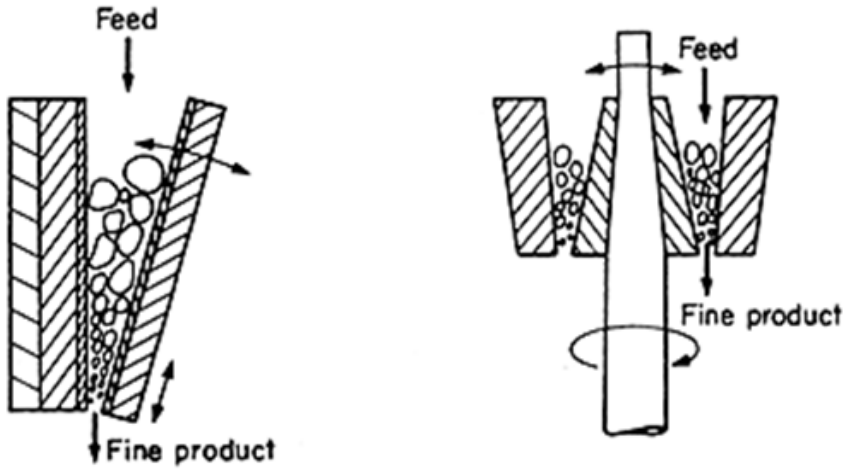


Fig. 3.17 Crushers: (a) Jaw, (b) Gyratory

3. Cutting/Chopping :

- Slicing Machines
- Knives/Blades
- Meat Grinders
- Band Saws

Fig. 3.18

4. Size Enlargement

Mechanical processes such as agglomeration or forming, and extrusion increase the average particle size of solid food matter. The equipment involved are -

(i) **Extrusion:** Food extrusion is a form of extrusion used in food processing. It is a process by which a set of mixed ingredients are forced through an opening in a perforated plate or die with a design specific to the food and is then cut to a specified size by blades.

- Twin-Screw Extruders
- Non-Thermal Extruders
- Single-Screw Extruders

(ii) **Agglomeration:** Agglomeration is a common technique that is used to increase the particle size of fine food powders. The increase in particle size improves the wettability and solubility and therefore gives instant properties to such products as baby food powders, cocoa-sugar mixes, dairy powders, and fruit powders.

- Pelletizing Equipment
- Rotating Drums
- Rotating Pans
- Tableting Equipment
- High-Speed Agitators

Fig. 3.19

(iii) Forming:

- Confectionary Molders
- Bread Molders
- Enrobing Machines
- Pie and Biscuit Formers

Fig. 3.20

5. Homogenization/emulsification

The average particle size is reduced and the consistency of semi-solid and liquid food matter is increased. Types of food processing equipment are:

Fig. 3.21 Homogeniser

- High Shear Mixers
- Emulsifiers
- Colloid Mills
- Homogenizers
- Jolly Mixer – for powders

6. Mixing/blending

To achieve and maintain a uniform mixture, mixing combines and disperses two or more components into one another. The type of equipment depends on the food components' form.

(i) Fluid Mixers :

- Anchor Mixers
- Agitated Tanks
- Paddle Mixers
- Turbine Mixers

Fig. 3.21

Dough/Paste Mixers :

(ii) Cutter Mixers:

- Horizontal Dough Mixers
- Sigma-Blade Mixers

(iii) Solid Mixers:

- Drum Blenders
- Diffusive (Passive) Mixers
- Convective (Active Mixers).

Fig. 3.22

3.1.6.3 Industrial Fryer

Fryers can be batch or continuous. Industrial fryers are mostly continuous. Continuous fryers for deep frying contain an oil bath through which the product is conveyed on a mesh belt. The oil is heated by combustion gases or by electric resistances. It is important to provide a large heat transfer area (fewer watts per unit area) to avoid the local overheating of the oil. The oil is continuously filtered to remove particles that catalyze oxidation. At the same time, fresh oil is added to make up for the oil intake by the product. Usually, the industrial continuous fryer is part of a production chain comprising pre-dusting, battering and breading equipment before and a baking oven, cooler and freezer after

1. Indirect heat type batch fryer

Rectangular or circler indirect heat type batch fryer is fabricated in stainless steel 304 body having pan mounted on a stainless steel 304 body.

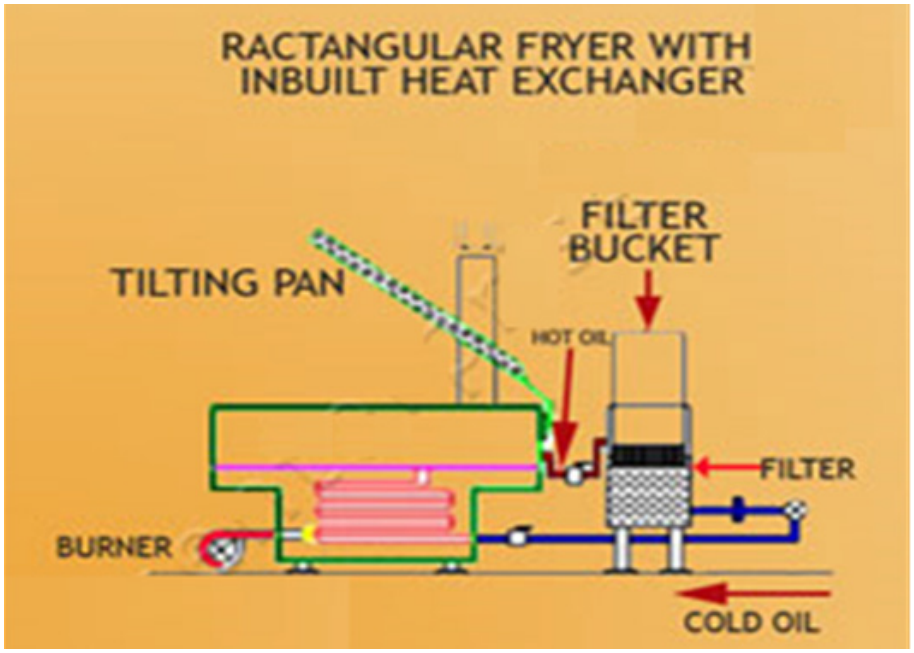


Fig. 3.23

2. Direct heat type batch fryer

Direct fryers are those in which the cooking oil is heated by an internal source in the fryer pan. The rectangular or circular fryer is a product in the intermediate range between the typical batch type fryer like diesel or kerosene Bhatti or commercial gas stove and continuous fryers.

Fig. 3.24

3.1.6.4 Mixing Equipment

Many forms of mixers have been produced from time to time but over the years a considerable degree of standardization of mixing equipment has been reached in different branches of the food industry. Possibly the easiest way in which to classify mixers is to divide them according to whether they mix liquids, dry powders, or thick pastes.

1. Liquid Mixers

For the deliberate mixing of liquids, the propeller mixer is probably the most common and the most satisfactory.

Fig. 3.25

2. Powder and Particle Mixers

The essential feature of these mixers is to displace parts of the mixture concerning other parts. The ribbon blender, for example, consists of a trough which rotates a shaft with two open helical screws attached to it, one screw being right-handed and the other left-handed. As the shaft rotates sections of the powder move in opposite directions and so particles are vigorously displaced relative to each other.

Fig. 3.26 Mixers (a) ribbon blender(b) double-cone mixer

A commonly used blender for powders is the double-cone blender in which two cones are mounted with their open ends fastened together and they are rotated about an axis through their common base.

3. Dough and Paste Mixers

Dough and paste are mixed in machines that have, of necessity, to be heavy and powerful. Because of the large power requirements, these machines should mix with reasonable efficiency, as the power is dissipated in the form of heat, which may cause substantial heating of the product. Such machines may require jacketing of the mixer to remove as much heat as possible with cooling water.

Perhaps the most commonly used mixer for these very heavy materials is the kneader which employs two contra-rotating arms of special shape, which fold and shear the material across a cusp, or division, in the bottom of the mixer. The arms are of a so-called sigmoid shape as shown in the image below.

They rotate at differential speeds, often in the ratio of nearly 3:2. Developments of this machine include types with multiple sigmoid blades along extended troughs, in which the blades are given a forward twist and the material makes it's way continuously through the machine.

Fig. 3.27 Dough Kneader

Another type of machine employs very heavy contra-rotating paddles, whilst a modern continuous mixer consists of an interrupted screw which oscillates with both rotary and reciprocating motion between pegs in an enclosing cylinder. The important principle in these machines is that the material has to be divided and folded and also displaced so that fresh surfaces recombine as often as possible.

3.1.6.5 Packaging Machines

Depending on the type of food being packed, packing comes in various types. Pack these food materials, various food packaging machines are used. The packing styles also change depending on the storage life of the product.

Here are the various types of food packaging machines:

To address the variety of packaging needs, there is a wide variety of packaging equipment types. Categorized by the method used to package products, the main types include filling machines, sealing machines and vacuum packaging machines.

1. Filling Machine

Filling machines are used to take previously manufactured packaging and fill that packaging with a certain number of parts, whether it is one large part or a hundred small parts. A bagging machine is a type of filling machine in which the packaging is specifically limited to bags; bags are defined as containers made from flexible materials such as paper or plastic that have a single opening. Flexible packaging systems like bagging machines work well for liquid packaging. They're often used for storing beverages like soda.

2. Sealing Machine

Sealing machines are packaging machines used to close and make airtight packaging after a product has been put inside it. One of the most common types of sealing machines is the heat sealer, which

Fig. 3.28

seals thermoplastics like shrink wrap using the direct application of heat and pressure. Sealing machines are common as food packaging equipment, for packaging bakery goods and fresh produce. Variations on the sealing machine include the bag sealer.

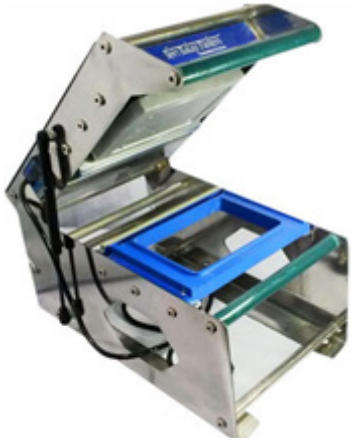


Fig. 3.29

3. Vacuum Packaging Machine

This is perhaps the most common type of packaging machinery for industrial and food-handling applications. Vacuum packing machines provide air-tight packaging by first removing the atmospheric oxygen in the package and then sealing the package. Vacuum packaging is also a popular way to seal electronics like cameras into waterproof packaging.

4. Labelling Equipment

An important aspect of any complete packaging operation is labelling. Labelling equipment provides the finishing touch to packaging by adhering labels for purposes like product identification, pricing, usage guidance, barcoding, shipping instructions and an indication of tampering. Labelling equipment can be large enough to tackle high industrial loads, or it can be as small enough for small business purposes, as is the case with a handheld label applicator.

Fig. 3.30 Vacuum Package Machine

Fig. 3.31 Vacuum Sealing Machine for Sweets

5. Fill Machine

Filling machines, or fillers, are designed to fill containers with a predetermined amount of material. This material can be a finished product, like glass bottles, or it can be liquid that goes into those bottles, or it can be industrial materials, such as palletized plastic. Fillers are typically components of conveyors, and their design varies based on whether they are meant to be liquid fill or solid fill.

A popular filler process is “form fill seal” (FFS), a process during which the machine takes

Fig. 3.32

v-fold or flat material, forms it into a container or bag, and then fills it and seals it. Similar is filling capping sealing, during which bottles are filled, capped and sealed.

6. Case Packing

Case packing equipment is packaging machinery designed specially to work with cases of all sizes and volumes. They help manufacturers pack cases of the product more quickly, efficiently and uniformly. To finish the operation, responsible manufacturers also send their cases through a case sealer, which ensures that all the contents are securely inside, and nothing can get in or get out. Common case-packing equipment varieties include top-load case packers, side-load case packers and robotic case packers. As high-traffic industrial packing equipment, case packers can be designed to work in conjunction with palletizers.

Fig. 3.33

Fig. 3.34 Shrink Packaging Machinery

Shrink packaging, also known as shrink wrap, is a type of plastic used during packaging. When heated, it shrinks and takes the form of the item it surrounds. Shrink packaging can be used to wrap a wide range of products, so, shrink-wrapping jobs can be done with large machines or heat guns.

Fig. 3.35

Unit 3.2– Processing of Sweet and Savoury Products

Unit Objectives

At the end of this unit, you will be able to:

1. Identify the use of the steam jacketed kettle and its working
2. Determine how to set parameters for the steam-jacketed kettle
3. Demonstrate traditional and mechanized methods of Gulab-jamun making
4. Demonstrate the extrusion process of savoury making
5. Categorize different types of extruders
6. Demonstrate the use of Industrial Fryer and its types
7. Identify various mixing equipment used in the sweets and savoury-making process
8. Discuss how to handle and dispose of used cooking oil
9. Identify the process of foreign object detection in the food industry
10. Identify ways of sensory evaluation of food product

3.2.1 Steam Jacketed Kettle

Steam-jacketed kettles utilize steam energy to transfer heat via conduction to food product inside.

The energy source — electric, gas and direct steam — that operates the unit helps define the categories of kettles available to operators. Direct steam kettles offer greater efficiency, cooking the fastest with the highest capacity as compared with electric and gas models. Kettle sizes range from 5 to 200 gallons, although 40 gallons represent the most common size commercial foodservice operators tend to use.

The operating pressures of these kettles range from 45 PSI to 50 PSI, which produces an even temperature from the entire jacketed surface of 267 degrees to 338 degrees F.

Fig. 3.36

Most kettles come with optional accessories as well as features that enhance the operation for specific applications, such as mixers, draw-off valves, pan carriers and mixing faucets.

3.2.1.1 Construction

- The apparatus consists of two hemispherical pans one is a kettle (inner pan) and the other is a jacket (outer)
- These two pans are joined to each other enclosing a space through which steam is passed
- The kettle is made of copper or stainless steel and the jacket is made of iron
- At the top of the jacket inlet for steam is provided
- The jacket has two outlets one is for uncondensed gases (on opposite sides of the inlet) and another is to remove condensate (at the bottom of the jacket)

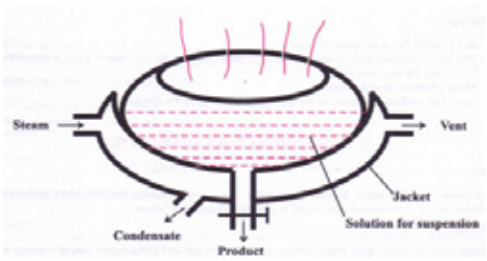


Fig. 3.37

3.2.1.2 Working of Steam Jacketed Kettle

- The aqueous extract to be evaporated is placed in the kettle. Steam is supplied through the inlet. Steam gives out its heat to the contents and the condensate leaves through the outlet. The contents must be stirred manually for smaller volumes and mechanically for larger volumes. The rate of evaporation is fast in the initial stages and decreases gradually as the liquid gets concentrated.
- Any room where evaporation is carried by this apparatus must have good ventilation to remove the vapour. Otherwise, the room is quickly filled with a dense fog of condensed vapour and waterfalls from the roof and runs down the walls. Fans fitted over the pan not only remove the vapour and prevent condensation in the room but also accelerate the rate of evaporation by quickly removing saturated air from the surface of the liquid.
- The kettle may be fixed or made to tilt. A kettle of capacity up to about 90 litres may be made to tilt. But above this capacity, the weight of the pan along with its contents becomes too great to tilt. Hence, the bottom outlet is used to collect the concentrated product.

3.2.1.3 Setting parameters in steam jacketed kettle

- **Operating the control panel – General**

When the appliance is started with the ON/OFF switch, all displays and indicator lights on the control panel illuminate for a short time (display test). After that, 'On' remains on the temperature display and the time on the timer display (if the kettle is fitted with a timer function). The appliance is now ready for use.

Fig. 3.38

- Transferring product or empty kettle

1. The kettle is tilted using a hand wheel on the front of the control housing. The kettle remains in the position which tilted until turned again.
2. Product may also be transferred using the optional draw-off valve if the kettle is so equipped.

It is not possible to tilt the kettle when the lid is closed. In case you try to tilt the kettle with the lid in a closed position, a blinking 'Lid' message appears on the display.

Tilting the kettle is carried out by pressing the tilting button. The kettle tilts as long as the button is held down. In case the "pull-back" function is on, a slight reversing movement occurs after the button is released, which decreases the dripping of food from the spout.

Tilting the kettle to the cooking position is carried out by pressing the upright position button.

- Parameter to set while Cooking

1. Switch on the appliance. 'On' appears on the temperature display.

2. Press the temperature button once.

When the temperature starts to blink on the display, one can select the desired temperature using the central dial. The set value is automatically saved in the memory after about three seconds, the temperature blinking stops on the display and the kettle starts to heat. If one does not manage to set the temperature while the temperature display was blinking, press the temperature button again and select the desired temperature with the central dial.

Temperature setting and temperatures displayed:

0 - 50°C	kettle inner surface temperature on the display
51 - 100°C	food temperature on the display
101 - 120°C	steam jacket temperature on the display

The heating is only switched on when the kettle is in an upright position (cooking position). If the heating function is selected when the kettle is not in an upright position, the message 'PoS' appears on the display indicating that the heating will not switch on because the kettle is not in the cooking position. Open the lid and revert the kettle to the cooking position.

- **Changing the temperature**
  1. Press the temperature button.
  2. Select the temperature desired.

- **Stopping the cooking**
  1. Press the temperature button for a long time (approx. 2 seconds).
  2. The heating goes off when 'On' appears on the display.

- **Mixing functions**
  1. Starting the mixer (manual mixing)
  2. Switch on the appliance. The temperature display indicates 'On'.
  3. Select the mixing function. Message '15' appears on the mixer display.
  4. Start the mixer.

- **Changing the speed**
  1. When the mixer is running, press the start/pause button once.
  2. Select the speed (15-140 rev./min.) with the central dial.

NOTE: You cannot change the mixing speed if a mixing program (P1-P6) is in operation. However, it is also possible to start power mixing when a mixing program is running (see "Power mixing during mixing").

- **Manual cooling**

Cooling is based on cold tap water circulating in the kettle's steam jacket. Mixing and use of scrapers make the cooling more efficient. The cooling time depends, for example, on the product and the amount to be cooled, the product's initial and end temperature, the flow rate and temperature of the cooling water, as well as mixing operations.

- **Starting the cooling**
  1. Set the temperature to 0°C.
  2. Close the water tap.
  3. Detach the spray gun from the cleaning hose and connect it to the connector of the emptying valve located under the kettle.
  4. Open the emptying valve.
  5. Turn the drain valve to the cooling position.
  6. Open the cold water tap.

Fig. 3.39

1. Spray gun hose
2. Connector of emptying valve
3. Emptying valve
4. Drain valve

- **Stopping the cooling**
  1. Close the cold water tap.
  2. Detach the hand spray hose from the connector of the emptying valve.
  3. Turn the drain valve to the cooking position.
  4. Let excess water flow out of the steam jacket into the drain.
  5. When no more water is flowing from the steam jacket, close the emptying valve.

3.2.2 Khoa Burfi

3.2.2.1 Making of Khoa

Khoa is prepared by different methods depending on the location and quantity of milk available for conversion. Khoa is manufactured by the following four basic methods viz. traditional method, improved batch method, mechanized method and use of membrane technology.

Variety of Khoa

- **Dhap**

For preparing dhap variety of khoa, the heating should be stopped at rabri stage (thick mass) and leaving the product without much working which carries soft grains and high moisture content.

Fig. 3.40

- **Pindi**

For the production of the pindi variety of khoa, heating is continued after rabri stage and with the help of a wooden ladle the soft grains are crushed and the mass is worked up to a smooth textured product. khoa is moulded into hemispherical moulds to give its shape and allowed to cool.

Fig. 3.41

- **Danedar**

Generally, the milk that is left over after the preparation of other varieties of khoa during the day develops acidity which is converted into danedar variety of khoa. Sometimes citric acid (0.05 to 0.1%) or sour whey is added to milk at the boiling stage to get a granular texture.

Fig. 3.42

Traditional Method of Khoa Making

Generally, buffalo milk is preferred for the manufacture of khoa as it results in a higher yield, smooth texture and soft body with a sweet taste. Where buffalo milk is not available, cow milk is used for khoa making but it results in a pasty body and slightly saltish taste due to higher chlorides in the product.

4 litres of buffalo milk or 5 litres of cow milk which approximately yields 1 kg khoa is used per batch. Filtered milk is taken in a heavy-bottomed wide-mouth iron pan (karahi) and boiled on a brisk non – smoky fire. A Steel scraper (khunti) is used for stirring the milk during boiling and to scrap the milk film forming on the surface during boiling. Rapid stirring and scraping are carried out throughout boiling to facilitate quick evaporation of water from milk and to prevent scorching of milk film on the surface. Due to the continuous evaporation of water, the milk progressively thickens. The heating is continued till the milk thickens considerably and at this stage, heating is reduced and the speed of stirring, and scraping is increased to obtain a good quality product. If the milk is subjected to high heat treatment with less stirring and scraping at this stage, it results in dark-coloured khoa that does not fetch a good price in the market as white/cream-coloured khoa is preferred for sweets making.

As the concentration is progressing, the product slowly tends to leave the sides of the pan and starts accumulating at the bottom, and at this stage; the pan must be removed from the fire. The contents are worked up and the residual heat of the vessel helps in the further evaporation of moisture. The contents are transferred to the non-corrosive metal moulds and allowed to cool.

To check the consistency of the evaporated milk, stop stirring once the milk is less than half its original volume. If you started with 3¾ cups / 890 mL of milk, turn off the heat once you're down to 1½ cups / 350 mL. The milk has now turned a creamy colour Next, pass it through a sieve to remove any skin and set it aside to cool completely.

Unlike a canned product, homemade evaporated milk is not shelf-stable. Although the lower water content does increase the shelf life. Hence, it usually lasts longer than regular milk.

Generally, khoa has a shelf life of 2-3 days at room temperature and for a week under refrigerated storage conditions when packed in parchment paper and paper board boxes. It can be stored for longer periods with better packaging and/or under deep-frozen conditions at -18°C or below.

