सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

Participant Handbook

Sector
Food Processing

Sub-Sector
Dairy Products

Occupation
Processing - Dairy Products

Reference ID: **FIC/Q2005, Version 3.0**
NSQF level 3

Cottage Cheese Maker

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Shri Narendra Modi
Prime Minister of India

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FOOD INDUSTRY CAPACITY AND SKILL INITIATIVE (FICSI)

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: **Cottage Cheese Maker** QP No. **FIC/Q2005, NSQF level 3**

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(CEO, FICSI)

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DECLARATION

In case of any issue regarding the plagiarism, the onus lies on the author of the participant handbook of milk powder manufacturing technician.

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 'Packing Machine Worker-Food Processing' and 'Packing Machine Worker-Food Processor' 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.

- Introduction to the Training Program and Overview of Food Processing Industry (FIC/N2017)
- Complete documentation and record keeping related to production of cottage cheese (FIC/N2019)
- Food Safety, Hygiene and Sanitation for Cottage Cheese (FIC/N9001)
- DGT/VSQ/N0101 Employability Skills

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1. Introduction to the Training Program and Overview of Food Processing Industry

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FIC/N2017

Key Learning Outcomes

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

1. Introduce each other and build rapport with fellow participant and trainer
2. Define food processing
3. List the various sub sectors of food processing industry
4. Define Dairy Processing
5. To understand milk and the methods of testing milk for accepted quality standards
6. Introduction of coagulated product
7. Introduction of Cottage Cheese (Paneer)
8. To understand various units under dairy processing plant

Unit 1.1 Introduction to the training program

Unit Objectives

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

1. Know each other and about trainer
2. Know about the purpose of training against this Job Role
3. Know about training outcomes
4. Discuss the National Occupational Standards and the Qualification Pack

1.1.1 Purpose of training

This training programme is developed to impart specific knowledge and skills relevant to job role required to perform as a Cottage Cheese (Paneer) Maker. The training programme of Cottage Cheese (Paneer) Maker is based on the Qualification Pack (QP) code FIC/Q2005. A QP consists of a set of National Occupational Standards (NOS). A NOS specify the standard competency, a worker must possess while conducting any job/activity at the processing area. The following NOS are compulsory to QP Cottage Cheese (Paneer) Maker:

1. FIC/N2017 Preparation and maintenance of work area and machineries involved for production of cottage cheese (paneer)
2. FIC/N2018 Carry out production of cottage cheese (paneer)
3. FIC/N2019 Complete all the documents and records in continuation of the production of Cottage Cheese (Paneer) Maker.
4. FIC/N9001 Maintain safety, hygiene and sanitation in a food processing industry

Occupation Standards (OS) is the set of standards related to performance at workplace, an individual must accomplish while performing any job/activity, along with the knowledge and understanding need to achieve that standard without fail. Occupational Standards are relevant to the Indian and global contexts.

After successful completion of training and passing the assessment, you will be issued a certificate.

Fig.1.1.Skill card

1.1.2 About Skill card

Skill Card is issued to Certified Trainers and Assessors, displaying the following:

- Name
- Unique ID
- Certification Grade
- Validity of the Certification

The skill card will have a quick response (QR) code and by scanning it, an employer will know what kind of skill course a person has undergone and what type of certification he or she has been awarded. For a trained job seeker, it will lead to less hassle—he or she will not have to carry bundles of certificates.

The card may be converted into a smart card, with an embedded chip over time.

1.1.3 Training Outcomes

After completing this programme, participants will be able to:

1. Learn about Food Processing
2. Plan production sequence as per production order
3. Produce Cottage Cheese following specification and standards of the organization
4. Observe food safety and hygiene standards at work
5. Maintain documents and keep records of raw material, finished goods and process parameters

Notes

Unit 1.2 Overview of the Food Processing Industry

Unit Objectives

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

- Describe food processing
- Enlist a range of sectors present in the food processing industry
- Know the market trends of food processing industry

1.2.1 Food Processing

Agriculture is the backbone of the Indian economy. The produce from various agriculture-based occupations is primarily used for consumption within the country. It is exported to different parts of the world as well. Agricultural produce is also used as raw material in the food processing industry.

The role of food processing is the conversion of agricultural harvest into value added food products. Food processing includes many unit operations through which raw agricultural produce can be transformed into more valued shelf stable product. The main purpose of food processing is to increase the storage life of food using preservation techniques.

Indian food processing industry is divided into numerous sub-sectors viz:

Table 1.1: Sub-Sectors of food processing industry

Sub-Sectors	Industry Scenario
Dairy	Whole milk powder, skimmed milk powder, condensed milk products, cream, butter and ghee, ice-cream, cheese, paneer, flavor milk, curd, shrikhand, etc.
Fruit and vegetable processing	Juices, slices, concentrates, pulps, frozen and dehydrated products, wafers, pickles, etc.
Grains and cereals	Flour, bakeries, cornflakes, vermicelli, malted foods, beer and malt extracts, grain-based alcohol, etc.
Fisheries	Fish oil, frozen and canned products, etc.
Meat and poultry processing	Frozen and packed meat, egg powder, etc.
Bread and bakery	Biscuits, cookies, breads, cakes, buns, confectionery, pastries, etc.
Consumer foods	Snack foods, namkeen, ready-to-eat foods, etc.