There are several limitations of this method such as:

- Time and labour-consuming
- Large variation in quality
- Poor keeping quality
- Small scale production
- Smoky smell

Fig. 3.43

Limitation of Traditional Khoa-Making Process

Several limitations of this method such as:

- Time and labour-consuming
- Large variation in quality
- Poor keeping quality
- Small scale production
- Smoky smell

Khoa Making through Steam Jacketed Kettle

A continuous khoa-making machine was developed which consists of a preheating stainless-steel double-jacketed, steam-heated pan or kettle is used to provide greater control on the healing process and to ensure non-smoky heating. The milk is brought to a boil in the kettle. During boiling, the bottom and the surfaces of the kettle are scraped, and milk is stirred vigorously by a stainless-steel stirrer to avoid the burning of milk solids. About 2 kg/cm2 pressure is used for boiling milk. When the milk concentration remains at 50% of total solids or a rabri stage is attained, slow heating is necessary at this stage to prevent the burning of solids on the surface, discolouration of the product, and development of burnt flavour and hard body and coarse texture. The rate of stirring should be increased during lathe stages to obtain a good quality product. As soon as the product shows signs of leaving the sides of the kettle and accumulates in the centre in a pat form, heating is stopped. It takes about 15 -20 min to prepare a batch of khoa by this method.

Khoa Manufacturing Process

1. Milk Reception and evaporation:

- The high-fat percentage of milk should be taken in an open pan for evaporation
- A continuous scrapping mechanism must be attached to the pan.
- It may be steam-jacketed or gas-fired.

Fig. 3.44 Steam Jacket Kettle

Fig. 3.45 Steam Kettle used in Sweet Industry

2. Addition of Sugar and ground cardamom (OPTIONAL)

- Evaporate the milk till the volume gets reduced by one third
- Addition of sugar and ground cardamom as per final product taste.
- Continuous scrapping.

Fig. 3.46

3. Unloading and shaping of khoa mass

Unloading the khoa mass in a tray for cooling and shaping.

3.2.2.2 Traditional Method of making Khoa Burfi

Burfi is a popular milk-based confection in which the base material is essentially khoa. Sugar is added in different proportions and other ingredients are incorporated according to the demand of consumers. Several varieties of burfi are sold in the market depending on the additives present, viz., plain mawa, pista, nut, chocolate, coconut and rava burfi. A lot of variation can be observed in the physical attributes of market samples. Good quality burfi, however, is characterized by a moderately sweet taste, soft and slightly greasy body and smooth texture with very fine grains. The Colour, (except chocolate burfi) should be white or slightly yellowish. The shape of the burfi is either square or rectangular.

The manufacture of burfi is mainly restricted to private traders (milk confections), although during the past decade serious efforts have been made to develop mechanized systems for organized dairies. The flow diagram of a batch method, the variables of which have been optimized in the laboratory to produce burfi of consistently good quality is shown in Fig. below.

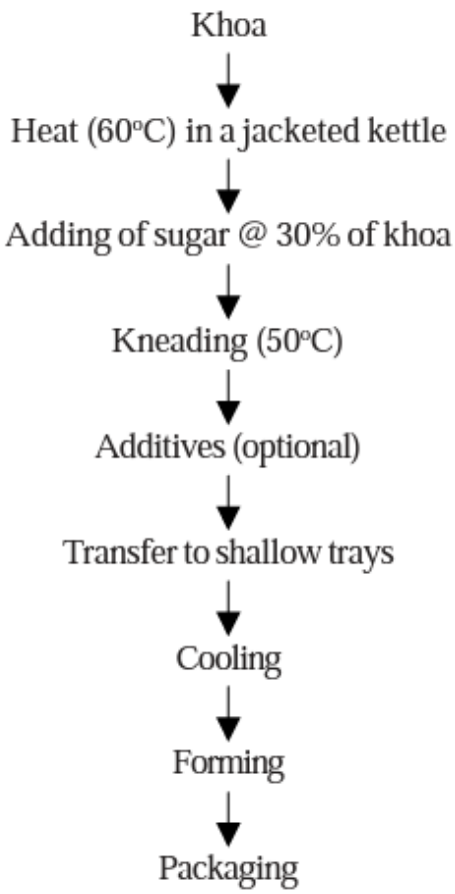


Fig. 3.47 Flow chart for preparation of burfi

Dhap khoa made from fresh buffalo milk is desirable for making burfi. Khoa is taken preferably in a double-jacketed stainless steel hemispherical kettle and heated up to 60oC by steam. In the traditional method shallow karahi made up of mild steel is used and the heating source is kerosene oil or LPG burner. Khoa is thoroughly worked at about 60oC by a wooden ladle (long handle with flattened end). Sugar, preferably ground, @ 30% of khoa, is added. The aggressive beating of khoa and sugar is done at about 50oC to achieve a completely homogenous and smooth mass. At this stage, heating is discontinued and additives may be added depending on the type of burfi. Burfi base is poured into previously greased (with desi ghee) shallow trays. The trays are left at room temperature for cooling and setting of burfi. Dressing of burfi with nuts, silver foil, etc is done at this stage. Finally, pieces of the required shapes and sizes are cut and packaged in suitable boxes.

3.2.3 Gulab-jamun

Gulabjamun is a popular sweet prepared in all parts of India. Like other sweets, the manufacture of Gulab Jamun is also largely in the hands of halwais who adopt the small-scale batch method. Though there are large variations in the sensory quality of gulabjamun, the most liked product should have a brown colour, smooth and spherical shape, soft and slightly spongy body free from both lumps and hard central core, uniform granular texture, mildly cooked and oily flavour free from the doughy feel and fully succulent with sugar syrup. It shall have optimum sweetness. It may or may not contain a piece of currant or cashew nut in the centre.

Presently gulabjamun is prepared from two base ingredients, namely khoa and gulabjamun mix powder. The former method based on khoa as the main ingredient for gulabjamun making is discussed here. Invariably gulabjamun is prepared by the traditional method and the large-scale mechanized method is used only by a few organized dairies.

Ingredients: Besan flour, cashew/almond batter, maida, ghee/oil, nuts etc.

3.2.3.1 Making of Sugar Syrup

The sugar syrup is just sugar and water boiled together. This liquid substance has the same sweetness as granulated sugar. Simple Syrup has a multitude of uses and is a great addition to Jalebi, Gulab Jamun. It is perfect for sweetening your cold drinks where regular sugar wouldn't normally dissolve with ease. You will find many uses for this syrup in your cooking, as it can also be used in sorbets, candying fruits, moistening sponge cakes, etc.

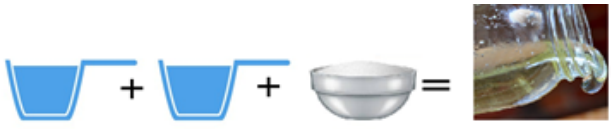
Types of Sugar Syrups

There are several thicknesses or densities of sugar syrup, and they have different uses. The thickness depends on the ratio of water to sugar used. The one with more sugar will be more syrupy and sweeter. Follow the measurements listed in the recipe, or use these general guidelines:

- **Thin Sugar Syrup –** A ratio of 3 parts water to 1 part sugar – used to glaze cakes and cookies.

3 Parts Water to 1 Part Sugar — Thin Sugar Syrup

- Medium Sugar Syrup – A ratio of 2 parts water to 1 part sugar – used to make sweetened beverages and iced tea.



2 Parts Water to 1 Part Sugar — Medium Sugar Syrup

- Thick or Rich Sugar Syrup – A ratio of 1 part water to 1 part sugar – This is used as the basis for cold fruit drinks, cocktails, and sweets. Also used to make candied fruits.

1 Part Water to 1 Part Sugar — Thick Sugar Syrup

Process of Making Sugar Syrup

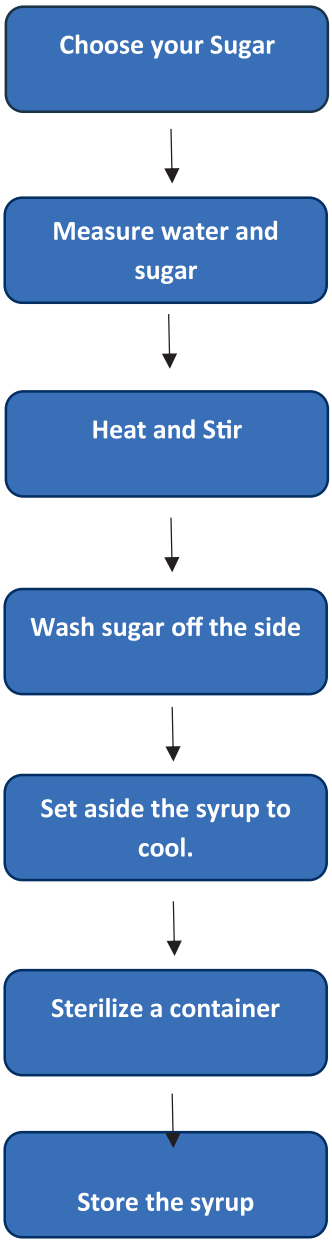


Fig. 3.48 Sugar Syrup Preparation

Fig. 3.49 Sugar Syrup Preparation

Checking the concentration of Sugar

In the beverage, confectionery, and canned product industries, sugar is mostly processed as an aqueous solution or syrup. Therefore, the first stage of the process is the preparation of the standardized sugar syrup.

To obtain a uniform product quality, one needs to control the sugar concentration as too much or too little sugar affects the composition of the product.

The precise and rapid in-line measurement of sugar syrup can be done by a refractometer. A refractometer is an instrument for measuring refractive index which is widely used for measuring sugar concentration. It is easy and quick and requires only a few drops of sample liquid in the main prism and the percentage value is immediately read outshining a beam of light through a sample of liquid, the refractometer measures the total soluble solids in a liquid.

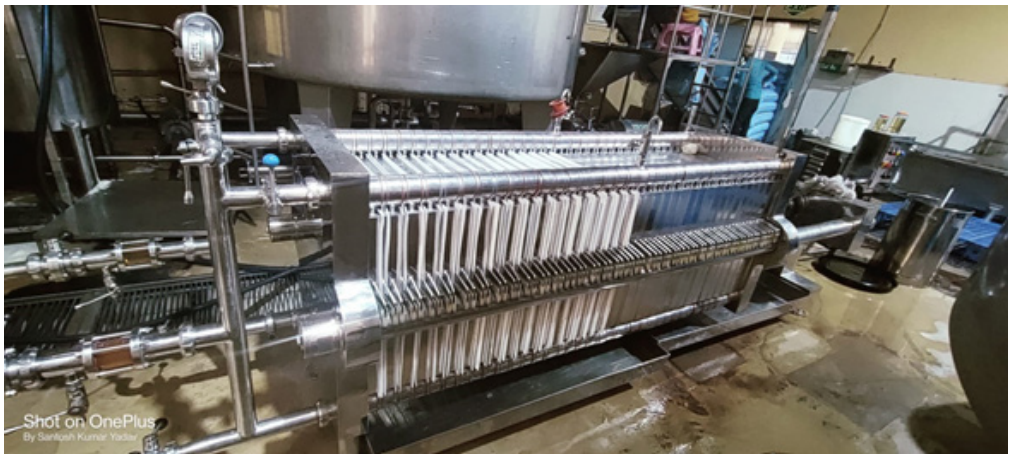


Fig. 3.50 Filters for Cleaning Sugar Syrup

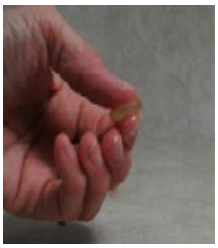
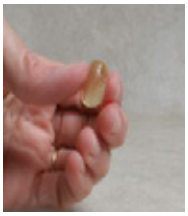
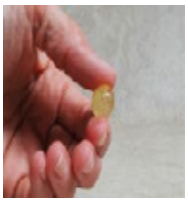
Stages of Sugar Cookery

Making Sugar Syrups and caramel always begins with heating and melting ordinary granulated sugar and recrystallizing it according to to need. During the heating process, the sugar first dissolves into syrup. As the temperature gets higher the syrup begins to thicken. As the temperature continues to rise and the water evaporates, the sugar begins to caramelize and turn a darker colour.

As long as, there is a lot of water in the syrup mixture the temperature will not raise much above the boiling point. As the water begins to evaporate the temperature of the mixture also begins to rise. As the water continues to evaporate, the temperature continues to rise. When most of the water has evaporated the temperature of the syrup will begin to rise rapidly. At 320oF(160°C) there is no water left, the sugar is melted and begins to caramelize, and the sweetness starts to decrease. The hotter the caramel gets the darker it becomes, and the deeper and less sweet the flavour becomes.

Formally the sugar syrup undergoes 6 distinct stages or forms when it has been boiling from room temperature to the utmost temperature of 320 degrees Fahrenheit (160°C).

These "stages" of sugar cooking are given in the following table -

Stage	Fahrenheit (ºF)	Celsius (ºC)	Sugar Concen-tration	Appearance and uses
Thread 	223 -234	106-112	80%	It is a test of how hot sugar syrup is, and of how much water is left in it. At this point of heating, the sugar concentration in the syrup is 80%. The syrup will form a loose thin thread. Used for making sugar syrups.
Soft Ball 	234 –240	112-115	85%	At this point of heating, the sugar concentration in the syrup is 85%. To test this stage a small amount of the sugar syrup could be dropped from a spoon into a cup of cold water. If the stage has been reached, the syrup will form a soft, sticky ball that can be flattened when removed from the water. Used for caramels, fudge, pralines, fondant, and butter creams.
Firm Ball 	242 – 248	116-120	87%	At this point of heating, the sugar concentration in the syrup is 87%. To test this stage a small amount of the sugar syrup could be dropped from a spoon into a cup of cold water. When taken out from the water, the syrup will form a firm but pliable, sticky ball that holds its shape briefly. Used for caramels, butter creams, nougat, marshmallows, gummies, and toffees.
Hard Ball 	250-266	122-130	92%	At this point of heating, the sugar concentration in the syrup is 92%. When a small amount of the sugar syrup from a spoon is dropped into a cup of cold water the syrup will form a firm ball (clump). When taken out from the water, the syrup will form a hard, sticky ball that holds its shape. Used for caramels, nougat, divinity and toffees.
Soft Crack 	270 – 290	132-143	95%	At this point of heating, the sugar concentration in the syrup is 95% The syrup will form strands that are firm yet pliable. Used for butterscotch, firm nougat, and taffy.

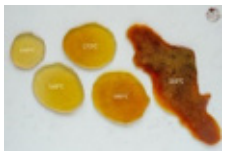
Stage	Fahrenheit (ºF)	Celsius (ºC)	Sugar Concen-tration	Appearance and uses
Hard Crack 	295-310	146- 155	99%	At this point of heating, the sugar concentration in the syrup is 95% The syrup will form threads that are stiff (brittle) and break easily. Used for brittles, toffees, glazed fruit, hard candy, pulled poured and spun sugar.
Clear Liquid 	320 °F	160°C	100%	At this temperature, all the water has boiled away. The remaining sugar is liquid and light amber.
Brown-liquid Caramel 	320-360	160-185	100%	The syrup will become transparent and will change colour, ranging from light golden brown to dark amber. Used for pralines, brittles, caramel-coated moulds, and nougatine.
Burnt Sugar 	350°F	177°C	100%	The sugar begins to burn and develops a bitter, burnt taste.

Table 3.3

3.2.3.2 Traditional Method of Making Gulab Jamun

This small-scale batch method is adopted by milk confectioners (halwais). Dhap khoa, having about 40-45% moisture, is used for making gulabjamun. The method involves the proper blending of 750 g khoa, 250 g maida, nuts, and 5 g baking powder to homogenous and smooth dough. A small amount of water can be added in case the dough is very hard and does not roll into smooth balls. The mix should be prepared fresh every time. A piece of good quality current (kishmish) or cashewnut may be placed in the centre of the dough and then rolled into smooth balls. The balls of the required size (normally in the range of 10-15 g) are formed from the dough and deep fried in ghee (vegetable/vanaspati) in a karahi to golden brown colour. The temperature of the frying medium is maintained at about 125o C and balls take about 15-20 min for proper frying. It is necessary to turn balls up and down during frying to avoid localized burning. Subsequently, the balls are transferred to 60% sugar syrup maintained at about 60o C. It takes about 30 min for the balls to completely absorb the sugar syrup. For preparing sugar syrup, equal quantities of sugar and water are boiled for about 10 min. The dirt or froth collecting on the surface of the syrup is removed with a strainer. Sometimes even raw milk (about 50 ml for one litre of syrup) is added to boiling syrup for better refining of syrup.

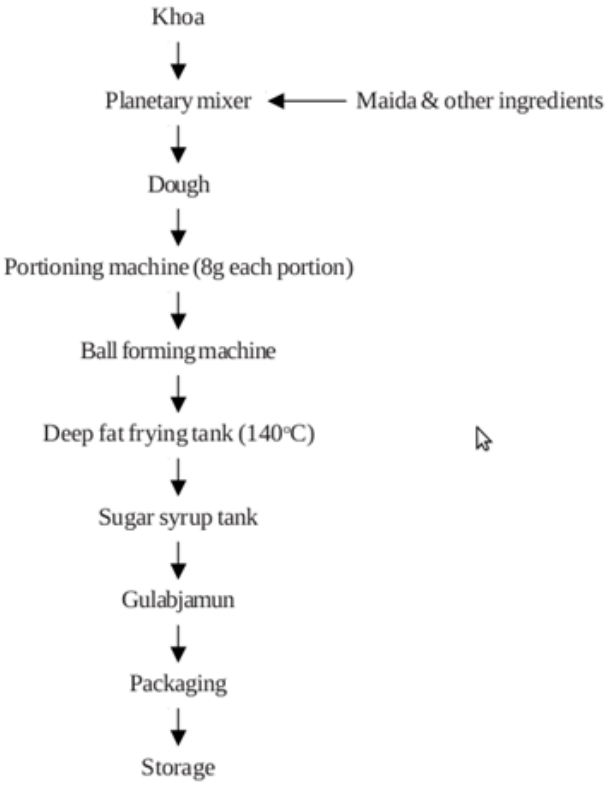


Fig. 3.51 Production Plan of Gulab jamun

3.2.3.2 Mechanized Method

New technology has been developed for the industrial production of Gulab Jamun using an assembly-line system. The flow diagram of this mechanized method is presented below. First of all, the raw materials are cleaned, sorted, and grind. Khoa with 35-40% moisture is mixed in a planetary mixer or kneader with about 20% maida(bleached wheat flour) and 0.5% baking powder and nuts. The dough of homogenous consistency is prepared by sufficient blending, which can be judged by the formation of smooth balls without surface cracks. In a portioning machine, the dough is divided into 8 grams

portions. These dough portions are conveyed to the Extruder. Here balls are shaped like a cylinder and are carried to a frying vat containing edible oil at a temperature of 140o C. After proper cooking, the balls are shifted to a sugar syrup tank containing syrup of about 60o Brix. After proper soaking, indicated by settling of balls at the bottom of the syrup, the Gulab Jamun balls are packaged in plastic containers along with an appropriate amount of hot syrup. Then the plastic cups are heat-sealed with lids.

Fig. 3.52 Machine used for making balls of Gulab Jamun from dough

3.2.3.3 Analysis of the Gulab jamun

To check the correct texture, one ball is cut and examined for its porosity. If there is insufficient porosity, a small quantity of baking powder dissolved in a small amount of water is added to the dough and remixed. If the balls are too porous, a small quantity of flour is added, and the test-frying is repeated.

The gulab jamun balls are deep-fried until it attains golden brown colour, any colour which is less or more than this texture will be seen as under-fried or over-fried balls respectively.

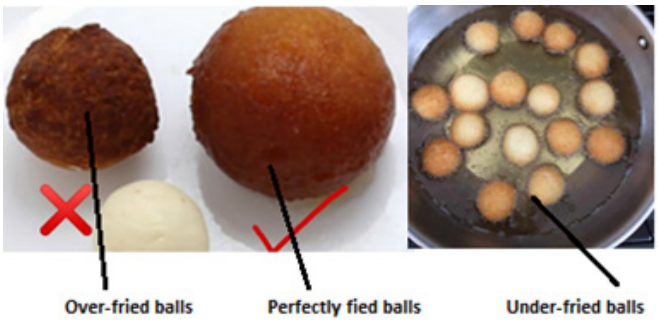


Fig. 3.53

The composition of gulab-jamun is 10% fat, 6% protein, 42% sugar, and 14% other solids. The Bureau of Indian Standards has the following specifications for gulab-jamun: Moisture (maximum) 30%, milk fat (minimum) 8%, and protein (minimum) 8%. The concentration of sugar in syrup (minimum) 62.4°Brix.

3.2.4 Milk Cake

Milk cake resembles kalakand except for its colour and flavour. The colour of milk cake is more intense brown with horizontal layers of white or light brown. It has a distinct caramelized flavour and large size hard grains with a typical gummy texture. Though milk cake is consumed all over the country, particularly in northern parts it has more preference.

Fig. 3.54

Composition of Milk Cake

The average percentage composition of milk cake prepared by a standard method is moisture, 15.83; fat, 21.32; protein, 11.38; lactose, 7.67; sucrose, 40.46 and ash 2.29.

Method of Preparation of Milk Cake

Milk cake is essentially prepared on small scale by adopting the batch method by the milk confectioners. Each confectioner has his method based on experience and market demands. A standard method developed for preparing milk cake of consistent quality is shown in Fig. below.

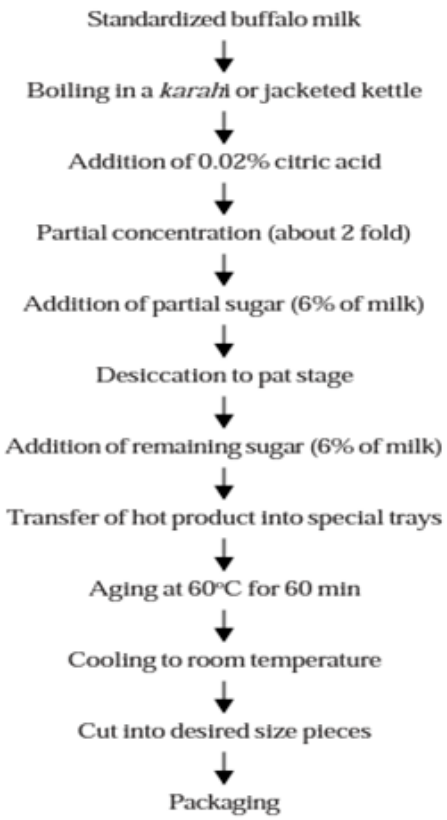


Fig. 3.55 Flow diagram for preparation of milk cake

In the method shown above, buffalo milk has 6% fat and 9% SNF with an acidity level of 0.18% preferred. Sugar is added @ 12% of milk at two stages, i.e. half the sugar on achieving about 2-fold concentration and the remaining half at pat stage formation. The product in hot condition (about 80-85oC) is transferred into designed aluminium trays with about 3-4 cms depth and kept at 60oC. This enables the product to remain in hot condition for a longer time so that caramelized flavour and intense brown colour are developed in the centre whereas light brown colour remains outside. The length of exposure to this temperature (60oC) depends on the intensity of colour required. Like kalakand, milk cake can also be prepared from Danedar khoa, but the quality of the product is not as good as that obtained directly from milk.

3.2.5 Besan Namkeen

Savoury are foods that are not consumed as a main meal but are eaten to maintain an energy balance between meals, or because of their taste and enjoyment.

- Namkeen is a Hindi term that means "savoury flavour."
- Namkeen is a derivative of the word Namak (meaning salt).
- Namkeen is a term that refers to savoury snack items in general.
- Both black and regular white salt are used in Indian cooking, which gives it the salty flavour many people like.
- Other namkeen snacks common in Indian cuisine include khaara, farsan, chivda, sav, chips and bhujiya.
- Namkeen foods are typically designed to be portable, quick, and satisfying.

3.2.4.1 Raw Materials Required

- Besan
- Oil
- Spices
- Dal
- Peanut
- Potato

Fig. 3.56

3.2.4.2 Raw Material Description

- BESAN is a product obtained by grinding, dried and decuticled Bengal Gram (L: Cicer arietinum).
- Besan is a bengal gram flour widely consumed in India.
- It is yellowish and possesses characteristic Bengal gram taste and smell.
- Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 per cent of the total pulse production.

3.2.4.3 Raw Material Aspects

- The Besan is obtained from Bengal gram.
- The colour of the gram seeds is brown.
- On one end, they're pointed, and on the other, they're spherical.
- The thick seed coat protects the seed.
- The seed coat is made up of two layers: the brownish testa on the outside and the papery white membranous tegmen on the inside.

3.2.4.4 Technologies

1. Extrusion and frying

- it is the most popular food processing method in preparing snacks like Namkeen.
- extrusion and frying refer to the frying of this extruded food product.
- this process involved the shaping of food through specific shape die.
- The extruded food is then cut to a specific size by blades.
- the extruded material is then fried in a frying machine.

Fig. 3.57

Extrusion Process of Savoury Making

Extrusion is a process used to create products of a fixed cross-sectional profile. Food extrusion is a form of extrusion used in food processing. It is a high-temperature short-time (HTST) process. It is a process by which a set of mixed ingredients are forced through an opening in a perforated plate or die with a design specific to the food and are then cut into a specific size by blades. The machine which forces the mix through the die is an extruder. The mix which is obtained is known as an extrudate.

The extruder consists of a large, rotating screw which is fitted to a stationary barrel, at the end of which is the die.

Extrusion enables the mass production of food by a continuous, efficient system that ensures uniformity of the final product. Food products manufactured using extrusion usually have a high starch content. These include some pasta, bread, many breakfast cereals and ready-to-eat snacks, confectionery, premade cookie dough, some baby foods, full-fat soy, textured vegetable protein, some beverages, and dry and semi-moist pet foods.

Extruders are composed of five main parts. They can vary with respect to screw, barrel and die configuration. The selection of each of these items will depend on the raw material used and the final product desired

(i) Pre-conditioning: Pre-conditioning is done with steam or water and mixed manually. This is applied when moisture contents are around 20 to 30% and long residence times of the material are used. Preconditioning flavours uniform particle hydration, reduce retention times within the extruder and increases throughput, due to a reduction in the wearing of barrel and screw components increasing the life of the equipment and reducing the costs of energy involved in the process

(ii) Feeding system: Feeding of raw material into the extruder should be constant and non-interrupted for efficient and uniform functioning of the extrusion process.

(iii) Screw: Screw conveys material into the extruder barrel, shearing and ensuring final product quality.

(iv) Barrel or sleeves: It is divided into feeding, kneading and sleeves they are often jacketed to permit the circulating of steam or superheated oil for heating or water or air for cooling, thus enabling the precise adjustment of the temperature in the various zones of the extruder

(v) Die and Cutting mechanism: The die presents two main functions: give shape to the final product and promote resistance to material flow within the extruder causing an increase in internal pressure. The die can be present in various designs and several orifices. The cutting mechanism must permit obtaining final products with uniform size. Product size is determined by the rotation speed of the cutting blades. This mechanism can be horizontal or vertical.

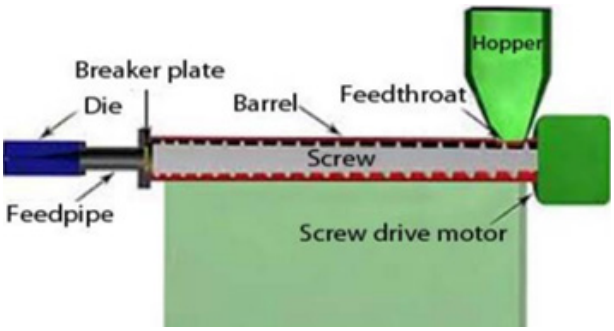


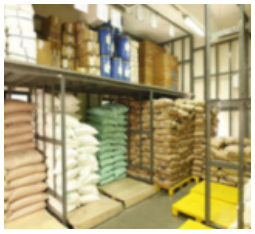
Fig. 3.58

2. Cooking extrusion

It's a food processing method. Raw food Mix is cooked within the barrel of the cooking extruder. This results in high temperature & pressure of food mix. The pressure gradient generated immediately after extrusion results in the Puffing of food. Therefore, this process is widely used for puffed snacks.

Fig. 3.59

3.2.4.5 Manufacturing Process



1. Raw material

- Raw materials are procured from the local vendor.
- All raw materials are placed in the inventory

2. Kneading

- Raw materials for the dough are fed to the kneading machine
- The kneading Machine kneads fed raw material into the dough.

3. Extrusion

- Prepared Dough is then fed to Namkeen Extruder
- The appropriate die is mounted as per the shape required

4. Frying

- Extruded product lands into the frying tank of the Frying Machine
- Namkeen Frying Machine fries various Namkeen components
- Mostly different components are fried separately

Fig. 3.60

5. De-oiling

- After frying, they are passed through the de-oiling machine.
- It removes most of the excess oil & makes the product dry.

Fig. 3.61

6. Mixing

- Most seasoning machines can perform both mixing & seasoning
- Tough many large scale players use separate machines

Fig. 3.62

- In either case, namkeen are initially mixed & then seasoned

7. Packaging

Namkeen is then weighed & packed using the appropriate machines

Fig. 3.63

8. Weighing machine

Used for weighing the raw material and ingredients.

Fig. 3.64

Fig. 3.65

3.2.6 Potato Chips

Manufacturing Process The simplest chips of the kind that are just cooked and salted, but manufacturers can add a wide variety of seasonings of herbs, spices, cheese or artificial additives. Potato wafers are manufactured in mechanized plant under hygienic conditions for the snack foods market. Fully grown and ripe potatoes are generally received for storage at the plant in sacks. The production process mainly comprises the following steps:

1. Washing and Peeling – The potatoes are first thoroughly washed before peeling them with the help of a peeler. They are fed to a peeler where high-speed abrasive rotating discs remove the skin. Then these potatoes are trimmed and put in brine water for 30-35 minutes to prevent browning.
2. Slicing and Blanching – Afterwards they are cut into the required sizes on the slicing machine. These slices are blanched in boiling water.
3. Drying and Frying – Then the blanched potatoes are placed on drying trays which are then put in the drying machine. The temperature of the dryer is maintained in the range of 140 to 150 0F. After drying, they are fried in edible oil to make them crisp and brown.
4. Packaging – The fried potato wafers are then kept on the sieve to remove excess oil, cooled and other ingredients like salts, and the spicy mixture is sprayed as per the required taste. Cooled potato wafers are then packed in a polythene bag.

Fig. 3.66

3.2.6.1 Process Flow diagram

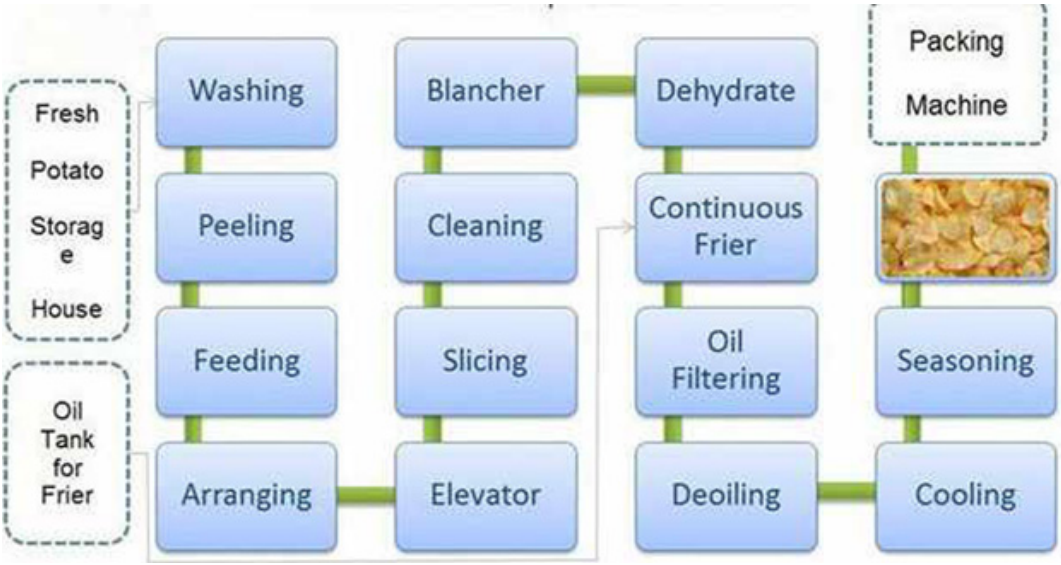


Fig. 3.67

3.2.7 Pallet Fried Snacks

Fig. 3.68 Snacks Pallets Processing Line

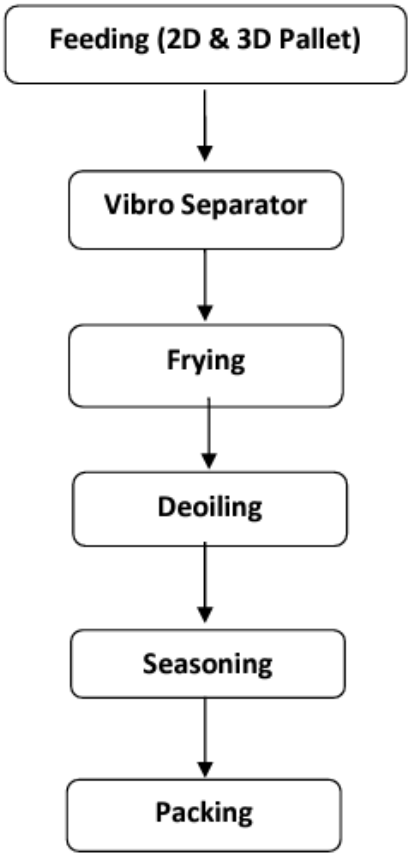


Fig. 3.69

3.2.7.1 Pallet fried snacks production line

Fig. 3.70

1. **Vibratory feeder with hopper**

   Vibratory feeder with buffer hopper to feed raw material into frying system, for separating fine extraneous material through sieving system. Hopper volume: 275 litres.

2. **Continuous frying system with heat exchanger**

   The complete system consists of a frying section and peddles, a sub-merger belt, a top hood, a takeout belt, an oil filter, heat exchanger. The flow of oil ensures a linear flow of oil, which is necessary to have a uniform frying time for the entire product. Heat Exchanger It is coil type-seamless stainless steel tubes fitted in ms shell, the oil is heated by hot air not direct flame in coils which have an inlet system from one end and heated oil will be coming out from the other end and will go to the fryer. Whole burnt fuel used in this system gives more than 55% saving in fuel.

3. **De-oiling conveyor**

   The conveyor receives pellets from the fryer and transports them to further process. It allows the product temperature to come to equilibrium and thus removes excess surface oil, and belt speed regulation by VFD. The entire construction is of stainless steel except for the standard parts. The feeder receives fried pellets from the takeout belt and feeds to the flavouring drum the feeding speed can be controlled by a VFD. A tray is also fitted on the top of the feeder where dry flavour falls from the applicator.

4. **Flavour applicator and drum**

   Technical Specification of flavour applicator and drum Applicator motor: 1 HP 3 phase Drum length: 1500 mm Drum diameter: 800 mm Drum motor: 1 HP 3 phase.

5. **Control panel**

   The electrical control panel is the hub of all starters, temperature control and variable frequency drives for the operation of equipment. Technical specification of control panel Supply voltage: - 415 volts, 50 Hz, 4 wires. Technical specification of pellet fryer Required space: 30 x 15 feet Fuel: Diesel/ Kerosene, Gas, Thermic fluid or wood Material of construction: AISS-304 grade stainless steel.

3.2.8 Handling and Disposal of Used Cooking Oil

Edible vegetable oils are used in the frying of foods. During frying, the quality of the oil deteriorates. Using the same oil for frying repeatedly leads to changes in the physicochemical, nutritional and sensory properties of the oil. It also leads to the formation of Total, Polar Compounds (TPC), which makes the oils, unfit for human consumption beyond certain limits. Reports have associated these compounds with several diseases to several diseases such as hypertension, Atherosclerosis, Alzheimer's disease, liver disease etc.

RUCO Program -A major initiative has been taken by the government to reuse cooking oil by emphasizing the RUCO program, under this program vegetable oils, animal fats or restaurant grease that has already been used in cooking is converted into biodiesel for running diesel vehicles, or indeed any equipment that uses diesel.

Impact of RUCO

RUCO will help bring:

- Health benefits by avoiding ill effects of UCO
- Employment generation and economic growth
- Infrastructural investment in Rural Areas
- Cleaner environment with a reduced carbon footprint
- Reduction of import dependency (Palm Stearin)

Guidelines in Food Safety and Standards as per Industry

S.No.	Standards to be followed
1	Reuse of cooking oil should be avoided.
2	In the case of reheating of oil, use maximum of three times to avoid the formation of trans fat. It is ideal to use it once, if possible.
3	Re-heating and reuse of oil should be avoided as far as possible. Avoid using leftover oil wherever possible.
4	The vegetable oil has developed a Total Polar Compound of more than 25% shall not be used

Table 3.4

Disposal of Unused Cooking Oil (UCO)

At present, UCO is either not discarded at all or disposed of in an environmentally hazardous manner choking drains and sewerage systems. Also, UCO from organised Food Business Operators (FBO) reportedly finds its way to small restaurants/dhabas and roadside vendors which may lead to adverse health effects.

Procedures to be followed for handling and disposal of UCO

1. **For small FBOs**
    - Do not use the same oil more than three times. It is ideal to use it only once.
    - Used cooking oil should be filtered frequently to remove food particles.
    - UCO should be disposed of when blue-grey smoke appears or tough foam gets formed or oil becomes dark and murky or the consistency of oil changes. These are some of the indications that the quality of oil has deteriorated.
    - Do not dispose of the discarded oil in drains/sewerage systems.

- UCO should be discarded in an environment-friendly way preferably by providing it to the authorized UCO aggregators/collection agencies that are registered with authorized agencies such as States Biodiesel Boards, Biodiesel Association of India and other agencies nominated by the state government to mention such oil for the manufacture of biodiesel or any other industrial purpose
- Keep UCO away from flame, gas cylinders etc.
- FBOs should refrain from buying UCO for manufacturing their food products.

2. For big FBOs

- Cooking oils have developed Total Polar Compounds beyond the limit of 25% are hazardous waste. Discard such edible oil.
- Keep the discarded oil in a separate container once it is cooled. Keep headspace while filling. Always label the container to avoid cross-contamination.
- Do not transfer hot oil to avoid the chances of spilling and injury.
- Transfer the used cooking oil safely into the collecting drums provided by an authorized collection agency.
- Keep used cooking oil away from flame, gas cylinders etc.
- UCO should be discarded in an environment-friendly way preferably by providing it to the authorized UCO aggregators/collection agencies that are registered with authorized agencies such as States Biodiesel Boards, Biodiesel Association of India and other agencies nominated by the state government.
- All Food Business Operators should train their staff responsible for handling and disposal of used cooking oil regarding procedures prescribed in this document
- All FBOs whose consumption of edible oils for frying is more than 50 Kg or litres per day shall maintain the following record:

Date	Name of oil	Quantity of oil used in frying	The quantity consumed at the end of the day	Quantity discarded at the end of the day	Mode and date of disposal of used cooking oil	Used cooking oil collected by (name of the authorised agency)
-	-	-	-	-	-	-

3.2.8 Quality analysis of Traditional snack and savoury products

3.2.8.1 Foreign Object Detection in the Food Industry

Nowadays food producers have many options when it comes to the detection of foreign objects from food production lines. What are the factors you should focus on when deciding between different inspection systems?

First off, let's determine what is a food safety hazard. According to the Food and Drug Administration's (FDA) "HACCP Principles and Application Guidelines" a hazard (meaning a risk to safe food) is "a biological, chemical, or physical agent that is reasonably likely to cause illness or injury in the absence of its control."

How to detect hazardous foreign objects in food production?

Physical agents (a.k.a. foreign objects or bodies) are any undesirable, solid objects in food. They can be divided into hazardous or non-hazardous contaminants.

For example, non-hazardous contaminants such as hairs or paper (although unpleasant) will not endanger or injure the consumer if found in the food product.

Contaminants such as metals, glass, and stones are classified as hazardous foreign objects. Detecting hazardous foreign objects in food products requires a Critical Control Point (CCP) that inspects each food product and automatically rejects contaminated ones from the production line.

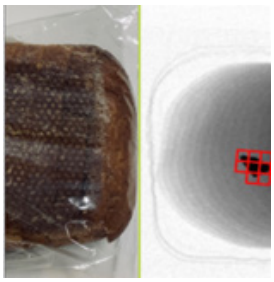


Fig. 3.71

3.2.8.2 Food Testing Parameters Specific to Sweets and Savoury

The physicochemical properties of foods (e.g., rheological, optical, stability, flavour) are indicators of food quality, sensory, and safety. Understanding the physiochemical characterizations of foods is not only essential for food preservation and food quality assessment, but also important for consumers' health.

- **Product weights, volumes, and dimensions**

  Labelling of product weights, volumes, and dimensions are vital for the control of product quality. The labelled weight, volume, and/or dimension are expected to accurately reflect what is in the package.

- **Water activity (Aw)**

  Water activity (Aw), which determines how much water is available for microbial growth, can affect food odour, colour, flavour, texture, and shelf-life. The chance for microbial spoilage is reduced with lower Aw. The Aw can be measured using a water activity meter where the Aw value for pure water works as a standard.

- **Moisture**

  Moisture content in food is important for food quality measurements, food yield, and shelf-life determination, as well as legal labelling requirements. Karl Fischer method, distillation method, dielectric method, hydrometry method, refractometry method, oven drying method, dynamic vapour sorption method, etc. are some tests to measure moisture content.

- **Structure**

  The food structure can influence food texture. For example, the bubble structure can affect the softness of aerated foods and bakery products, as well as the crispiness of starch-based snacks. Scanning electron microscopy, X-ray micro-CT, light, confocal laser scanning microscopy, etc. are used to determine the structure of food qualitatively and quantitatively.

- **Texture**

  Food textural attributes, such as hardness, fracturability, compressibility, shear force, and springiness, are important attributes for food sensory. They can affect the way food tastes and how it feels in the mouth.

- **Rheological properties**

  The rheological properties of food materials are important in determining the texture as well as their behaviour when subjected to physical forces. For instance, margarine should be spreadable when it is carried out of a refrigerator, while it must be hard enough to withstand its weight.

- **Particle size**

  Particle size determination, including machine sieve screening, laser diffraction, and static light scattering is used for particle size determination of food products

- **Colour**

  The colour of foods is an important criterion for food quality evaluation, and colour measurement is used to predict visual and chemical changes in foods. The most widely used method for colour measurement is the Hunter “L a b” system, where “L” represents lightness (100)/darkness (0); “a” is positive with redness and negative for greenness; “b” measures yellowness when "positive" and blueness when "negative".

- **Viscosity and consistency**

  Viscosity measures the flow resistance in soups, beverages, shake mixes, and syrup solutions. Consistency measures the distance that a sample flows in a predefined time interval.

- **Temperature**

  Accurate temperature measurement is important for the monitoring of food safety and food quality.

- **Brix Value**

  Brix value refers to the concentration of soluble solids which is measured by a refractometer and is equivalent to the percentage by weight of sugar. Brix is an important parameter during the production of fruit juices, jams, and jellies. Brix is also important in controlling microorganisms in foods. The higher the Brix value is, the less water is available for microbial growth, as the sugars are bound to the free water.

- **pH -Acidity**

  The pH is an indicator of the amount of acid or base present in a food. The pH level can not only affect the growth of microorganisms, but also affect the flavour, colour, and texture. The pH of food products can be measured using a pH meter.

- **Fat /oil quality and content**

  Fat /oil quality and content depend on the composition, size, type of processing, and type of oil used in the product. A deficiency of fat can cause off-odour or off-flavour in foods, while higher-fat products are more susceptible to rancidity. Rancidity can be detected by the peroxide value, thiobarbituric acid (TBA) reactive substances assay, Schaal test, or smoke point.

- **Thermal properties**

  Thermal properties include melting point, boiling point, vapour pressure, degree of crystallization, and glass transition temperature. Thermal properties can be analyzed by thermal analysis techniques such as differential scanning calorimetry (DSC).

- **Salt**

  The salt content refers to the content of inorganic anions and cations left after food combustion, which can be determined by liquid-chromatographic techniques.

3.2.8.3 Food Sampling

Food sampling is a process of drawing a sample/a small portion of food which is representative of a lot of food testing and analysing, intended to show the nature and quality of the whole specimen. A food sample is normally drawn to check the safety and standards of the food products.

Sampling procedures shall be established and documented. The following shall be included as a part of the sampling procedure

1. The sampling equipment and type of sample container to be used
2. The method and frequency of sampling
3. Sample storage and handling requirements before testing, e.g. to minimize separation of mixed powders
4. The number of samples required
5. Any special precautions to be taken to maintain the homogeneity of the sample
6. Instructions for any subdivision of the sample
7. The cleaning and storage of sampling equipment and reusable containers
   - o Simple containers shall be clearly labelled with the contents, sample identification number, lot number and date sampled.
   - o Tables or notes used for the calculation of the sample requirements shall be documented.