1.2.2.Opportunities in Food Processing:

Indian Economy is fastest growing economy in the world. The Indian food processing industry is actually supported by two key sectors of Indian Economy – Agriculture and Manufacturing. Food Processing Sector is rightly being phrased as Sunshine sector, as several policies are being amended to encourage the build investment ecosystem and all efforts are being made to achieve the required infrastructure.

1.2.3 Production, Processing and Wastage

India is the world's largest economy and ranked 3rd after US and China. India ranked first in production of milk, pulses, spices, fish, livestock, and plantation crops. India secured second position in Fruits and Vegetables production after China. The domestic market is growing rapidly with the increasing demand of food groceries and services.

1.2.3.1 Production Status (2017 - 2018)

- Milk: 176.3 Million MT
- Horticulture: 307.16 Million MT
- Food grains: 279.51 million MT
- Meat and poultry: 6.7 Million MT
- Marine: 11.41 million MT
- Fruits and vegetables : 314.5 MT

1.2.3.2 Processing status

In Spite of a large production ground, only a very small portion of production is processed.

- Fruits and vegetables: 2%
- Poultry: 6%
- Milk: 35%
- Marine : 8%
- Overall processing: <10%
- Meat: 1%

Table 1.2: Segment wise types of processing

Segments	Primary Processing	Secondary Processing	Tertiary Processing
Milk	Inspection, Grading and Chilling	Packaged milk, Cream, Flavored milk, Milk powder	Paneer, Cheese, Ice cream, Curd, other value added products
Fruits and Vegetables	Cleaning, Cutting, Sorting	Pulp, Slices, Flakes, Paste, Frozen, Canned	Jams, Jellies, Chips, Syrup beverages, Indian ethnic drinks
Grains and Cereals	Sorting and Grading	Rice Puff, Flour, baby food(final product/ ingredients)	Cakes, Biscuits, Breakfast cereals, breads, other bakery products, RTC/RTE products
Oilseeds	Sorting and Grading	Oil Cakes, Refined Oils	Soya Oil, Olive Oil, Mustard Oil, Fortified Oil
Meat and Poultry	Sorting and Refrigeration	Chilled/Frozen products	Ready to Eat products

1.2.3.3 Processing Advantage in India

- ✓ 3rd largest and extremely growing economy in the world
- ✓ Major producer of various agricultural commodities in the world
- ✓ Geographical advantage
- ✓ High number of skilled personnel at considerable rate
- ✓ High emphasis on the development of skill through several schemes of GOI
- ✓ Attractive incentives of GOI for the food processing industry
- ✓ High opportunity for investors in the supply chain of food commodities
- ✓ GOI investments for the development like ports, infrastructure related to transportation, supply chain and storage facilities.
- ✓ 1st in Milk Production

1.2.4 Market trends of food processing industry

Food Processing industry is an important industry of India and ranks fifth with context of production, consumption, and exports of processed food. The diverse agro-climatic conditions and availability of food infrastructure are the key factors for the growth of Indian food processing hub. Only 10% of the total food produced in India is converted into value-added products, which is very less as compare to the developed nation like United States (65%) and China (23%).

The food processing industry is expected to expand in the tune of 11.5% compound annual growth rate (CAGR) between FY 2018 and FY 2023.

National Investment Promotion & Facilitation Agency predicted the following:

1. Indian food processing along with retail market is estimated to reach 828.92 billion dollar by 2020.
2. Dairy industry of India is likely to double to 140 billion dollar by 2020.
3. The industry have the potential to attract 33 billion dollar investments by 2020 and able to generate employment for 9 million people
4. 100% FDI is permissible through the automatic route in food processing industry,
5. 100% FDI is through e-commerce platform for the food commodities produced or manufactured in India.

1.2.5 Government initiatives for food processing sector:

Several schemes and financial support were launched by the Ministry of Food Processing Industries (MOFPI), GoI. Some of them are mentioned below:

- ➢ Pradhan Mantri Kisan Sampada Yojana: focused on the development of Agro-Marine Processing and Agro-Processing hubs.
- ➢ Mega food park scheme: Sanctioned 40 Mega Food Parks (MFPs). At present, 17 Mega Food Parks are in operation.
- ➢ Scheme for creation/expansion of infrastructure for preservation or value addition units,
- ➢ Scheme for development of cold chain

Unit 1.3 Overview of Indian Dairy Industry

Unit Objectives

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

- Explain the requirement of processing milk
- List down the various sub section within a dairy processing plant

1.3.1 Need for Processing Milk

Milk is considered wholesome food mainly because of its high nutritive value. It has to be processed because:

The primary responsibilities and essential functions of extruder operator are as follows:

- It is highly perishable by nature.
- It can be used for preparing other dairy products like dahi, cheese, paneer, butter etc.
- The demand for liquid milk and value added products is continuously increasing in domestic as well as international market.