Unit 3.3 – Canning, Packaging, Labelling, and Post-Production Maintenance of Equipment

Unit Objectives

At the end of this unit, you will be able to:

1. Demonstrate canning and can-making equipment
2. Demonstrate Packaging and its packaging types
3. Identify types of food packaging machines
4. Define Labelling and FSSAI food labelling guidelines
5. Define quality control in the food industry
6. Identify various sweet and savoury testing parameters
7. Define GHP/GMP Principles
8. Maintain records related to sweet and savoury production
9. Demonstrate cleaning and sanitizing program
10. Demonstrate cleaning in place (CIP) and cleaning out of place (COP)
11. Define standard practices for storing tools and equipment

3.3.1 Introduction to Packaging

Packaging is an important part of the food manufacturing process. It protects food products from physical, chemical, and biological damage. Without packaging, materials handling would be a messy, inefficient and costly exercise and modern consumer marketing would be virtually impossible.

Packaging Institute International defined packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or another container form to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. If the device or container performed one or more of these functions, it was considered a package.

There are many ways of defining packaging reflecting different emphases. For example:

- A means of ensuring safe delivery to the ultimate consumer in sound condition at optimum cost.
- A coordinated system of preparing goods for transport, distribution, storage, retailing and end-use.
- A techno-commercial function aimed at optimizing the costs of delivery while maximizing sales (and hence profits).

3.3.1.1 Purpose of Packaging

Today's consumer is not only looking for value in the products they purchase but convenience in packaging functionality. When people buy an item at their local grocery store, they are more concerned about what's wrapped inside the packaging than the packaging itself. Many reasons are considered for using packaging on a given product such as display, convenience, handling, sale, security concerns, barrier protection, physical protection, information transmission, agglomeration or containment, marketing and finally portion control. Product packaging plays an important role in the marketing success or failure of many products, especially for non-durable consumer products.

Food packaging is the enclosing of food for protection from:

- Environmental factors that may cause contamination, damage, or decay in the process of transport, storage or selling
- Intentional modification of the product, or what is known as tampering.

In addition to protection and preservation – and thus maintenance of the food's shelf life – food packaging is used for containing the foods, providing information about the ingredients and nutritional aspects of its contents, and providing convenience for customers during usage and consumption.

Packaging depends on the type of food being packaged, and it varies over a wide array of materials and forms.

Needs / Wants of consumers from packaging

- Providing consumers with ease of meal preparation.
- Delivering a choice in cooking methods.
- Maximizing shelf life.
- Portion control.

Purpose of Packaging

Food packaging serves many important purposes. They may be broken down as follows.

- Containment: For granulated items, paper-based packages are the best, with a sealing system to prevent the infiltration of moisture into the product. Other products are packaged using metal cans, plastic bags and bottles, and glass containers. Another factor in containment is packaging durability—in other words, the packaged food has to survive transport from the food processing facility to the supermarket to the home for the consumer.
- Protection: The packaging must protect the food from (a) biological agents such as rats, insects, and microbes; (b) mechanical damage such as product abrasion, compressive forces, and vibration; and (c) from chemical degradation such as oxidation, moisture transfer, and ultraviolet light.
- Communication: Packaged food must be identified for consumer use, mainly with label text and graphics. It can also be done by using special shapes for the food package, such as the Coca-Cola bottle or the can of Spam. Other well-known food package shapes include potato chip bags and milk bottles. These packages also detailed nutritional information, and whether they are packaged according to kosher or halal specifications. The label may also indicate whether it is safe to put the packaged food (such as a TV dinner) through a microwave process.

Fig. 3.72

- Environmental issues: To protect the environment, we must be willing to reuse or recycle the packaging or reduce the size of the packaging.
- Package safety: Before using a particular type of package for food, researchers must ensure that it is safe to use that packaging for the food being considered and that there are no adverse interactions between the package and the food. This includes any metal contamination issues from a can to the food product or any plastic contamination from a bottle to the food product.
- Product access: The packaging must be such that the product is readily accessible when the consumer is ready to use it. For example, pouring spouts on milk cartons can make it easy to dispense the milk.

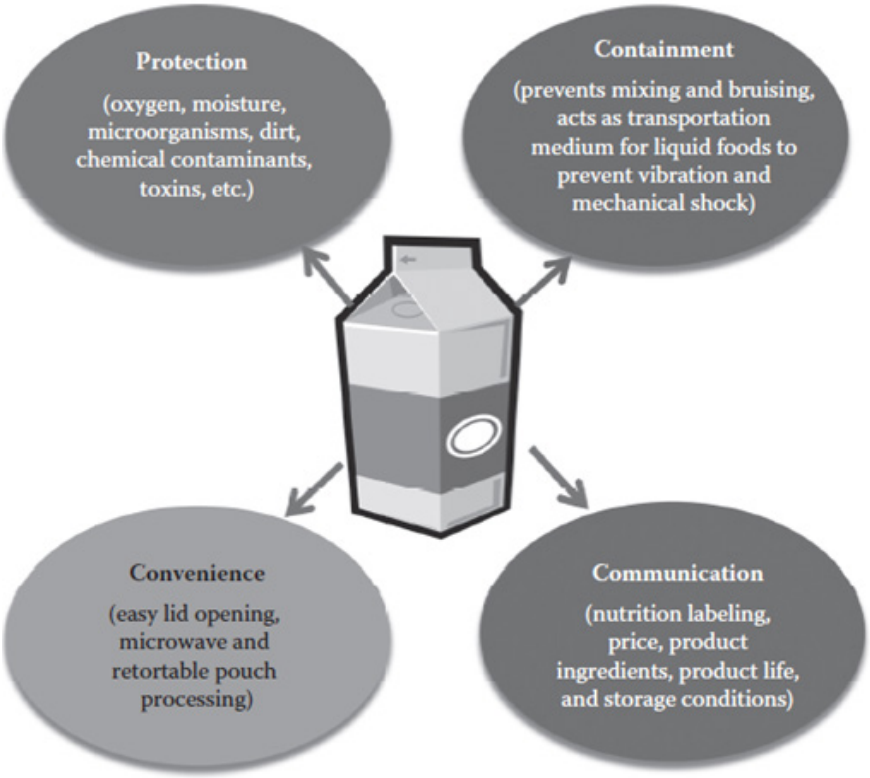


Fig. 3.73 Purpose of food packaging.

3.3.1.2 Types of Food Packaging

Packaging materials come in different shapes with various functions relative to their properties. The packaging material needs to have a balance between its shape and its function. Given the packaging's main purpose of preservation, containment, and protection of food, the packaging material can be rigid, flexible, or semi-flexible.

1. Primary Packaging

The primary package is those packages which directly came into contact with food products. It provides the first or initial layer of protection for food products. Examples of primary packaging include parchment paper, greaseproof paper, paperboard cartons, and plastic pouches.

2. Secondary Package

The secondary package is the package which surrounds or contains the primary package. Ex. Corrugated case, Boxes

3. Tertiary Package

It contains several secondary packages together. Mainly used for bulk handling of food products.

3.3.1.3 Canning

Canning is the method of packaging sweet and savoury food products. Preservation of food materials in a closed container by using heat as an agent to destroy microorganisms and other spoilage agents is termed canning.

Canning Process

In the conventional canning process, there are basic steps that similar for almost all products. The steps outlined in these figures are intended for the basic processes in production. A typical commercial canning operation may employ the following general processes: washing, sorting/grading, preparation, container filling, exhausting, container sealing, heat sterilization, cooling, labelling/casing, and storage for shipment.

In these diagrams, no attempt has been made to be product specific and include all process steps that would be used for all products. In given below figure optional operations are shown as dotted line steps, that are often used but are not used for all products.

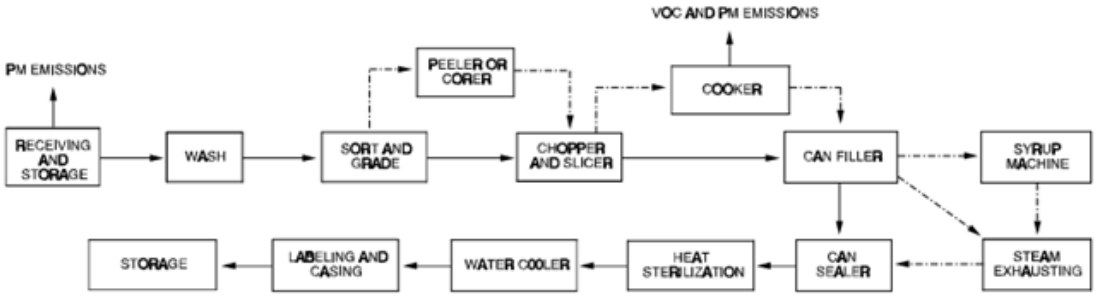


Fig. 3.74

3.3.1.4 Packaging Material for Khoa

Packaging of khoa and its products is mainly done to protect the products from the outside environment especially after the completion of the process so that products can retain moisture, flavour, and freshness for a longer period.

Fig. 3.75

1. **LDPE**
   - Low-density polyethene is heat sealable, inserts, odour free and shrinks when heated.
   - It acts as a barrier to moisture and has high gas permeability
   - It is less expensive, therefore widely used.
   - Has the ability of fusion welded to itself to give good, tough, liquid-tight seals.

2. Parchment Paper

Parchment paper is also used for the packaging and handling of khoa in the unorganized sector for a shorter duration. Parchment paper is a heavy-duty grease and moisture-resistant paper.

Fig. 3.76

3. HDPE

High container has been also used for packaging khoa and its products. The benefits of HDPE include:

- Weather-resistance
- Malleability
- Light-weight
- Cost-effective
- Hygienic Recyclable
- FDA-approved

Fig. 3.77

4. Aluminium Foil

Aluminium is used for packaging as it is highly malleable. It can be easily converted to thin sheets and folded, rolled or packed. The aluminium foil acts as a total barrier to light and oxygen odours and flavours, moistness, and is used broadly in food packaging, including long-life packs.

Fig. 3.78

5. Paper Board (White Lined Chipboard)

Mostly used for khoa and the packaging of its products because of the low moisture in the product.

- Recycled
- Economic
- Easy to print
- May take any shape
- Lightweight

Fig. 3.79

3.3.1.5 Some Recent Trends in Packaging

1. Modified Atmosphere Packaging

- MAP can be defined as the packaging of food items where the atmosphere inside the packet has been modified to increase the shelf life of food products. It involves active modification or passive modification.
- In an active modification, the air is displaced with a controlled, desired mixture of gases, and the process is called gas flushing.
- Passive modification occurs due to respiration and the metabolism of microorganisms associated with the food.

2. Active and Intelligent Packaging

- Active packaging is defined as packaging in which subsidiary constituents have been deliberately included in or on either the packaging material or the package headspace to enhance the performance of the package system.
- Intelligent packaging is defined as packaging that contains an external or internal indicator to provide information about the history of the package and/or the quality of the food.
- Various functions performed by intelligent packaging include Oxygen absorber, Carbon dioxide absorber or emitter, Ethylene absorber, Ethanol emitter, and Moisture absorber.

3. Aseptic Packaging

- Aseptic packaging is the filling of sterile containers with a commercially sterile product under aseptic conditions, and then sealing the containers so that re-infection is prevented; that is so that they are hermetically sealed.
- Aseptic packaging is used for
  a) To take advantage of high temperature.
  b) Increase the shelf life of food products at normal temperatures.
  c) In-package sterilization.

3.3.2 Labeling

Labelling is any written, electronic, or graphic communications on the packaging or on a separate but associated label. Display of information about a product on its container, packaging, or the product itself.

- Brand Identification - Labeling helps in the identification and principal place of business of the person by or for whom the prepackaged product was manufactured, processed, produced, or packaged for resale
- Description - Labels provide information regarding the food product. It describes the contents, nutritional values, cost, product usage methods, shelf life, etc.
- Promotion - Finally labels help in promoting the product through attractive and bright graphics replacing paper labels glued on cans and bottles.

It is very important to the identification of a product with the brand name and description. Labelling may help to become unique in the target customer audience and market the product directly to the customer. As well as it may include measures, ingredients, health and safety instructions, production and expiration dates, brand ownership, and contact information to communicate with the customer straightly. This guidance is very important to maintain customer service as a key function of marketing.

3.3.2.1 FSSAI Food Labelling Guidelines

1.	Name of the food	The name of the product should be mentioned on the label in clear format and font prescribed in the food labelling FSSAI rules.
2.	The List of Ingredients	The manufacturer should mention all the ingredients of the product fairly in making the final food product.
3.	Nutritional Information	FSSAI labelling rules mandate that the calorie-related information related to the food product must be mentioned on its label. Calories received from trans-fat, saturated fat, sodium, cholesterol dietary fibre, carbohydrates, protein, sugar, iron, calcium, vitamin A, and vitamin C contained in the product should be mentioned
4.	Declaration Regarding Non-vegetarian or Vegetarian	The label must have a small dot at the corner to indicate if the product is vegetarian or non-vegetarian. A red-coloured dot indicates non-vegetarian food, and a green-coloured dot indicates vegetarian food.
5.	Declaration Regarding Food Additives Used	Additives are substances added to a food product to enhance its appearance and/or taste and to preserve its flavour. The producer must make a declaration on the label regarding the additives used in the product.
6.	Name and complete address of the manufacturer	The manufacturer's name, complete address, and place of manufacturing should be mentioned at a prominent place on the label.
7.	Customer care details	The contact details of the customer support centre must be on the label
8.	Quantity	The net quantity or packaged weight of the food product must find a prominent mention on the label
9.	Retail Sale Price	The maximum retail price at which the product is on sale should be there.
10.	FSSAI logo and license number	The FSSAI logo and license number must be mentioned at a prominent place on the label.

11.	Batch no/Code no/lot no	These numbers provide authenticity about the manufacturer of the product and hence should mention on the label.
12.	Manufacturing Date and the Best Before/use-by date	The manufacturing date is the date on which the final product gets manufactured by clearing all the processes, and the Expiry Date is the date that tells about the last date of consuming the food product. If the consumption takes place after the Use-by or expiry date, then it can probably harm the health of the consumer.
13.	The instructions for use	The FSSAI labelling rules mandate that the producer must mention the instructions to use the product on its label.
14.	Country of origin (for imported food)	According to the FSSAI label rules, the nationality of the food must be mentioned on the labels of all imported foods. This will inform the consumers where the product has been grown, manufactured, or processed.

3.3.3 Recordkeeping

Another legal requirement is that food firms maintain records relating to the manufacture, processing, packing, distribution, receipt, holding, or importation of food products. The purpose is to assist in determining whether anything has happened to the food or been done to the food that would render it unsafe (i.e., adulterated). Accordingly, firms must maintain records and government authorities may access the records.

Manufacturing records -

The master manufacturing record must include:

1. The name of the dietary supplement to be manufactured and the strength, concentration, weight, or measure of each dietary ingredient for each batch size.
2. A complete list of components to be used.
3. An accurate statement of the weight or measure of each component to be used;
4. The identity and weight or measure of each dietary ingredient will be declared on the supplement Facts label.
5. A statement of any intentional overage amount of a dietary ingredient.
6. A statement of the theoretical yield of a manufactured dietary supplement expected at each point, step, or stage of the manufacturing process where control is needed to ensure the quality of the dietary supplement, and the expected yield when you finish manufacturing the dietary supplement, including the maximum and minimum percentages of theoretical yield beyond which a deviation investigation of a batch is necessary and material review is conducted and disposition decision is made.
7. A description of the packaging and a representative label, or a cross-reference to the physical location of the actual or representative label.
8. Written instructions, including the following:
    a) Specifications for each point, step, or stage in the manufacturing process where control is necessary to ensure the quality of the dietary supplement and that the dietary supplement is packaged and labelled as specified in the master manufacturing record.

b) Procedures for sampling and a cross-reference to procedures for tests or examinations.

c) Specific actions are necessary to perform and verify points, steps, or stages in the manufacturing process where control is necessary to ensure the quality of the dietary supplement and that the dietary supplement is packaged and labelled as specified in the master manufacturing record.

   i. Such specific actions must include verifying the weight or measure of any component and verifying the addition of any component;

   ii. For manual operations, such specific actions must include:

   - One person weighing or measuring a component and another person verifying the weight or measure; and
   - One person adds the component and another person verifies the addition.

d) Special notations and precautions to be followed; and

e) Corrective action plans for use when a specification is not met.

3.3.4 Control of Non-Conforming Product

- A non-conforming product can be detected through customer complaints, internal defect findings, internal audits, external audits, incoming material inspection or simply during normal testing and inspection activities.
- All rework/non-conforming/market-returned materials shall be segregated, identified, stored, handled, labelled, and used in such a way that product safety, quality, traceability and regulatory compliance are maintained.
- All Traceability records for rework shall be maintained.
- Stored rework/non-conforming/market-returned material shall be protected from exposure to microbiological, chemical or extraneous matter contamination.
- Where rework/non-conforming/market returned is incorporated into a product as an “in-process” step, the acceptable quantity, the process step and the method of addition, including any necessary pre-processing stages, shall be defined.
- Where-ever rework activities involve the removal of the product from filled packages adequate controls shall be put in place to ensure removal and segregation of packaging materials and to avoid contamination of the product with extraneous matter.
- The standard operating procedure should be defined and documented for handling any rework or non-conforming products.
- Additional inspection of reworked/reprocessed in-process or finished products is required and documented.

3.3.5 Cleaning and Sanitizing Program

The objective of cleaning and sanitizing food contact surfaces is to remove food (nutrients) that bacteria need to grow and to kill those bacteria that are present. The clean, sanitized equipment and surfaces must drain dry and are stored dry to prevent bacteria growth. Necessary equipment (brushes, etc.) must also be clean and stored in a clean, sanitary manner.

Detailed procedures must be developed for all food-product contact surfaces (equipment, utensils, etc.) as well as for non-product surfaces such as non-product portions of equipment, overhead structures, walls, ceilings, lighting devices, refrigeration units and heating, ventilation and air conditioning (HVAC) systems, and anything else which could impact food safety.

Cleaning/sanitizing procedures must be evaluated for adequacy through evaluation and inspection procedures. Adherence to prescribed written procedures (inspection, swab testing, direct observation of personnel) should be continuously monitored, and records maintained to evaluate long-term compliance.

The correct order of events for cleaning/sanitizing food product contact surfaces is as follows:

- Rinse
- Clean
- Rinse
- Sanitize.

3.3.5.1 Cleaning

Cleaning is the complete removal of food soil using appropriate detergent chemicals under recommended conditions.

Equipment can be categorized with regard to cleaning methods as follows:

(A) Clean-in-place (CIP) systems

Food establishments use CIP systems when the item being cleaned cannot easily be taken out of the assembly line. For example, items process piping, large vessels, and liquid processors are all best cleaned in place. A CIP system uses detergents and chemical cleaners to clean and sterilize items in the line, along with engineered turbulence to simulate scrubbing and cleaning out even the smallest nooks and crannies. A constant flow ensures that contaminants are carried away, and a final rinse removes any lingering detergents or cleansers. The chemicals involved can typically be reused.

(B) Clean-out-of-place (COP) systems

Food establishments typically use COP systems when cleaning items that are not easily cleaned in places – such as utensils, fittings, clamps, mechanisms, and hoses. They may need disassembly or reorientation or might require direct cleaning rather than an even flow or bath. In addition, COP systems may use immersion tanks and spray jets to create turbulence for scrubbing and sanitation purposes.

Which Is Better: CIP or COP?

While both systems use the same detergents and cleansers and are preferable to manual cleaning, which one should you use?

The deciding factor comes down to what needs cleaning. If your manufacturing process includes a lot of smaller, more complex assemblies that need to be taken apart and cleaned, a COP system is better. Conversely, a CIP system is ideal if your system is extensive and difficult to disassemble. Neither COP nor CIP is inherently better than the other; they both have their purposes. In the rare instance where you can choose one, a CIP system is considered better. COP systems typically require some manual work or cleaning and thus can introduce human error.

3.3.5.2 Sanitization

It is important to differentiate and define certain terminology:

- Sterilization refers to the statistical destruction and removal of all living organisms.
- Disinfect refers to inanimate objects and the destruction of all vegetative cells (not spores).
- Sanitizing refers to the reduction of microorganisms to levels considered safe from a public health viewpoint.

The official definition of sanitizing for food product contact surfaces is a process that reduces the contamination level by 99.999% in 30 sec.

General types of sanitizations include the following:

- Thermal Sanitization involves the use of hot water or steam for a specified temperature and contact time.
- Chemical Sanitization involves the use of an approved chemical sanitiser at a specified concentration and contact time.

3.3.5.3 Objective of cleaning/disinfection/sanitation

For all cleaning /disinfection/sanitation activities, the objectives of the cleaning should be clearly defined, e.g.:

- To control hazardous microorganisms.
- To control food chemical contamination and residues from cleaning/sanitation regimes.
- To control foreign body contamination.
- To control allergen cross-contact.
- To control ingredient/residue/colour/flavour at product changeover.
- To avoid pest infestation.
- To assure mechanical operations of equipment
- To assure occupational safety.
- To satisfy local regulatory requirements.
- To meet specific customer requirements.

3.3.6 What can go wrong with Cleaning and Disinfection?

Things can go wrong during cleaning and disinfection which could mean that food becomes unsafe to eat or staff are harmed. These possibilities should be considered when developing cleaning schedules and procedures. Examples are:-

- Physical contamination of food from cleaning equipment (eg brushes, cloths)
- Microbiological contamination of food (for example from contaminated cleaning cloths spreading pathogens around the kitchen)
- Chemical contamination of food from cleaning and disinfection products, for example from inadequate rinsing, using chemicals at too high a concentration or storing chemicals in a potentially dangerous way such as transferring them into another bottle.
- Staff not wearing the correct personal protective equipment when cleaning and disinfecting.
- The disinfection stage is ineffective. Problems could result from incorrect dilution of chemicals, inadequate contact time, the surface not being cleaned before the disinfection stage or not using a suitable disinfectant for the job.
- Accidents from slipping on wet floors.
- Inadequate cleaning and disinfection of equipment due to staff not being trained in how to carry out the work. “Cleaning in place” systems, where cleaning solutions may be pumped through food processing equipment, requires careful design to ensure that there are no pockets that the chemicals do not reach.

3.3.7 Storage and Maintenance of Tools and Equipment

In the food processing industry, the tools and equipment used must maintain their hygienic qualities. Leaving food processing equipment unorganized and in unsanitary locations when not in use is not advised. Proper storage in a clean, protected storage area ensures good hygiene in the food processing facility and helps extend tool life

From an organizational perspective, having a storage plan ensures that tools are where you need them when you need them.

Below given are some points to consider while storing food processing equipment:

- Avoid storing tools in extremely cold temperatures as it can cause the fracturing of tools and possible physical hazards in a food facility.
- High-humidity areas that do not allow for proper tool drying can support the growth of microbial hazards.
- Tools should be organized neatly in an area that allows adequate space to keep them from colliding or bumping against other objects. Rough contact with other objects can potentially cause breakage, in turn introducing risk for physical hazards in the facility.
- The location of the storage unit may be determined by whether or not the tools may be cleaned-in-place or cleaned-out-of-place (COP) in tanks, sinks, autoclaves, or a location other than where they are used or stored. Multiple storage locations may be useful, depending on whether the tool is needed during processing, or if the tool is used only during sanitation processes
- The most important consideration of a storage system for food processing tools is that tools should be maintained in a sanitary state before being used again.

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=uxCuZYeYkUo

Traditional sweet and savoury making

Skill India
कौशल भारत-कुशल भारत

NCVET
कौशल शलगुणव त्तात्ताप्रगतिति

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

FICSI
Food Industry Capacity and Skill Initiative

4. Ensuring Food Safety and Personal Hygiene

Unit 4.1 - Introduction to Food Safety
Unit 4.2 - Schedule IV requirements of FSSAI
Unit 4.3 - Personal Hygiene
Unit 4.4 - Health Safety

FIC/N9901

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Identify the hazards, types of hazards (Physical, chemical, biological and Allergenic) and risks at workplace
2. HACCP , TACCP, VACCP , Control measures , CCP, Critical limit
3. Explain the preventions of product contamination
4. Discuss the factors affecting food spoilage and food storage techniques
5. Describe Schedule IV requirements of FSSAI
6. Discuss cleaning and sanitization process, needs and importance and storage of sanitizing materials
7. Discuss health and safety policies and procedures
8. Discuss Employee health do's and don'ts, Food borne illness and preventive health checkups

UNIT 4.1: Introduction To Food Safety

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify types of hazards and risks at workplace

4.1.1 Food Safety

Food safety refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption. Safe food handling practices and procedures are thus implemented at every stage of the food production life cycle in order to curb these risks and prevent harm to consumers.

4.1.2 Food Safety Hazard and Risk

Hazard is a factor or agent which may lead to undesirable effects like illness or injury in the absence of its control, whereas, risk refers to the probability that the effect will occur.

Hazard is that part of food which somehow entered in the food and which is non-consumable.

Types of hazards and risks at work place

There are two types of hazards: one is food safety hazard and second is health safety hazards.

Food Safety Hazard

There are four major hazards that may be introduced into the food supply any time during harvesting, processing, transporting, preparing, storing and serving food. These hazards may be microbiological, chemical, physical and allergens.

Microbiological hazards

When harmful microorganisms are found or grown on food it is called microbiological hazards. Food which contains harmful or pathogenic bacteria when eaten can make people ill.

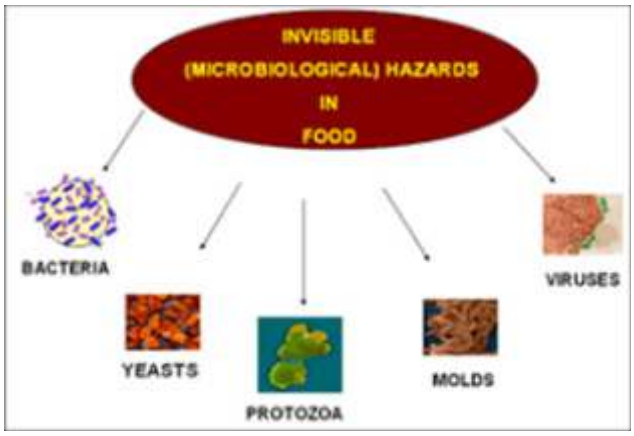


Fig. 4.1: Microbiological Hazards

Food spoilage and deterioration is no accident. It is a naturally occurring process. To understand how to maintain the quality of food and prevent spoilage, we need to know what can cause it.

Food spoilage: The microorganisms that can cause food-borne illness are called pathogenic microorganisms. These microorganisms grow best at room temperatures (25-30°C), but most do not grow well at refrigerator or freezer temperatures. Pathogenic microorganisms may grow in foods without any noticeable change in odor, appearance or taste. Spoilage microorganisms, including some kinds of bacteria, yeasts and molds, can grow well at temperatures as low as 4°C. When spoilage microorganisms are present, the food usually looks and/or smells awful.

Fig. 4.2: Food Spoilage

FAT TOM- This is a term used commonly in food industry to describe the six favorable conditions required for the growth of the food borne pathogens/micro-organisms.

Fig. 4.3: FATTOM Food Safety

Physical Hazards

These include any foreign material, which you would not expect to find in your food. Hair, finger nails, pieces of wood, metal, plastic, glass and insect debris are examples of what can find their way into food as foreign matters.

Fig. 4.4: Physical Hazards

Chemical Hazards

Chemical hazards include, food contact materials, cleaning agents, pest control substances, contaminants (environmental, agricultural and process e.g. acrylamide), pesticides, biocides and food additives. They are naturally occurring, intentionally added or unintentionally added.

- Preservatives
- Colours and dyes
- Flavour enhancers
- Water additives
- Packaging materials
- Processing aids

Allergen

An allergen is any protein that is capable of producing an abnormal immune response in sensitive segments of the population.

A known component of food which causes physiological reactions due to an immunological response (e.g.- nuts, gluten, egg, ,milk etc, identified in legislation relevant to country of production or sale)

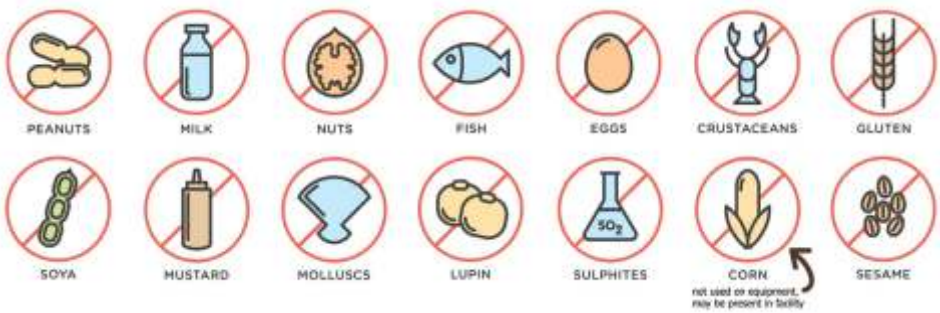


Fig. 4.5: Allergens

It is important to be aware of food allergens in food industry as this is the risk associated with the unintended presence of allergen due to cross contamination and should take this a matter of serious concern. Food allergies can cause serious and even deadly reactions.

What Are the Most Common Food Allergens?

There appears to be eight common allergens accounting for most food allergic reactions. They stand to be- milk, eggs, peanuts, soya, wheat, tree nuts (like walnuts and cashews), fish and shelfish (such as shrimp).

What Are the Signs & Symptoms of a Food Allergy?

The common sign and symptoms are: trouble breathing; coughing; hoarseness; throat tightness' belly pain' vomiting' diarrhea itchy, watery, or swollen eyes; red spots; swelling, a drop in blood pressureand is capable of happening because a person can't digest a substance, such as lactose.

Handling of Allergenic Foods:

1. Allergen-containing ingredients should be kept separate from non-allergen-containing products. Also, finished products containing that ingredient should be kept separate from non-allergenic products.
2. Allergen-containing products should be run at the end of the day or shift or isolated to a specific production line to avoid contact with non-allergen products.
3. Post-production, effective cleaning, and sanitizing must be performed to remove all allergen-containing products.
4. Sampling and testing of food products should be performed by the quality assurance staff or specially trained personnel to detect allergens in food products and on equipment surfaces.
5. Ensure that appropriate and correct information is provided in the labeled packaging of the food product.
6. Proper employee training should be given to to prevent allergen contamination.

4.1.3 Contamination, Cross Contamination and Prevention

Contamination: The presence of unwanted materials such as dust and particles during the manufacturing and transportation time is called contamination. The term contaminants include any unwanted matter that is found in the product. These contaminants affect the quality of the product or the process.

The most common types of contaminant include:

- Physical contaminant Examples: fiber material, particles, chips from your pill press tooling.
- Chemical contaminant. Examples: vapor, pesticides, grease. detergents, and so on.
- Biological contaminant Examples: fungus, bacteria, virus.

Cross contamination is possible when the unwanted matter is introduced or brought from one process to the next during manufacturing.

A leak in the holding containment would contaminate the product inside it, this would be an example of physical contamination.

Certain metals standing to be more advantageous to health, like iron, appearing to be globally added to some foods, involving infant formulas as well as breakfast cereals, to highlight their dietary advantages.

For biological contamination, bacteria may thrive if the container is not properly cleaned and dried. The contaminated container will then affect the product and microbes may thus be introduced to the batch.

Prevention of Contamination:

Determine the cause of the contamination

Anticipate the effect

Eliminate the source material

- To remove the contaminant carrier:
  - Reduce human involvement
  - Regulate the use of the equipment
  - Regulate the use of air
  - Regulate the use of water
- To reduce human carrier risk:
  - Ensure that proper attire is worn when coming and going from the production area
  - People frequently touch their eyes, nose, and mouth without even realizing it. Germs can get into the food through their contaminated unwashed hands.
- To reduce water as carrier:
  - As water is the number one source for cross contamination, it is important to reduce and prevent water contamination
  - Water borne contaminants: particulates (such as minerals) and pathogens (e. coli, salmonella, etc.)
  - Use of preventive measure such as filtration devices, distillation or reverse osmosis, UV treatments
- To reduce air as carrier:
  - Control air flow through AHUs (Air Handling Unit)
  - Use of air locks
  - Installation of HEPA (High Efficiency Particulate Absorbing Filters) filters
  - Ultra-Low Particulate Air

4.1.4 Storage (Importance of Storing Food at Specified Temperature)

Storage temperature is one of the most important factors in the preservation of food because microorganisms have been found to grow in almost all temperature.

Food storage is a major issue when keeping food safe. Food which is not correctly stored can spoil or become contaminated, which can make people sick. There are very specific rules regarding the temperatures that food must be stored at, cooked to and reheated to and if not followed, the risk of becoming ill as a result of contamination increases.

Room Temperature Food Storage

Keep dry storage areas clean with good ventilation to control humidity and prevent the growth of

Keep dry storage areas clean with good ventilation to control humidity and prevent the growth of mold and bacteria. 21°C is adequate for dry storage of most products. One of the first things to check regarding food which has been stored in the 'use-by' or 'best-before' dates printed on the packaging.

These dates will give you the most accurate indication of a food's shelf life, however, when a packet or can is opened, the expiry date almost always changes.

Refrigerating and Freezing Food

To reduce the risk of bacterial contamination, many foods must be stored in the refrigerator and thus kept below 5°C. These foods are often classified as 'high-risk foods' and include – meat, poultry, dairy, seafood, eggs, small goods and cooked rice and pasta. This also refers to ready-to-eat foods that have high-risk foods as ingredients and include – quiche, pasta salad, pizza, sandwiches and many cakes.

By keeping these high-risk foods under 5°C it stops them from entering the 'danger-zone' – temperatures between 5°C and 60°C. The danger-zone is the temperature zone which provides bacteria with the perfect environment to rapidly grow and multiply to numbers that cause food poisoning.

By freezing food its longevity is increased because the water content of the food freezes – this prevents bacteria from multiplying and food spoiling. Food should be kept frozen at –18°C; when thawing, it should be stored in a refrigerator that reaches no more than 5°C until it is ready to be prepared.

4.1.5 Transportation

Selling fresh and high-quality produce is essential in groceries and retail food businesses. That's why the transport and storage of foods is so important, and refrigerated transport is essential to achieve this.

Refrigerated Transportation

Refrigerated transportation is a shipping cargo with advanced temperature adjustment features. It is built and designed mainly for climate-sensitive goods such as vegetables, fruits, meat, all-prep meals, bread, etc. in which the freight is loaded with ice and salt to maintain the food's quality at a particular temperature.

Fig. 4.6: Refrigerated Transportation

Ambient Temperature for Shipping

When it comes to cold chain logistics, maintaining ambient temperature tends to mean maintaining a temperature between 15°C to 25°C or 59°F to 77°F. These temperatures fall in the range of comfortable room temperature instead of being on one extreme and of temperature ranges.

4.1.6 HACCP, TACCP, VACCP, Control Measures, Critical Control Point, Critical Limit

HACCP (Hazard Analysis Critical control point): It is a systematic approach in identification, evaluation and control of food safety hazards and it's written documented plan based on HACCP principles known as HACCP Plan. It has 12 steps and 7 principles as:-

- Assembly of HACCP Team
- Describe Product
- Identify indent use
- Draw Flowchart / Diagram
- Verify Flowchart/ Diagram
- Conduct a hazard analysis (Principle 1)
- Determine critical control points (CCPs) (Principle 2)
- Establish critical limits (Principle 3)
- Establish monitoring procedures (Principle 4)
- Establish corrective actions (Principle 5)
- Establish verification procedures (Principle 6)
- Establish record-keeping and documentation procedures (Principle 7)

VACCP (Vulnerability Analysis Critical control points):

It focuses on food fraud as well, and widens the scope to include systematic prevention of any potential adulteration of food, whether intentional or not, by identifying the vulnerable points in a supply chain. It is especially concerned with economically motivated adulteration (EMA). Examples include product substitutions, unapproved product enhancements, counterfeiting, stolen goods and others.

TACCP (Threat Analysis Critical control points): generally requires a wider range of employee involvement than HACCP, as it covers issues such as manufacturing plant and transportation security, IT security, and employee background checks. Some points will overlap with HACCP, such as tamper-proof seals and various quality control checks.

Reduce the likelihood (chance) and consequence (impact) of a deliberate attack;

Protect organizational reputation;

Reassure customers and the public that proportionate steps are in place to protect food;

Demonstrate that reasonable precautions are taken and due diligence is exercised in protecting food.

Control: It means to prevent, eliminate, or reduce hazard.

Control measures: It is means of any action or activity that is used to prevent, reduce to acceptable levels, or eliminate a hazard.

Critical limit: it means a point, step, or procedure in a food process at which a control measure can be applied and at which control is essential to prevent, reduce to an acceptable level, or eliminate an identified food hazard.

UNIT 4.2: Schedule IV Requirements of FSSAI

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify requirements in Schedule IV in FSSAI

4.2.1 Schedule IV Requirements of FSSAI

To provide assurance of food safety, Food businesses must implement an effective Food Safety Management System (FSMS) based on Hazard Analysis and Critical Control Point (HACCP) and suitable pre- requisite programmes by actively controlling hazards throughout the food chain starting from food production till final consumption.

As per the condition of license under FSS (Licensing & Registration of Food Businesses) Regulations 2011, every food business operator (FBO) applying for licensing must have a documented FSMS plan and comply with schedule 4 of this regulation. Schedule 4 introduces the concept of FSMS based on implementation of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) by food businesses and is divided into five parts as under:.

Schedule 4	General Requirements
Part 1	General hygienic and sanitary practices to be followed by food business operators applying for registration - Petty food operators and Street food vendors
Part 2	General hygienic and sanitary practices to be followed by food business operators applying for license- Manufacturing/ processing/ packaging/storage/distribution
Part 3	General hygienic and sanitary practices to be followed by food business operators applying for license- Milk and milk products
Part 4	General hygienic and sanitary practices to be followed by food business operators applying for license- Slaughter house and meat processing
Part 5	General hygienic and sanitary practices to be followed by food business operators applying for license- Catering

Table 4.2.1: Five Parts of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP)

Part II: General hygienic and sanitary practices to be followed by food business operators applying for license- Manufacturing/ processing/ packaging/storage/distribution

- **Location and Surroundings**
- Location shall be:
  - away from environmentally polluted areas
  - away from industrial activities which produce:
  - Disagreeable or obnoxious odor,
  - Fumes
  - Excessive Soot
  - Dust

Well Guarded Entrance of the plant

Demarcation of the area

Fig. 4.7: Location and Surrounding factors

- Smoke
- Chemical or biological emissions
- Pollutants
- Layout and Design of Food Establishment Premises

Facility in good condition leads to clean, pest free environment	• Repaired or replaces holes, broken tiles missing ceiling panel etc. • Sealed/grated sewer grids less than 1/4 inch
Hole free exterior walls	• Louvers in exterior wall fans that close tightly when turned off • Screened pipes & windows • Sealed outside pipe
Striped or sealed gaps around all doors	• Use of screen door, air curtains & other mechanisms • Sealed cracks to prevent insect harborage

Fig. 4.8: Layout and Design factors

- **Equipment and Containers**
  - made up of non-corrosive / rust free material
  - smooth, free from any grooves
  - easy to clean and maintain
  - non-toxic and non-reactive
  - of food grade quality

Fig. 4.9: Equipment and Container factors

- **Facilities**
  - **Water supply**
    - Only potable water meeting BIS (Bureau of Indian Standards) standards
    - Appropriate facilities for storage and distribution of water
    - Periodic cleaning of storage tanks and its record
    - Non-potable water, if used, only for cooling of equipment, steam production, fire fighting
    - Distinguished non-potable water pipes

Colour coding of water pipes to avoid contamination

Fig. 4.10: Water Supply

- Drainage and waste disposal
  - Disposal of sewage and effluent in conformance with the requirements of Factory
  - Designed and constructed to reduce risk of contamination to food and potable water
  - Separate waste storage area
  - Covered containers for waste storage
  - No accumulated waste in food handling, food storage or other working areas
  - Periodic disposal of waste/refuse
  - Pedal operated adequate size bins for waste collection
  - Waste bins emptied and washed daily with a disinfectant and dried before next use

Sr. No.	Material	Dustbin Colour	SYMBOL
1	Oily Cotton Waste	Red	
2	Paper	Green	
3	Plastic Jars, Sampling Bottles	Blue	
4	Plastic Bags	Yellow	
5	Polish Filter	Grey	
6	Food Waste	Orange	
7	Glass Bottles	Black	

Fig. 4.11: Waste Disposal

Fig. 4.12: Drainage System

- Personnel facilities and toilets
  - Facilities for washing and drying hands
  - Supply of hot and cold water
  - Separate lavatories of appropriate hygiene design for males and females separately
  - Suitably located Changing facilities for personnel
  - No direct opening of such facilities in food processing, service or storage area

Fig. 4.13: Personal facilities

- **Ventilation and Lighting**
  - Air quality and ventilation:
    - Natural / mechanical ventilation system including air filters, exhaust fans
    - Designed and constructed as such air does not flow from contaminated areas to clean areas
  - Lighting
    - Adequate Natural /artificial lighting
    - Protected lightings to avoid contamination by breakages

Fig. 4.14: Ventilation and Lighting

- **Food Operations And Controls**
  - **Procurement of raw materials**
    - Quality raw materials (free of parasites, micro-organisms, pesticides etc.)
    - Raw material conforming to the regulations under the act
    - Records of raw material as source of procurement

Fig. 4.15: Procurement of raw materials

  - **Storage of raw materials and food**
    - Adequate food storage facilities to protect food from contamination
    - Cold storage facilities according to requirement
    - Segregation of storage area for raw and processed food, recalled materials, packaging materials, stationary, cleaning materials/ chemicals
    - Separate cold storage of raw food like meat/poultry/seafood product away from the area of WIP (Work in Progress), processed, cooked and packaged products.
    - Monitoring of temperature and humidity
    - FIFO First received (In) materials must move out first
    - Non –toxic containers for food storage
    - Stored on racks or pallets well above the floor and away from the wall

Fig. 4.16: Storage of raw materials and food

Review Of Product Label /Packaging Usage And Control

Labels should be reviewed prior to their receipt for their accuracy. Line Personnel should be trained to ensure labelling is changing when a changeover takes place.

Food Processing / Preparation, Packaging and Distribution / Service

- **Storing at appropriate temperature:** The Food Business shall develop and maintain the systems to ensure that time and temperatures are controlled effectively where it is critical to the safety and suitability of food. Such control shall include time and temperature of receiving, processing, cooking, cooling, storage, packaging, distribution and food service till it reaches the consumer, as applicable.
- **Food Packaging:** Packaging materials shall provide protection for all food products to prevent contamination, damage and shall accommodate required labelling as laid down under the FSS Act & the Regulations there under.
- **Transportation:** All critical links in the supply chain need to be identified and provided to minimize food spoilage during transportation. Processed / packaged and / or ready-to-eat food shall be protected as per the required storage conditions during transportation and / or service.
- **Management and Supervision**
  - Provision of resources to implement & maintain Food Safety
  - Developing SOPs for processing, packing, dispatch & storage of food
  - Competent Technical Managers & Supervisors:
    - having skills on food hygiene principles & practice
    - taking appropriate preventive & corrective action
    - ensure effective monitoring and supervision.
- **Maintaining Process related records (e.g. production records)**
- **Sanitation And Maintenance of Establishment Premises**
  - Facilities should permit effective cleaning.
- **Cleaning Program**
  - areas to be cleaned,
  - cleaning frequency,
  - procedure,
  - equipment,
  - cleaning material and method

Visualizing for HK material


Kamishibai Board for maintaining HK


Hanging of Flexible pipes for ease of cleaning

Fig. 4.17: Cleaning Program

- **Maintenance**
  - Preventive and Corrective Maintenance
  - Lubricants and heat transfer fluids shall be food compatible Procedure for releasing maintained equipment back to production
  - Maintenance personnel shall be trained in the product hazards associated with their activities

Fig. 4.18: Maintenance

- **Pest Control Systems**
  - Report pest infestations immediately.
  - Do not use pesticides/insecticides in food processing area.

Fig. 4.19: Fly Catcher and Rodent Traps

- **Personal Hygiene**
  - Health Status
    - Personnel suffering from disease or illness shall not be allowed to enter in food handling area
    - System to report illness or symptoms of illness to management
    - Medical examination of food handlers/ employees once in a year
    - Records of medical examination
    - Factory shall be compulsorily inoculated against the entire group of diseases and recorded
    - In case of epidemic, all workers to be vaccinated irrespective of the yearly vaccination.
  - **Personal Cleanliness**
    - High degree of personal cleanliness by food handlers
    - Food business shall provide to all food handlers;
    - Protective clothing
    - Head covering
    - Face mask
    - Gloves
    - Foot wear

Fig. 4.20: Personal Cleanliness

- **Visitors Generally**
  - Generally visitors should be discouraged to go inside the food handling areas
  - The food business shall ensure visitors to its food manufacturing/ handling areas shall;
  - Wear protective clothing
  - Footwear
  - Adhere to personal hygiene provisions envisaged in the respective section
- **Product Information And Consumer Awareness**
  - Batch Identification
    - Identifies producer
    - Product recall
    - Effective stock rotation - FIFO
  - Product Information
    - Adequate information & enables other person in food chain to handle, display, store, prepare & use the product safely & correctly
  - Labeling
    - Should confirm to Legal Requirements
- **Consumer Education**
- **Training**
  - Awareness & responsibilities
  - Training Programmes
    - Nature of food
    - Control Spoilage
    - Handling of food
    - Storage
  - Training Records
  - Instruction & supervision
    - Periodic assessment of training & effectiveness
  - Refresher training
- **Good Manufacturing Practices For Whole Premise**

  Good Manufacturing Practices* (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment.

  GMPs address the hazards associated with personnel and environment during food production. They provide a foundation for any food safety system. Once GMPs are in place, processors can implement a Hazard Analysis Critical Control Point (HACCP) system to control hazards that may affect the ingredients and packaging material during food processing.

GMPs Address:

Fig. 4.21: GMPs Address

- **Environmental control (premises):** Location, design and construction of the building and its interior, equipment, water supply.
- **Personnel practices:** Personal hygiene, hand washing, clothing/footwear/headwear, injuries and wounds, evidence of illness, access and traffic patterns, chemical use.
- **Shipping, receiving, handling, storage:** Inspection procedures for transport vehicles; loading, unloading and storage practices; inspection procedures for incoming products; shipping conditions; returned and defective products; allergen control; chemical storage; waste management.
- **Pest control:** Monitoring procedures for the exterior and interior of the building (ex: surveillance, fumigation) and the use of pesticides.
- **Sanitation:** Cleaning and sanitizing procedures and pre-operational assessment.
- **Equipment maintenance:** Procedures describing preventive maintenance and calibration of all the equipment and instruments that can affect food safety (ex: thermometers, thermocouples, metal detectors, scales, pH meters)
- **Recall and traceability:** Procedures that ensure final products are coded and labeled properly; incoming materials; in-process and outgoing materials are traceable; recall system is in place and tested for effectiveness (ex: procedures for mock recalls).
- **Water safety:** Water safety monitoring procedures for water, ice and steam, and water treatment procedures that ensure it is potable for use in food processing

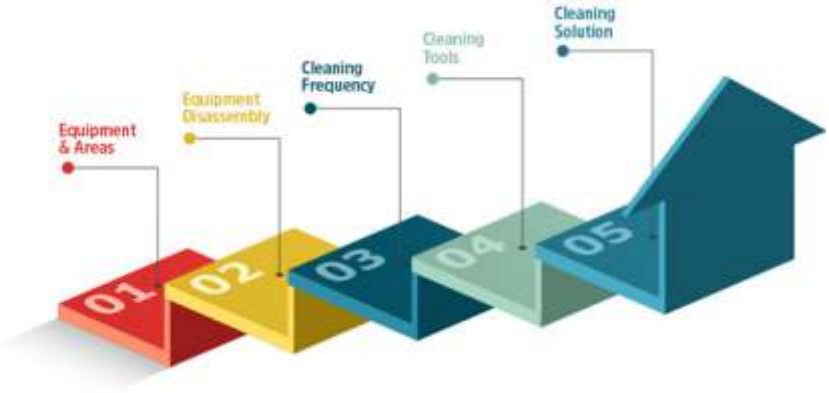


Fig. 4.22: Storage of sanitizing materials

Where and How to Store Your Cleaning Supplies

- **Clean, Cool, Dry:** Store your cleaning supplies in an area that is clean and free of debris. Make sure that there aren't any temperature extremes in the area where your cleaning supplies are stored. Another thing to make sure of is that the area is dry.
- **Original Containers:** Keep cleaning supplies in their original containers. If you mix your own cleaners, make sure you use new clean bottles and label them to avoid a mixup.
- **Safe Storage:** Be sure to keep your cleaning supplies stored in places where your children and/or pets will not be able to get to them. Consider higher storage or locked storage options to protect small children and pets.

Cleaning and Sanitization Process, Need and Importance

Workplace Sanitation: Maintaining a clean work environment is critical in preventing foodborne illness. Bacteria can grow on unsanitary surfaces and then contaminate food. Just because a work surface looks clean does not mean that it is sanitary. Always ensure that you clean and sanitize a work area before starting to prepare food.

Cleaning Procedures and Schedules: Cleaning with soap and other detergents is just one step of the cleaning procedure. It is also necessary to sanitize. Cleaning will remove any dirt or grease, but will not necessarily kill any bacteria or other pathogens. Only a sanitizer will kill bacteria and ensure the area is safe for food preparation. Leading sanitizers used in the food service industry are chlorine solutions (bleach), quaternary solutions (quarts), and iodine. Use these materials according to the manufacturer's instructions that accompany the product and that are found on the material safety data sheet (MSDS) using the appropriate personal protective equipment.

A sanitation plan is important in any food service preparation area. It ensures that all surfaces are cleaned on a regular basis and reduces the risks of transferring bacteria or other pathogens from an unclean surface to clean equipment such as cutting boards or tools. A sanitation plan has two components:

- A list of cleaning and sanitizing agents or supplies with instructions on their safe use and storage
- A cleaning schedule, outlining how each item needs to be cleaned, who is responsible, and how frequently it happens

Routine Equipment Maintenance

Refer to the manufacturer's instructions and training provided by your employer or instructor on how to do this safely. Some equipment is intended to be cleaned in place. This should be identified in your sanitation plan and cleaning schedule.

All equipment must be routinely cleaned and inspected. Older equipment may have nooks and crannies where dirt and bacteria can hide, which can be difficult to clean effectively. Proper cleaning procedures must be established and followed at all times with regular review to ensure that procedures are working. If equipment is replaced or cleaning materials change, the process may have to be adjusted. If you notice any safety concerns with the equipment while cleaning it, such as a frayed cord, missing guard or loose parts, let your supervisor know immediately.

- **Good Food Hygiene Practices**
  - Cleaning
    - Food areas and equipment between different tasks, especially after handling raw food shall be cleaned.
    - The surface shall be thoroughly cleaned in case if somebody spills food / water / drink.
  - Raw materials
    - Raw materials shall be purchased from reliable and known dealers and checked for visible deterioration & off-odour, physical hazards and foreign body contamination.

Fig. 4.23: 8 Principles based on eight quality management principles

- Cooking
  - The preparation/ processing/ cooking should be adequate to eliminate and reduce hazards to an acceptable level which might have been introduced at the raw food level.
  - The preparation/ processing/ cooking methods should ensure that the foods are not re-contaminated.
  - The preparation/ processing/ cooking of veg. & non-veg. products should be segregated.
  - Whenever cooking or reheating of food is done, it should be hot all the way through, it is especially important to make sure that food is cooked thoroughly.
  - Re-use of cooking oil should be avoided.
  - In case of reheating of oil use maximum three times to avoid the formation of Trans fat. It is ideal to use once if possible.
- Chilling
  - Semi cooked or cooked dishes and other ready-to-eat foods such as prepared salads and desserts having short shelf life should not be left standing at room temperature.
  - Chilled food intended for consumption should be cold enough.
  - Food items that need to be chilled should be put straight away into the fridge.
  - Cooked food should be cooled as quickly as possible and then put it in the fridge.
  - Chilled food should be processed in the shortest time possible.
  - Fridge and display units should be cold enough and as per requirement. In practice, fridge should be set at 5°C to make sure that food is kept in chilled condition. Also, fridge and display units should be maintained in good working condition to avoid food spoilage and contamination.
- Cross-contamination

  Following should be done to avoid cross-contamination.
  - Separation of each crop/species and also processed and unprocessed foods.
  - Hands should be thoroughly washed after touching.
  - Work surfaces, chopping boards and equipment should be thoroughly cleaned before the preparing of food starts and after it has been used.

- **Personal Hygiene**
  - High standards of personal hygiene should be maintained.
  - All employees handling food should wash their hands properly
    - before preparing food
    - after touching raw food or materials, specially meat/poultry or eggs
    - after breaks
    - after using the toilet after cleaning the raw materials or utensils / equipments
  - Street shoes inside the food preparation area should not be worn while handling & preparing food.
  - Food handlers should ensure careful food handling & protect food from environmental exposure.
- **Transportation and Handling Of Food**
  - Food shall be adequately covered during transportation to assure food safety.
  - Transportation vehicles
    - Vehicle inspection
    - Shall not contaminate foods & packaging
    - Should be easy to clean and maintain

- Provide effective protection from dust & dirt
- If required maintain temperature, humidity, atmosphere
- If required allow monitoring of temperature, humidity, etc.
- Should be used only for carrying food.
- Regular maintenance of vehicles is required.
- Appropriate supply chain to minimize food spoilage
- Non-toxic, clean, well maintained food containers during transportation
- Temperature and humidity control during transportation
- Dedicated vehicles for food transportation
- Effective cleaning and sanitation of vehicles between loads carrying high risk foods as fish, meat poultry to avoid cross contamination

Fig. 4.24: Transportation and handling of food

- **Storage**
  - It is very important to store food properly for the purpose of food safety. Following things must be ensured:
    - Raw meat/poultry should be stored separately from other foods
    - Storage temperature of frozen food should be -18°C or below.
    - Storage instructions over food packaging should be followed.
    - Dried foods (such as grains and pulses) should be stored off the floor, ideally in sealable containers, to allow proper cleaning and protection from pests.
    - Store commercial ice cream at temperatures below 0°F.
    - Store biscuit, brownie, and muffin mixes at room temperature.

Stock rotation

The rule for stock rotation is FIFO (first in, first out) to make sure that older food is used first. This will help to prevent wastage. Older product will have nearer shelf life expiry, so older product should be moved out first, but new products will have time to move out since expiry is so far. That's why a rule of FEFO does also exist which means First Expiry First Out. It is called Good Distribution Practice.

UNIT 4.3: Personal Hygiene

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify types of health and safety policies and procedures

4.3.1 Personal Hygiene

The expression "food hygiene" is often associated to personal hygiene. The concept of food hygiene really refers to the general cleanliness state of the food handlers' body and clothes. Microorganisms can easily pass to food and reach the consumer if the handler comes into contact with any pathogenic microorganism by their clothes, hands, hair, nails, rings and then sets out to prepare food. As so, the personal hygiene of whoever contacts with food, as well as behaviors they assume during its processing, constitute an important preoccupation in the food business. The set of rules, conditions and practices that assure adequate personal hygiene make up the good practices for personal hygiene.

4.3.2 Importance of Personal Hygiene

It is imperative for safe food-handling outcomes for all workers to be familiar with standard sanitation and hygiene practices. Fig. 1.3.1 shows the cycles of transmission of micro-organisms. One of the basic principles is to break the cycle by avoiding cross-contamination, which can be achieved by ensuring personal hygiene practices are followed.

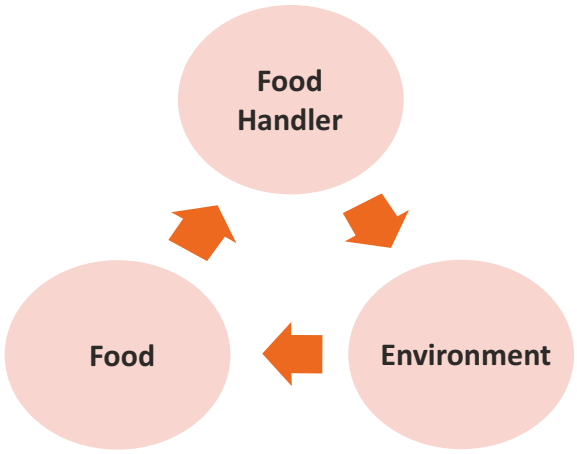


Fig. 4.25: Importance of Personal Hygiene

Proper personal hygiene is critical in any food service premise. Personal hygiene includes:

- Showering and bathing regularly
- Keeping hair clean hair and covered or tied back
- Keeping clean clothing and footwear that is used only at work
- Hand washing regularly

Fig. 4.26: Personal hygiene

4.3.3 Hand Washing

Proper and regular hand washing is a critical part of any food safety system.

Fig. 4.27: Methods of washing hand

How to Use Sanitizer?

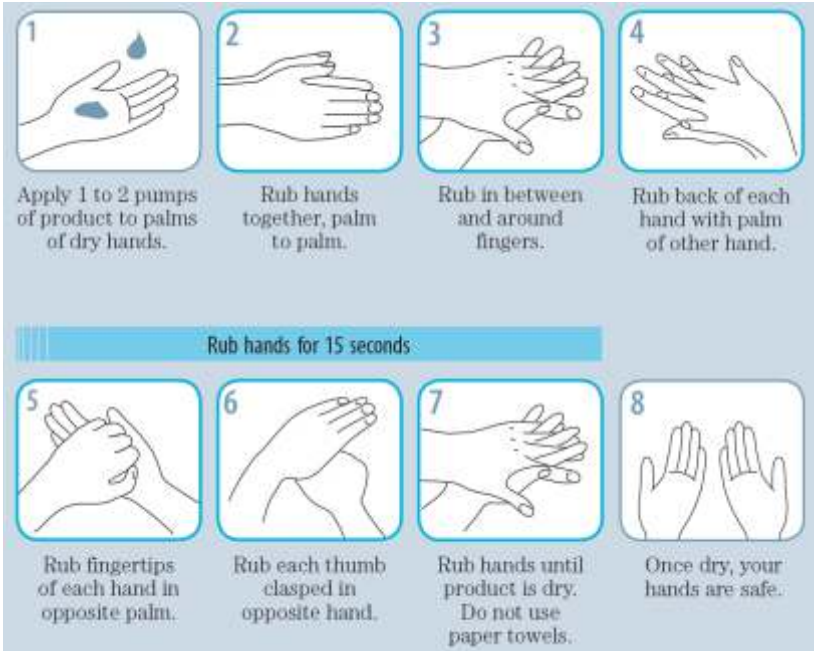


Fig. 4.28: Usage of Sanitizer

When to Wash and Sanitize Hand?

Fig. 4.29: Times to wash and sanitize hand

We need to stop the spread of COVID-19 in food industry by washing hands regularly with soap and water for 20 seconds – especially after going to the bathroom, before eating, and after coughing, sneezing, or blowing our nose.

4.3.4 Good personal hygiene can prevent food poisoning.

Bacteria that cause food poisoning can be on everyone – even healthy people. You can spread bacteria from yourself to the food if you touch your nose, mouth, hair or your clothes, and then food.

Good personal hygiene also makes good business sense. Customers like to see food-handling staff who take hygiene seriously and practice safe food handling.

- Personal hygiene is important to prevent food poisoning.
- When handling food, wash your hands thoroughly and often.
- If you are sick, do not go to work, because you can contaminate food more easily.
- Food handlers should be properly trained in safe food handling.

Food handling businesses ensure the following factors are considered to ensure personal hygiene:

- **Hand Washing —** ensure effective hand washing techniques are followed at appropriate times
- **Minimise hand contact with food —** try to minimise direct hand contact with raw food by using appropriate utensils and safe use of disposable gloves
- **Personal cleanliness —** cover hair; do not sneeze or cough over food; cover cuts and sores; and do not wear jewellery
- **Wear protective clothing —** wear suitable clean protective clothing and handle appropriately to prevent cross contamination
- **Exclude ill staff —** staff must report illnesses; exclude staff with vomiting or diarrhoea

UNIT 4.4: Health Safety

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Illustrate the concept of health safety
2. Understand the hazards of health safety
3. Explain the health and safety policies and procedures
4. Describe the personal protective equipment
5. Discuss the types of personal protective equipment

4.4.1 Health Safety

The term Health and Safety is generally used to describe Occupational Health and Safety, and relates to the prevention of accidents and ill health to employees and those who may be affected by their work.

4.4.2 Health Safety Hazards

Safety hazards exist in every workplace, but how do you know which ones have the most potential to harm workers? By identifying hazards at your workplace, you will be better prepared to control or eliminate them and prevent accidents, injuries, property damage, and downtime.

First of all, a key step in any safety protocol is to conduct a thorough safety hazard assessment of all work environments and equipment

In a safety hazard assessment, it is important to be as thorough as possible because after all, you can't protect your workers against hazards you are unaware of and unprepared for. Avoid blind spots in your workplace safety procedures by taking into consideration these 3 types of workplace hazards:

- **Safety hazards**

  Safety hazards are number one on the list of 3 types of workplace hazards. These hazards play an effect on employees who work directly with machinery or in construction sites. Safety hazards are unsafe working conditions that that can cause injury, illness, or death.

  Fig. 4.30: Safety hazards

  Safety hazards are the most common workplace risks. They include:

  - Anything that can cause spills or trips such as cords running across the floor or ice
  - Anything that can cause falls such as working from heights, including ladders, scaffolds, roofs, or any elevated work area.
  - Unguarded and moving machinery parts that a worker can accidentally touch.
  - Electrical hazards like frayed cords, missing ground pins and improper wiring
  - Confined spaces

- **Ergonomic hazards**

  Ergonomic safety hazards occur when the type of work, body positions, and working conditions put a strain on your body.

  Ergonomic Hazards include:

  - Improperly adjusted workstations and chairs
  - Frequent lifting
  - Poor posture
  - Awkward movements, especially if they are repetitive
  - Having to use too much force, especially if you have to do it frequently
  - Excessive vibration

Fig. 4.31: Ergonomic Hazards

- **Work organization hazards**

Safety hazards or stressors that cause stress (short-term effects) and strain (long-term effects). These are hazards associated with workplace issues such as workload, lack of control and/or respect, etc.

Examples include:

- Workload demands
- Workplace violence
- High intensity and/or pace
- Respect (or lack thereof)
- Flexibility
- Control or say about things
- Social support or relations
- Sexual harassment

4.4.3 Health and Safety Policies and Procedures

Overview

The law says that every business must have a policy for managing health and safety.

A health and safety policy sets out your general approach to health and safety. It explains how you, as an employer, will manage health and safety in your business. It should clearly say who does what, when and how.

4.4.4 What is Personal Protective Equipment?

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.

Employers are also required to train each worker required to use personal protective equipment to know:

- When it is necessary
- What kind is necessary
- How to properly put it on, adjust, wear and take it off
- The limitations of the equipment
- Proper care, maintenance, useful life, and disposal of the equipment

If PPE is to be used, a PPE program should be implemented. This program should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the program to ensure its ongoing effectiveness.

4.4.5 Types of PPE

Head protection

Examples of head protection equipment:

- Helmets
- Hard hats
- Hair nets

Hand protection

Examples of hand protection equipment

- Work gloves and gauntlets
- Wrist cuff arm nets

Eye and face protection

- Safety glasses and goggles
- Eye and face shields

Fig. 4.32: Eye and face protection

Respiratory Protection

This type of PPE must be present when being in contact with large amounts of gases, powders, dust and vapors.

Fig. 4.33: Types of Respirators

Hearing protection

Examples of hearing protection equipment:

- Earplugs and defenders
- Noise meters
- Communications sets
- Acoustic foam

Foot protection

As examples of foot protection equipment can be pointed out the following ones:

- Safety boots and shoes
- Anti-static and conductive footwear

Height and access protection

As examples of height and access protection equipment can be mentioned in the following ones:

- Fall-arrest systems
- Body harnesses
- Lowering harnesses
- Rescue lifting
- Energy absorbers and others

Fig. 4.34: FSSAI dos and don'ts for food handlers

First aid kit

The kit should be kept in an accessible location and /or close to areas where there is a higher risk of injury or illness. The first aid kit should provide basic equipment for administering first aid.

Pictograms

Not only is preparing your workshop for accidents a smart thing to do, it is even smarter to organize your workshop in such a way that no serious accidents can take place. A simple way to make your workshop safer is to use pictograms: indicating flammable materials, the necessary use of hearing protection, indicating emergency exits.

Health and Safety Policy

FBO is committed to the goal of providing and maintaining a healthy and safe working environment, with a view to continuous improvement. This goal is only achievable by adherence to established objectives striving to exceed all obligations under applicable legislation, and by fostering an enthusiastic commitment to health, safety and the environment.

In particular:

Management, working in cooperation with the Joint Health and Safety Committee, will strive to take all reasonable steps to reduce workplace hazards to as low as reasonably achievable.

Supervisors and managers are held accountable for the health and safety of all employees under their supervision. This includes responsibility for applicable training and instruction, appropriate followup on reported health and safety concerns, and implementation of recommended corrective action.

FBO is committed to providing all necessary training and instruction to ensure that appropriate work practices are followed on the job, and to promote their use off the job.

Health, safety, the environment and loss control in the workplace are everyone's responsibility. Company expects that everyone will join in our efforts to provide a healthy and safe working environment on a continuous day to day basis.

Importance of Preventive Health Checkups

No matter what age group you are a part of, regular preventive health tests are essential for each one of us.

Whether one is feeling fit from within or is still in his early years of life, a preventive health checkup is an important practice that one must inculcate in his or her daily life.

- It can detect developing disease and prevent them
- Increase better chances for treatment and cure
- Can identify health issues early and prevent them
- It helps to improve lifestyle and increase productivity at work

FSSAI Format for health check up

PERFORMA FOR MEDICAL FITNESS CERTIFICATE FOR FOOD HANDLERS

(FOR THE YEAR .....)

(See Para No. 10.1.2, Part- II, Schedule - 4 of FSS Regulation, 2011)

It is certified that Shri/Smt./Miss..... employed with M/s....., coming in direct contact with food items has been carefully examined* by me on date ..... Based on the medical examination conducted, he/she is found free from any infectious or communicable diseases and the person is fit to work in the above mentioned food establishment.

Name and Signature with Seal
of Registered Medical Practitioner /
Civil Surgeon

***Medical Examination to be conducted:**

1. Physical Examination
2. Eye Test
3. Skin Examination
4. Compliance with schedule of Vaccine to be inoculated against enteric group of diseases
5. Any test required to confirm any communicable or infectious disease which the person suspected to be suffering from on clinical examination.

Fig. 4.35: Format for health check up

Medical examination to be concluded –

1. Physical examination
2. Eye Test
3. Skin examination
4. *Compliance with schedule of vaccine to be inoculated against enteric group of diseases
5. Any test required to confirm any communicable or infectious disease which the person suspected to be suffering from on clinical examination

* Vaccine to be inoculated against enteric group of diseases shall be decided by the medical practitioners in accord to remove the ping to the list as declared by the municipal corporation of that area.

Summary

- Food safety refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption. Safe food handling practices and procedures are thus implemented at every stage of the food production life cycle in order to curb these risks and prevent harm to consumers.
- It is important to be aware of food allergens in food industry as this is the risk associated with the unintended presence of allergen due to cross contamination and should take this a matter of serious concern. Food allergies can cause serious and even deadly reactions.
- The presence of unwanted materials such as dust and particles during the manufacturing and transportation time is called contamination. The term contaminants include any unwanted matter that is found in the product. These contaminants affect the quality of the product or the process.
- Refrigerated transportation is a shipping cargo with advanced temperature adjustment features. It is built and designed mainly for climate-sensitive goods such as vegetables, fruits, meat, all-prep meals, bread, etc. in which the freight is loaded with ice and salt to maintain the food's quality at a particular temperature.
- The retail food industry plays a significant role in assuring a safe food supply for its consumers. At the retail level, activities to control food safety risks can be divided into four key areas: the supplier and source of foods and food ingredients; in-store practices and procedures; education and training of employees and food handlers; and consumer engagement.
- Good Manufacturing Practices (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment.
- Maintaining a clean work environment is critical in preventing foodborne illness. Bacteria can grow on unsanitary surfaces and then contaminate food. Just because a work surface looks clean does not mean that it is sanitary. Always ensure that you clean and sanitize a work area before starting to prepare food.
- The rule for stock rotation is FIFO (first in, first out) to make sure that older food is used first. This will help to prevent wastage. Older product will have nearer shelf life expiry, so older product should be moved out first, but new products will have time to move out since expiry is so far. That's why a rule of FEFO does also exist which means First Expiry First Out. It is called Good Distribution Practice.
- The expression "food hygiene" is often associated to personal hygiene, being many times limited to the care of washing hands. The concept of food hygiene really refers to the general cleanliness state of the food handlers' body and clothes.
- Health and Safety is a term that generally covers the legal requirements that fall under the Health and Safety at Work Act etc. 1974. The term Health and Safety is generally used to describe Occupational Health and Safety, and relates to the prevention of accidents and ill health to employees and those who may be affected by their work.

Exercise

A. Answer the following questions by choosing the correct option:

1. _____ refers to routines in the preparation, handling and storage of food meant to prevent food borne illness and making food safe for human consumption.
   a. Food Safety
   b. Fire Safety
2. _____ is a factor or agent which may lead to undesirable effects like illness or injury in the absence of its control, whereas, risk refers to the probability that the effect will occur.
   a. Threat
   b. Hazard
3. The presence of _____ materials such as dust and particles during the manufacturing and transportation time is called contamination.
   a. wanted
   b. unwanted
4. _____ is one of the most important factors in the preservation of food because microorganisms have been found to grow in almost all temperature.
   a. Storage temperature
   b. Hazard temperature
5. Selling fresh and _____ produce is essential in groceries and retail food businesses.
   a. low-quality
   b. high- quality

B. Answer the following questions briefly.

1. What are the most common types of contaminant?
2. Outline the layout and design of food establishment premises.
3. Explain VACCP
4. What are the facilities provided by water supply?
5. What are the two components of the sanitation plan?

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=6WXc6cH_gil&t=1s	https://www.youtube.com/watch?v=d-5kn5ns0zWM	https://www.youtube.com/watch?v=K-BvU4Bmu5O0
Personal Hygiene	General Requirement on Hygiene and sanitation	Food Safety

5. Managing Accidents and Emergencies

FIC/N9901

Key Learning Outcomes

At the end of this unit, the trainee will be able to:

1. Recognize the types of hazards, risks as well as accidents
2. Categorize the standard precautions and practices
3. Examine the utilization of the electrical equipment
4. Explore the usage of personal protective equipment
5. Recognize the organizational protocols
6. Monitor the ways to handle the toxics
7. Identify fire prevention and fire extinguisher
8. Evaluate CPR as well as the artificial respiration
9. Discuss the evacuation and rescue
10. Catalogue the first aids
11. Understand the ill health as well as potential injuries
12. Demonstrate the precautions in mobility
13. Discuss the significance of various types of hazard and safety signs

UNIT 5.1: Hazard, Risk and Accidents

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify the types of hazards, risks as well as accidents

5.1.1 Types of hazards, risks and accidents

Hazard is considered a sort of incident or source that can fundamentally harm something, whether in a living or non-living state. It states to be significant to identify the hazard and the amount of risk or impact it would create on its surroundings. Thus, an individual must be prepared from the initial stages to manage such occurrences.

It is important to control workplace hazards by eliminating and identifying the capable risks. This is required as it is capable of causing accidents or hazards, along with finding the access based on the ways to isolate the risk which can lead to the hazard.

To ensure the safety of an individual and the workplace surrounding, an individual requires to regularly participate in the safety drill, which is conducted at their specific times.

Types of Hazards:

- **Safety Hazard:** A safety hazard is among the most common dangers found in every workplace. A safety hazard is capable of causing specific serious injuries or damage to the industrial workers. The safety hazards perform a practical part on the employees who have regularly contacted the heavy equipment or machinery throughout their working hours.

  Some of the safety hazards which lead to accidents in the workplace tend to include:

  - Anything capable of causing a fall, such as floor holes or opening walls, slippery surfaces, unprotected edges, and ladders which is unsafely situated.
  - Heavy-duty mechanisms, which is seen to be usually present in every industry, such as construction, manufacturing, mining and so on, can sometimes be the cause behind the accident. It is due to loose machinery parts, sharp edges, hot surfaces causing severe cuts, burns and wounds.
- **Chemical Hazards:** Chemical substances are seen to include but are also not restricted to acidic substances, petroleum products, reagents, acids, flammable liquids and many more.
  - Acidic substances are firmly alkaline in their state as they tend to possess properties to damage the accidental arrival in contact with the other substances by forming a chemical reaction.
  - The petroleum products generate gasoline such as Butane, Propane, Kerosene, and LPG as they are incredibly flammable hazards and can damage on a larger scale.
  - Acids occur to be more hazardous, relying on their corrosive materials. The common acid includes Hydrochloric Acid, Sulphuric Acid, and Nitric Acid.
- **Biological Hazards:** Biological hazard is also known as the biohazard and is connected to the biological substances that lead to sickness and illness in humans during its occurrence in direct contact.

  Sources through which the biological hazard might include are:

  - Bacteria, viruses, insects, plants and humans are capable of being the hazard carrier that adversely impacts their health, causing skin irritation and can also lead to serious infections, like Tuberculosis, AIDS, and carcinogenic infection.

- Toxins from biological sources stand to be extensively poisonous in their state as they are manufactured by harmful animals and plants, such as snake venom toxins and botulinum toxins.
- The most recent example of the biological hazard is the outbreak of Covid-19.

- **Physical Hazard:** A physical hazard is the least common hazard at the workplace and is not limited only to physical presence. Extreme weather conditions or unfavourable working environments are the major causes of physical hazards.

  Physical hazard has a prolonging effect on the health of the workers. These types of hazards are generally unrecognizable, like:

  - The temperature can also be a cause of danger for the workers who attempt to work indoor as well as outdoors, having the factors such as overexposure to heat and cold leading to some serious illness like heat stroke, sweaty palm increasing the risk of accident, frostbit hypothermia which can eventually lead to death also.
  - Harmful radiation like micro-waves, radio-waves, electro-magnetic waves, and so on.

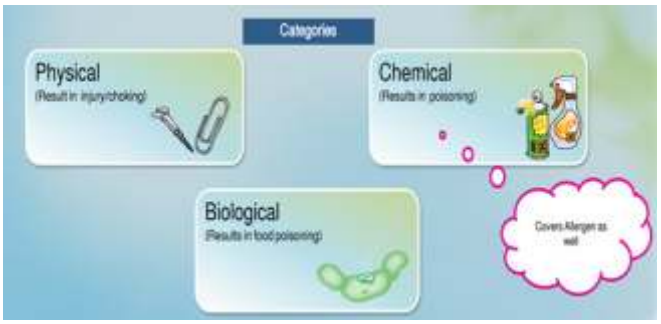


Fig. 5.1: Examples of physical, Chemical, Biological hazards

- **Ergonomic Hazard:** An ergonomic hazard is a type of hazard that adversely affects the worker's physical health, having continuous work leading to lower back pain, joint pains, muscles ache, and ligaments pain.

  Ergonomic hazards may include:

  - Poor sitting or standing postures.
  - Improperly adjusted chairs and workstation height.
  - Too much vibration or loud noise in the workplace.
  - Frequent lifting of heavyweights.
  - Prolong working conditions demanding physical force

- **Work Organization Hazard:** Work organization hazard usually defines the issues related to the workplace such as;
  - Excessive workload
  - Inappropriate behaviour of peers
  - Bullying
  - Lack of mental support
  - Work-related stress

Fig. 5.2: Sources of different types of hazards

5.1.2 Hazard Identification and Risk assessment

Risk Assessment (RA) and environment review (ER) were done for hazard and environmental impact. It is done from different stages, from evaluating a new operation, modification to the existing facilities, maintenance work and others.

RA identify all safety and health hazards – Including Operational, mechanical, electrical, chemical, biological and ergonomic for ER indicate the environmental aspects and impacts taken into consideration.

Review and update of R.A and ER to be done under following circumstances: -

- Amendments/addition in legal, corporate and other voluntary requirements.
- Change in process or product handled or new developments/ modifications in activities/ products/ services.
- Occurrence of the accident, emergency
- While initiating any corrective and preventive actions
- While purchasing and erecting any new equipment/ machinery/ building

UNIT 5.2: Standard Practices and Precautions

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Categorize the standard precautions and practices

5.2.1 Standard Practices and Precautions

- Hand hygiene- Physical, Chemical or Biological hazard
- Usage of personal protective equipment- Safety hazard
- Respiratory hygiene/ Cough Etiquette- Biological hazard
- Sharp Safety- Safety hazard
- Safe injection practices- Biological or Physical hazard
- Sterile instruments and Devices- Biological or Physical hazard
- Avoiding ergonomic hazard

- **Hand hygiene:** Washing hands regularly is a significant step towards cleanliness, protecting us from various diseases and infections. Washing hands can keep us healthy well as it protects us from viruses capable of travelling from one person to another person. Germs and bacteria are the only host which comes from touching the nose, eyes with dirty hands, or eating/cooking food with smeary hands.
- **Usage of Personal Protective Equipment**
  - Personal protective equipment, or PPE, protects its user against any physical harm or hazards that the workplace environment may present. It is important because it exists as a preventative measure for industries that are known to be more hazardous, like manufacturing and mining. Some of the personal protective equipment are: gloves, masks and eyewear.
- **Respiratory Hygiene / Cough Etiquette:** One should follow the below guidelines to maintain respiratory hygiene.
  - Covering the mouth and nose with a cloth or elbow while coughing or sneezing.
  - Throw the used tissues in a separate bin.
  - Washing of the hands or sanitizing before touching the nose or mouth
- **Sharp Safety:** Sharp objects such as needles, lancets, and surgical knives must be handled with utmost care to prevent injury or spread of infection.
- **Avoiding ergonomic hazard:** Headsets, monitor stands, and adjustable chairs are just some devices that can be easily integrated into a workspace to diminish the risk of injury from repetitive motions. Awkward locating refers to positions in the body when a person deviates significantly from a neutral position while performing tasks.

UNIT 5.3: Uses of Electrical Equipment

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Examine the utilization of the electrical equipment

5.3.1 The Utilization of the Electrical Equipment

Electrical equipment is generally that equipment that requires electrical supplies for their operations. It generally consists of several small components in an enclosed form and is controlled by a power switch. It tends to include:

- Electric switchboard
- Distribution board
- Circuit breakers and disconnects
- Electricity meter
- Transformer

Fig. 5.3: Different type of electrical equipment's

Hazards Related to Electrical Equipment's

The five hazards described here are very common and easily preventable.

- Working on live circuits
- Skipping Lockout/Tagout. It is also known as LOTO, which disconnects electricity and avoids electrical hazards.
- Forgetting PPE.
- Improper grounding.
- Damaged extension cords.

Fig. 5.4: Electrical hazard symbols

UNIT 5.4: Usage of Personal Protective Equipment

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Explore the usage of personal protective equipment

5.4.1 The Usage of Personal Protective Equipment

Personal protective equipment is majorly used to protect oneself from serious accidents or illnesses originating from the workplace's physical, biological, chemical, and mechanical hazards.

Personal protective equipment includes:

Fig. 5.5: The usage of personal protective equipment

Importance of PPE in Food Industry

Protective Clothing Reduces Injury and Contamination Risks. In the food manufacturing units, workers are at a surprising risk of exposure to harsh and toxic chemicals, which can cause further contamination of the food product. Also, PPE importance can be identified during working at height to avoid slip, trip and fall.

UNIT 5.5: Organisational Protocols

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Recognizing the organizational protocols

5.5.1 The Organizational Protocols

Accidents are unplanned experiences resulting in injuries, illness, death, and loss of property and/or production. While there is no way to avoid accidents, some actions, plans, and preparations are capable of being taken to diminish them.

Knowledge of the Hazards

- Be aware of the environment. Look around and recognize workplace risks that are capable of causing harm.
- Look for manners to diminish or eliminate hazards and implement them.
- Report unsafe areas or practices.
- Dress for the weather.
- Use the EHS (Environmental Health & Safety) Job Hazard Analysis devices to recognize hazards linked with job sorts.

Originate a Safe Work Sector

- Keep an orderly job place. Poor housekeeping is capable of causing safety hazards and serious health. The workplace's layout requires to have accurate egress routes as well as be debris free.
- Take breaks as well as mobilize around regularly all through the day. Short breaks (moving around and standing up) can make a big distinction in combating the threats of residing in a static position all day long.
- Pay attention to workstation ergonomics.

Use Safe Lifting Techniques

- Follow the following safe lifting practices:
    - Lift from a position of power
    - Keep the load close
    - Use a staggered stance
    - Cable/Rope/Slings in good repair
    - Hoist chain/Rope free of kinks and twist
    - Hooks not deformed or damaged and safety latches intact
    - Display of testing date, capacity and safe working load
    - Do not attempt to twist while lifting
- Training in body mechanics can reduce strain injuries and keep employees safe during moving and lifting.
- Regular Interaction
    - Notify supervisors regarding the safety hazards
    - Speaking up as well as being included in safety strategizing.
    - Constantly cultivate a safety level
- Training as well as Education
    - Make sure for everyone who possesses the appropriate safety training linking to the job's

threats.

- Take benefit of Environmental Safety and Health online training events.
- Each employee's responsibility is to take an active role in maintaining safety.

Emergency Preparedness Plan

Nowadays, many organizations, including the food industry, also implement their emergency preparedness plan, which includes hazards identified during their past years of operation; possible weather or climatic condition; spillages during operational activities, etc. Hazards can be classified as low, moderate and significant impact on the organization based on the geolocation of the unit.

Incident Reporting and Investigation

Incident

It is an event that causes damage to equipment material or other property. It may or may not be accompanied by human injury. It can be categorized as: -

- **No Injury Incident / Dangerous Occurrences**

  Fire– An incident in which a fire broke out which has the potential of causing burn injury to humans or damage to property.

  Near Miss– An incident that has the potential for causing an injury to humans or damage to property but narrowly escapes
- **Industrial / Injury incident:** An incident is a sudden and unforeseen event, attributable to any cause, which happens to the person, arising out of or in this course of his or her work and resulting in an employment injury to that person.
- **Major Incident** An incident results in a human fatality, permanent disability or extensive loss of equipment or materials.
- **Lost Time Incident**- Human injury incident prevents the person from doing his work for more than 48 Hrs.
- **Minor Incident–** An incident that causes minor injury to a human which may prevent him from undertaking his work up to 48 Hrs.
- **First Aid Case–** An injury incident that requires a person to go to a dispensary for a one-time treatment and/or any follow-up visit for observation of minor scratches, cuts, burn, splinters or other minor industrial injuries which do not ordinarily require medical care.
- **Unsafe Act:** The violation of a commonly accepted safe procedure or practice which resulted in the incident or was against the safety guidelines. Examples are operating without authority, operating at an unsafe speed, making safety devices inoperative, posture or unsafe position, failure to use personal protective equipment etc.
- **Unsafe condition:** The condition which has the potential to cause injury/harm & damage to property material/ environment or process, improper guarding, defective tools/ equipment, hazardous arrangement or process, Improper ventilation, high temperature/dust Noise.

Incident Investigation

- Persons investigating any incident should collect all information, evidence regarding the situation under which the incident; this shall also include the condition of the persons, physical and mental conditions.
- The investigation should be based on fact-finding, and immediate causes of incidents are listed in two groups (Unsafe Condition and Unsafe Act). The investigating team shall find out and note down. The investigation team shall attempt to list all unsafe conditions and all unsafe behaviours on personnel.

UNIT 5.6: Dealing with Toxics

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Monitor the ways to handle the toxics

5.6.1 The Ways to Handle the Toxics

Toxics are chemical substances that can cause serious harm to the person if he/she comes directly in its contact. One should be extra careful while handling such substances and an organisation must have clear labelling, separate storage rooms and proper guidelines for its usage.

- **Exposure hazards:**
  - **Contact or Absorption:** It can cause when a person comes in direct contact with toxic substances. It can result in drying or defatting of skin, skin irritation, or redness.
  - **Inhalation** occurs when a person inhales the fumes or vapour of toxic substances. It can cause shortness of breath, sore throat, coughing, an effect on the nervous system, and irritation during the breath.
  - **Ingestion:** It occurs when people accidentally consume toxic material. It can result in diarrhoea, vomiting, indigestion, effect on the functioning of the liver and kidney.

- **Storage requirement:**
  - Toxic substances must be stored in designated storage compartments only.
  - It should be stored under the optimum condition as prescribed. Always take the material in desired quantity and never put the used or remaining material in the original container.
  - One should always look for an alternative before using the toxic agent.
  - Only authorised
  - Personnel should be given access to the storage compartment.

- **Labelling requirement:**
  - Toxic substances or materials should be labelled in clear and readable format and proper usage instructions.
  - Work areas should be labelled properly where toxic substances are used regularly or excessively.
  - Always label the emergency contact number near the storage and the work area.

- **Spill and accident procedures:**
  - In case of a spill or accident, immediately alert the people in that area and inform the supervisors.
  - Evacuate the area and seize the entry.
  - Inform the relevant authority in case of leakage or spillage in larger quantities.
  - The trained professional of designated staff should only perform cleaning of toxic spillage.
  - Usage of absorbent while cleaning the corrosive or other harmful liquid.
  - Usage of neutralizing agent while cleaning the acidic, toxic substances.
  - Never touch the toxic substance with naked hands.

- **Waste management:**
  - Toxic waste must be segregated separately in accordance with its nature.
  - It should be managed separately from other wastes.
  - Flammable chemicals, acids should be disposed of carefully and separately in order to prevent any type of accident or injury.
  - Never dispose of the toxic substance in an open area.
  - It should always be disposed of in a leak-proof and airtight container.

Fig. 5.6: Waste disposal process for a different type of waste

UNIT 5.7: Fire Prevention and Fire Extinguishers

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Identify fire prevention and fire extinguisher

5.7.1 Fire Prevention and Fire Extinguisher

Prevention from fire is necessary to avoid excessive damage. Their major goal remains to educate the workers on the ways to prevent the environment from fire.

To prevent the workplace from fire, we must enforce the following measures:

- Workers should be highly trained for the mock drill.
- No smoking signs around the highly flammable liquid and gases.

Causes of fire

- **Flammable and combustible liquids:** This requires proper storage and handling in order to prevent the occurrence of fire which must be stored under a well labelled and closed container to avoid any accident.
- **Liquified Petroleum Gases:** LPG gas has a low density and is heavier than air. It usually accumulates in low lying areas so that the workers are warned if they tend to find any leakage or hole in the cylinders. Moreover, they must not use fire; instead of that, they are capable of utilizing soapy water and finding out the bubbles.

Prevention of the Casualties from Fire

- **Fire Alarm Devices:** These are the devices used to warn people during fire and smoke or any other types of fire emergencies. These alarms are automatically activated once smoke and heat are detected. It should be installed on the telephone desk and the employer's entrance in order to evacuate promptly.
- **Fire Extinguisher:** It is a lifesaver device that is used to control small fires as well as in emergency situations. It should not be used in indented fire issues if it is reached to the walls, ceiling or where there is no route for escape.

  Placement of fire extinguishers at workplace or organization must include.

  - The fire extinguisher should always be placed or mounted on a wall and should be properly marked.
  - Employees should be well trained with PASS methods or firefighting.
  - The fire extinguisher should always be kept at the ease of location to all employees.
  - Vehicles should also carry out one ABC rated extinguisher in case of emergency.
  - All extinguishers should be well marked and labelled and should be clearly visible.
  - All extinguishers should be inspected on a monthly basis, and their place it has not tampered with.
  - For the point of safety, all extinguishers should be examined yearly or required to be refilled in order to ensure operability.
  - A tag should also be attached to ensure its maintenance or refilling date and the signature of the authorized person.

- **Fire Extinguisher Classes:** There are four types/classes of fire extinguishers, which are most common, i.e., A, B, C and D, where every class is capable of putting out a varied sort of fire.
  - Class A extinguishers would be capable of putting out fires in ordinary combustibles such as wood and paper.
  - Class B extinguishers are utilized for flammable liquids like grease, gasoline and oil.
  - Class C extinguishers are used only for electrically energized fires.
  - Class D extinguishers are used on flammable metals.

Fig. 5.7: Types of fire extinguishers

Uses of Fire Extinguishers

Once it is installed in the workplace or industry, it is important for every employee to get familiar with the usage and the direction of fire extinguishers so as to be well prepared for the sudden occurrence of any hazardous incidents and accidents. Fire extinguishers are relatively easy to use in case of small fires by using some simple technique called PASS.

Fig. 5.8: Pass technique for Fire Extinguisher use

Fire Hydrant/ Fire Hydrant Pump

Fire hydrant consists of a system of pipework connected directly to the water supply mainly to water to every hydrant outlet as well as is attempted to present water for the firemen in order to fight a fire. The water is seen to be discharged into the fire engine, from which it is then pumped and sprayed over the fire. Where the water supply is not inadequate or reliable, hydrant pumps requires to be presented to pressurize the mains of the fire.

UNIT 5.8: Artificial Respiration and CPR

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Evaluate CPR as well as the artificial respiration

5.8.1 CPR As Well As the Artificial Respiration

Artificial respiration and CPR is an act (or) technique used for stimulating respiration when there is a sudden stoppage of breathing or lung functioning.

Techniques used to provide artificial respiration are:

- Mouth-to-mouth breathing
- Prone-pressure method
- Cardiopulmonary resuscitation (CPR) or external chest compression

There are two types of ways to provide Artificial respiration. They are:

- Manual and,
- Mechanical

Manual ways consist of:

- Mouth-to-mouth breathing
- Prone Pressure Method
- Back Pressure Arm-Lift

Mouth-To-Mouth Breathing

The steps to perform in this specific process are:

		
Position your hand	Interlock fingers	Give chest compressions

Open the airway

Give rescue breaths

Watch chest fall

Repeat chest compressions and rescue breaths

Fig 5.9: CPR steps

Prone Pressure Method

This method, additionally known as the Schafer method, stands to be a type of artificial respiration which is used for a patient in case of drowning. In this, the patient is placed in a prone or placed in a face-down position allowing rhythmically pressure with the help of hand on the thorax by means of which the water present would get expelled from the lungs allowing air to enter by clearing the passage in order to breath.

Back Pressure Arm-Lift

This particular method is used as an alternative when other methods are not possible or are not working out.

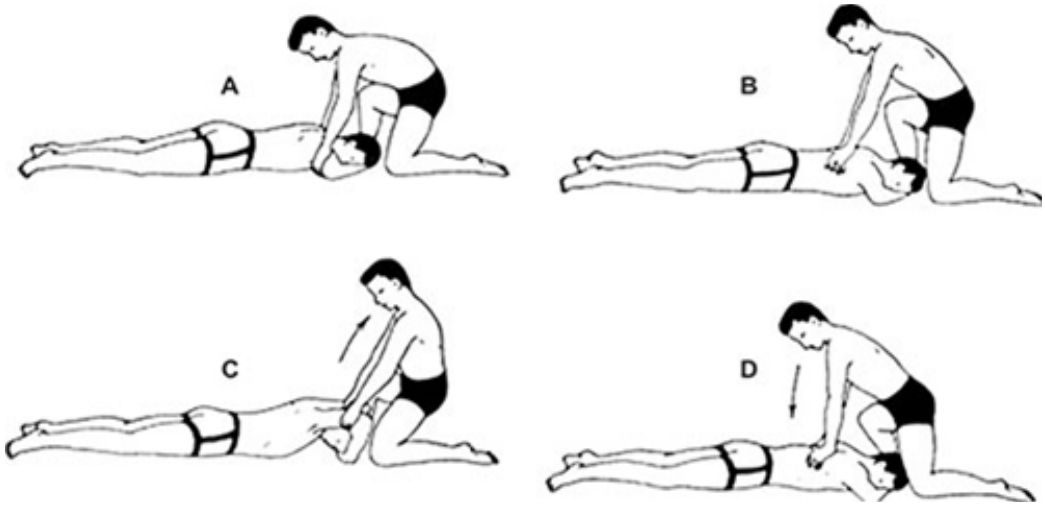


Fig. 5.10: Back Pressure Arm-Lift

A Mechanical Method of Artificial Respiration

These types of artificial respiration methods are generally performed by highly trained professionals such as a doctor, nurses, and paramedic forces. The mechanical method often uses machine-like ventilators. Another device that is used in the mechanical method is a bag valve mask. It has the self-inflate and deflates mechanism as well as has an air supply that is controlled by the valve.

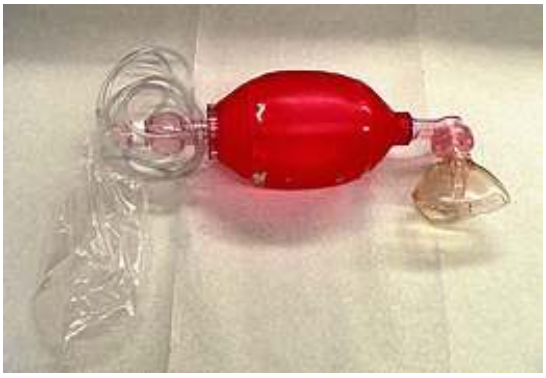


Fig. 5.11: Big Valve mask

Fig. 5.12: Ventilator

UNIT 5.9: Rescue and Evacuation In Case Of Fire

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss the evacuation and rescue during a fire incident

5.9.1 The Evacuation and Rescue during a Fire Incident

A "Fire Emergency Evacuation Plan (FEEP)" stands a scripted document that involves the activity to be adapted by all staff in the event of a fire and the sequences for calling the fire brigade.

Staff Fire Notice High fire threats or extensive premises that would be required a more illustrated emergency evacuation strategy which takes account of the findings of the assessment of fire risk, e.g. the staff importantly at threat and their spots. In addition, notices providing transparent and concise routine's instructions to be followed in the instance of fire that requires to be appropriately showcased.

In some instances, the inidviduals requires to be nominated inidviduals in order to conduct the fire action plan as well as provide them enough training in firefighting as well as procedures for evacuation. The following items require to be taken into consideration where appropriate:

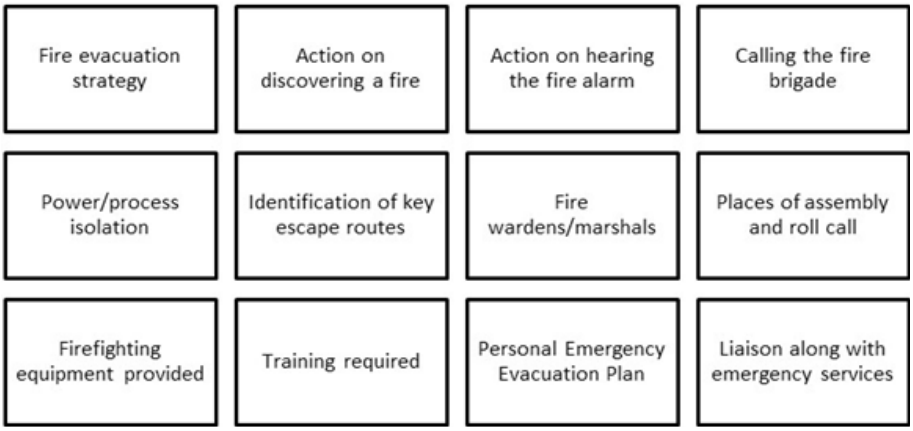


Fig. 5.13: Staff Fire Notice

Fire Evacuation Plan

You require taking into consideration of how you would tend to arrange the premises evacuation in the light of your risk evaluation as well as the other fire precautions that the individuals possesses or intended to put in spot.

Simultaneous Evacuation

In most premises, the evacuation in the instance of fire would easily be by means of each one responsing to the warning signal given when a fire is discovered, then making their way, by regards of escape, to a spot of safety away from the boundaries. This is referred as a simultaneous evacuation and would generally be initiated by the sounding of the normal alarm over the system of fire warning.

Vertical Phased Evacuation

In certain larger complex premises, the emergency arrangements are designed to allow people who are not at immediate risk from fire to delay initiating their evacuation. It might be accurate to start the evacuation by initially performing the evacuation by only the sector closest to the fire as well as warning other individuals to stand by. This is generally done by suddenly evacuating the floor where the fire is spotted as well as the floor located above. The other floors are then evacuated among the individuals to neglect congestion on the escape paths. The rest of the indivdiuals are then evacuated if it is important to do so. The fire warning system requires to be capable of providing two distinctly different signals (warning and evacuation) or giving accurate voice messages. Horizontal phased evacuation in hospitals as well as care homes: the floor may be divided into a number of fires resisting compartments, and the occupants are moved from the compartment involved in the fire to the adjacent compartment as well as, if required, moved again. Depending on the fire situation, it might eventually be significant to take into consideration vertical evacuation.

Other Fire Precautions

- systems of voice alarm
- fire control points
- compartmentation of the premises using fire-resisting construction
- sprinklers in buildings where the top floor is 30 meters or more above ground standards

Staff Alarm Evacuation (Silent Alarm)

In certain instances, it might not be accurate for a normal alarm to start immediate evacuation (Cinemas and Theatres). This could be as of the number of members of the public provided and the requirement for the staff in order to put pre-arranged strategies for the safe evacuation of the premises into action. In the mentioned situations, a staff alarm is capable of being provided (by fire records, personal pagers, discreet sounders, or a coded phrase on a public address system etc.). Following the staff alarm, a more normal alarm signal is capable of being provided, as well as a phased or simultaneous evacuation initiated. The general alarm might be activated automatically if manual initiation has not taken place within a pre-determined time.

Defend in Place

This strategy might be taken into consideration in blocks of flats where each flat is a minimum 60-minute fire-resisting compartment. It might additionally be considered in hospitals or nursing homes where patients are connected to life-supporting equipment as well as is not capable of being moved. The concept authorises the occupants to stay put as well as authorise the fire facility to extinguish the fire. If the fire spreads as well as it is not capable of being controlled, then they would tend to initiate an entire evacuation. In the instance of patients connected to life-supporting equipment, a decision has to be made which choice stands to be the best, stay or move; in either manner, the patient would be at grave threat.

You should only strategise in order to utilise defend-in-place, phased evacuation schemes or a alarm system for the staff if the individuals have sought the suggestion of a competent individual as well as the fire and rescue service.

Action on Hearing the Fire Alarm

On discovering a fire, it is the duty of every person to sound the nearest fire alarm immediately. The plan should include the method of raising the alarm in the case of fire.

People, on hearing the alarm, should proceed to pre-determined positions to assist members of the public and staff in leaving the building by the nearest safe route.

Lifts and escalators should not be used due to possible electrical failure unless they are part of a Personal Emergency Evacuation Plan.

Calling the fire brigade

The Fire Service should also be informed to combat from fire.

Power/Process Isolation

Close Down Procedure – Adopt your own 'Close Down' procedure as appropriate.

Fig. 5.14: Fire evacuation process

UNIT 5.10: First Aid

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Cataloguing the first aids

5.10.1 First Aids

First aid, as the name suggests, stands to be the first and immediate care or assistance provided to the person in case of either minor, serious injury or illness. First-aid provided on time can save the life in case of life and death kind of situation as well as additionally assists to control the condition from worsening further.

First aid is often controlled by the 3 P's principle:

- Prevent further injury
- Preserve life
- Promote recovery

It is necessary that each floor or manager should have the first aid box handy with them and can be easily accessed by the employees in case of emergency or need.

Fig. 5.15: First Aid Kit

UNIT 5.11: Potential Injuries and Ill Health

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Understanding the ill health as well as potential injuries

5.11.1 The Ill Health As Well As Potential Injuries

The major role of work is based on enhancing self-esteem, wellbeing and social mobility. However, work-related accidents or illnesses can impact the employee's health in longer or shorter terms and may result in economic as well as social repercussions for the employer.

It is mandatory for an employer to have precautionary measures in place to avoid such incidents. A few common work-related injuries and illnesses are:

- **Slips, trips and falls:** One of the most common causes of injury are slippery surface, fall from ladder or height. It can be avoided through a safety grill or safety bars.
- **Muscle strains:** Muscle strain occurs at the workplace due to lifting heavy items regularly and long-standing or sitting hours. This can be prevented easily through exercise, training and guidance.
- **Being hit by falling objects:** Employees working in warehouses often encounter injuries caused by fall-ing objects. It can be controlled by providing adequate storage and encouraging staff to store the item safely.
- **Cuts and lacerations:** It generally occurs by inappropriately handling sharp objects and is capable of being controlled by delivering the proper training to the staff, wearing proper protection and providing safety equipment to the workers.
- **Inhaling toxic fumes:** Workers who are dealing with chemicals are more likely to become a victim of an injury caused by toxic materials like inhaling dangerous gases or fumes. It is mandatory for the em-ployer to provide adequate safety gear to its worker who regularly meets such kinds of substances.
- **Crashes and collisions:** It can happen in warehouses and construction sites due to vehicle movement, and prevention can be done through necessary safety measures such as PPE, sufficient light, safety alert etc.
- **Exposure to loud noise:** Industrial deafness can occur to employees working in loud noise areas, and it can be avoided by wearing earplugs or earmuffs.
- **Fights at work:** Disagreement or tension may lead to fighting at work. It is a must to have an employee grievance department in order to deal with such cases.

UNIT 5.12: Precautions in Mobility

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Demonstration of the precautions in mobility

5.12.1 The Precautions in Mobility

For the safety of the workers or employees at the workplace or any industry, one should always take the necessary precautions.

All manufacturing owners need to comply with the legal requirements to order to ensure that their industry and workplace is safe to work for everyone, from the customers to employees, suppliers, visitors, contractors and others.

In order to provide better productivity for a workplace, the management of the organization:

- Should minimize illness and injury of employees.
- Should reduce the risk of accidents.
- Should maximize productivity.
- Should reduce the cost of injuries and workers compensation.
- Should meet their legal requirements and responsibilities.
- Should retain their staff for better performance.

Precautions at the workplace may include.

- Keep every corner organised, clean and clutter-free
- Usage of mats on slippery floors
- Properly stored combustible material
- Ensure proper training while handling equipment and machinery

It is very important to have medical facilities and proper first aid for the employees working with heavy equipment and machinery.

1. **Clothes for each different appropriate task:** The people who are working with tools or with machinery must have proper clothing while operating the machinery. They must wear the right size of gloves according to the type of work and must wear safety shoes as well as all protective equipment while handling the tools, machinery and chemicals.

   Different industries have different types of personal protective equipment based on their mode of work. Those are:

   - **The food processing industry:** In this particular industry, they do not require special types of uniforms unless they require antibacterial head caps, clothing or aprons in order to prevent bacterial contamination.
2. **Implementation of emergency procedures:** This procedure usually contains emergencies that do not announce themselves, and there can be the expectation of fire and accidents. For this, there is a need to be prepared beforehand for such emergencies in order to ensure the safety of the employees, workers, visitors as well for business.

3. **Reduce workplace stress:** The common cause of stress during work is working for long hours, insecurity of job and conflicts between employees, which can sometimes lead to depression, difficulties during work and affects the concentration of the employees. Employers must avoid excessive workload on their employees as it may lead to employee's frustration which will provide a direct impact on employee productivity.

In order to promote a healthy and stress-free environment at the workplace, it is the employer's duty to take care of both the physical and emotional well-being of its employees by conducting regular training on time management, outdoor activities, small group discussion and many more.

UNIT 5.13: Significance of Various Types of Hazard and Safety Signs

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Understanding the impact of various types of hazard and safety signs

5.13.1 The Impact of Various Types of Hazard and Safety Signs

Safety Hazard Significance

A hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socio-natural in origin.

Safety hazards are number one on the list of 6 types of workplace hazards. These hazards play an effect on employees who work directly with machinery or on construction sites. Safety hazards are the most common workplace risks. They include:

- Anything that can cause spills or trips such as cords running across the floor or ice
- Anything that can cause falls, such as working from heights, including ladders, scaffolds, roofs, or any elevated work area.
- Unguarded and moving machinery parts that a worker can accidentally touch.
- Electrical hazards like frayed cords, missing ground pins, and improper wiring
- Confined spaces.

Safety Hazards Symbol

Safety symbols, hazard symbols or safety labels are meaningful and recognizable graphical symbols that warn of or identify hazards associated with the location or item.

Fig. 5.16: Role of hazard in Risk assessment

Chemical Hazard Significance

A chemical hazard is a (non-biological) substance that has the potential to cause harm to life or health. Chemicals are widely used in the home and in many other places. Exposure to chemicals can cause acute or long-term detrimental health effects. In the workplace, exposure to chemical hazards is a type of occupational hazard. The use of personal protective equipment (PPE) may substantially reduce the risk of damage from contact with hazardous materials.

Chemical Hazards Symbol

Hazard pictographs are a type of labelling system that alerts people at a glance that there are hazardous chemicals present. The symbols help identify whether the chemicals that are going to be in use may potentially cause physical harm or harm to the environment.

These pictographs are also subdivided into classes and categories for each classification. The assignment for each chemical depends on its type and severity.

Fig. 5.17: Chemical hazard safety signs

Biological Hazard Significance

Biological health hazards include bacteria, viruses, parasites and moulds or fungi. They can pose a threat to human health when they are inhaled, eaten or come in contact with skin.

Fig. 5.18: Biological hazard safety signs

Biological Hazards Symbol

The biohazard symbol is used or displayed only to signify the actual or potential presence of a biological hazard. Appropriate wording may be used in association with the symbol to indicate the nature or identity of the hazard, the name of the individual responsible for its control, precautionary information, etc., but never should this information be superimposed on the symbol.

Ergonomic Hazard Significance

Poor ergonomics contributes to muscle strain, muscle imbalances, and fatigue. Many muscle strains result from performing the same motion over and over again. These become repetitive stress injuries, which are some of the most common workplace injuries.

Ergonomics alone won't eliminate this type of injury. However, proper ergonomics will significantly reduce fatigue and strain.

Ergonomic Hazard Symptoms

Signs and symptoms of ergonomic injuries include pain which may be dull and aching, sharp and stabbing or a burning sensation—tingling or numbness; swelling, inflammation, stiffness. Muscle weakness or discomfort; extremities are turning white or cold.

Work Organization Hazard Significance

A few examples of work organization hazards and it is effective they are defined below.

- Falls and Falling Objects- It can result in serious injury or fatality
- Fire Hazards- It can result in loss, serious injury or fatality
- Electrical Hazards- It can result in loss, serious injury or fatality

Work Organization Hazard Symbol

There are multiple signs or symbols used in an organization to alert the people in their workstations.

Fig. 5.19: Work organization related hazard safety signs

Summary

- Hazard can be identified as an extended-term as it is capable of causing severe disruption to the environment or surroundings.
- Risk Assessment (RA) and environment review (ER) were done for hazard and environmental impact. It is done from different stages, from evaluating a new operation, modification to the existing facilities, maintenance work and others.
- Electrical equipment is generally that equipment that requires electrical supplies for their operations.
- Personal protective equipment is majorly used to protect oneself from serious accidents or illnesses originating from the workplace's physical, biological, chemical, and mechanical hazards.
- Accidents are unplanned experiences resulting in injuries, illness, death, and loss of property and/or production. While there is no way to avoid accidents, some actions, plans, and preparations are capable of being taken to diminish them.
- The "Occupational Safety and Health Administration (OSHA)" needs to implement the organization with a fire prevention event in order to prevent injuries and accidents from the occurrence of fire in the workplace. Prevention from fire is necessary to avoid excessive damage.
- Fire hydrant consists of a system of pipework connected directly to the water supply mainly to water to every hydrant outlet as well as is attempted to present water for the firemen in order to fight a fire. The water is seen to be discharged into the fire engine, from which it is then pumped and sprayed over the fire.
- Artificial respiration and CPR is an act (or) technique used for stimulating respiration when there is a sudden stoppage of breathing or lung functioning. It requires metabolic processes to exchange the gases which tend to be present in the body by external or pulmonary ventilation.
- Fire drills can be initiated with a defined frequency in a surprising manner to ensure employees are well aware of the fire evacuation process. Attendance can be taken in assembly points, and briefing also can be arranged to further train the staff.
- First aid, as the name suggests, stands to be the first and immediate care or assistance provided to the person in case of either minor, serious injury or illness. First-aid provided on time can save the life in case of life and death kind of situation as well as additionally assists to control the condition from worsening further.
- The major role of work is based on enhancing self-esteem, wellbeing and social mobility. However, work-related accidents or illnesses can impact the employees' health in longer or shorter terms and may result in economic as well as social repercussions for the employer.
- A hazard is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socio-natural in origin.
- Poor ergonomics contributes to muscle strain, muscle imbalances, and fatigue. Many muscle strains result from performing the same motion over and over again. These become repetitive stress injuries, which are some of the most common workplace injuries.

Exercise

A. Answer the following questions by choosing the correct option:

1. Is Covid -19 a biological hazard?
   A True B False
2. Which of the following is included in Personal Protective equipment?
   A Spectacles or clear goggles B Earmuffs
   C Hard hat D All of them.
3. Can toxic substances spillage be wiped off with a normal cloth and with bare hands?
   A True B No
4. A simple technique for using fire extinguisher_____.
   A. PASS method B Installation on telephonic desk
5. Which is not a part of potential injury at the workplace?
   A Muscle strain B Cuts
   C Slip or fall D Drowning

B. Answer the following questions briefly.

1. Explain the golden rule of “First Aid”.
2. Why is Organisational Protocol necessary for an organisation?
3. Describe any two types of electrical equipment?
4. Explain why hand hygiene is necessary for oneself.
5. Describe the various types of hazards involved while handling or dealing with toxic?

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=-DaYwcH1GMEg

Emergency Procedures

6. Employability Skills

Scan the QR code below to access the eBook

https://www.skillindiadigital.gov.in/content/list

DGT/VSQ/N0101

7. Annexure

Unit 7.1 - List of QR Codes Used in Book

UNIT 7.1: List of QR Codes Used in Book

Module No.	Name	Page No.	URL	QR Code (s)
1. Introduction to the job role and overview of the Food Processing Industry	Scope of food processing in India with National and International perspective	15	https://www.youtube.com/watch?v=5VlYw38hCxU	
	Overview of Food Processing Industry	15	https://www.youtube.com/watch?v=J-2EiMVNtpM	
2. Prepare for Production	Introduction to Indian sweets	36	https://www.youtube.com/watch?v=Q9lgpwRLDoA	
	Procedure for Production Planning	36	https://www.youtube.com/watch?v=MiUgOzXfUYs	
	Waste management	36	https://www.youtube.com/watch?v=K6ppCC3lboU	
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Module No.	Name	Page No.	URL	QR Code (s)
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	Food Safety	140	https://www.youtube.com/watch?v=KBvU4Bmu5O0	
5. Managing Accidents and Emergencies	Emergency Procedures	170	https://www.youtube.com/watch?v=DaYwcH1GMEg	
6. Employability Skills- 30 Hours (DGT/VSQ/N0101)		171	https://www.skillindiadigital.gov.in/content/list	

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