1.3.2 Dairy Industry in India

As per recent data, India leads in the milk production throughout the world. The annual production of milk reaches up to 176.3 million tonnes in year (2017-2018). The organized sector handles only 50 percent of the milk produces in country. It is estimated that domestic market annual growth for the products like ice cream, paneer, cheese, butter and milk powder is 8 to10 percent. However, only 27% of the total milk production at present is processed into value added products. Consumption patterns of liquid milk at the farm level and less infrastructure for processing is the main reason for low value addition of milk. The demand for value added products especially traditional dairy products is increasing day by day and the dairy industry of the country is trying to met the present demand.

1.3.3 Units of a Dairy Processing Plant

A dairy processing plant consists of several units as per the size and operational requirement. Some of these are:

- Milk reception section
- Process milk section
- Butter oil section
- Powder section
- Ice-cream section
- Fermented Milk product section
- Utilities for processing plant
- Stores and purchase
- ETP section
- Quality assurance section
- HACCP/ISO Section
- Paneer section
- Flavor milk section
- Pouch section
- Finished foods dispatch
- Pouch dispatch
- Administration and accounts
- Milk marketing section
- Boiler Section
- Refrigeration Section
- Compressed air section
- Cream/Butter section

1.3.4 Opportunities in Infrastructure and Technology for Dairy Processing

- ✓ New technology in dairy processing, like membrane filtration, cold centrifuge, cold concentration modified cold storage, and ice silo or ice bank tank.
- ✓ New and innovative Packaging solutions for dairy products, which attracts customers and provides easy handling along with high shelf life.
- ✓ Enhancement of shelf life for the existing products, without altering the taste and texture,
- ✓ Research infrastructure for new product development
- ✓ Energy efficient technologies
- ✓ Dedicated testing labs for nutrients and sensory parameters

1.3.5 Opportunities in Processing of dairy products

- ❖ New product development in dairy beverages viz. herbal milk, smoothies, health drinks, energy drinks, sports drinks
- ❖ New products development- products with fortification, tradition Indian food, convenience food
- ❖ Creation of Supply chain facilities – with the increasing demand of food products, there will be huge demand and potential for the creating a Supply chain facilities in food processing sector. MoFPI is also focusing in the area like mega food park, cold storage, and infrastructure related to supply chain.
- ❖ Design and development of machineries or equipment related to food processing activities like canning, innovative processing and packaging, cold plasma, non thermal and non destructive technologies.

It was 'White Revolution or Operation Flood" which has transformed India into a leading milk producer in the World. Cooperative and private dairy sector come into the existence and really helped dairy farmers to enhance their income. Top fifteen milk and milk products producing companies are as below.

1. Amul – Anand Milk Union Limited, Gujarat
2. Nandini Milk – Karnataka Milk Federation
3. Mother Dairy – Noida, Uttar Pradesh
4. Dudhsagar Dairy – Mehsana, Gujarat
5. Milma Milk – Kerala Co-operative Milk Marketing Federation
6. Aavin Milk – Tamil Nadu Co-operative Milk Producers Federation
7. Sanchi Milk – Madhya Pradesh State Cooperative Dairy Federation
8. OMFED Milk – Orissa State Cooperative Milk Producers Federation
9. Sudha Dairy – Bihar State Milk Co-operative Federation
10. Verka Milk – Punjab State Cooperative Milk Federation
11. Heritage Foods
12. Hatsun Agro Product
13. Kwality Ltd
14. Milky Mist Dairy – Erode, Tamil Nadu
15. Reliance Dairy

Unit 1.4 Introduction to Milk and testing procedure

Unit Objectives

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

- Explain milk
- State the composition of milk
- Describe milking practices
- Describe milk collection and transportation practice
- Describe the testing method for milk as per standards

1.4.1 Milk

As per FSSAI, "Milk is a whole, fresh, clean lacteal secretion obtained by complete milking of one or more healthy milch animals excluding that obtained within 15 days before calving or 5 days after calving. Market milk must possess the pre determined percentage of milk fat and SNF (Solid Not Fat)."
Milk of different classes and types must conform to the standards laid down by FSSAI. Mixed milk means a combination of the milk from cow and buffalo or any other milch animal. The combination also should at par with FSSAI standards. The following table explains the composition of milk:

Table 1.3: Nutritional values of milk

Nutritional Factor	Description	Energy Value
Protein	Milk protein is casein, a high quality protein. Allessential amino acids is present in Milk.	4.1 KC/g
Minerals	Milk contains phosphorus and calcium.	
Vitamins	Milk contains vitamins A, D, thiamine, and riboflavin.	
Fat	Milk fat is responsible of good flavor and physical properties. The fat content in cow milk is generally from 3.5 to 4.5 %	9.3 KC/g
Lactose	Lactose is the sugar component of milk and supply energy.	4.1 KC/g

1.4.1.1 Percentage of different compounds in milk

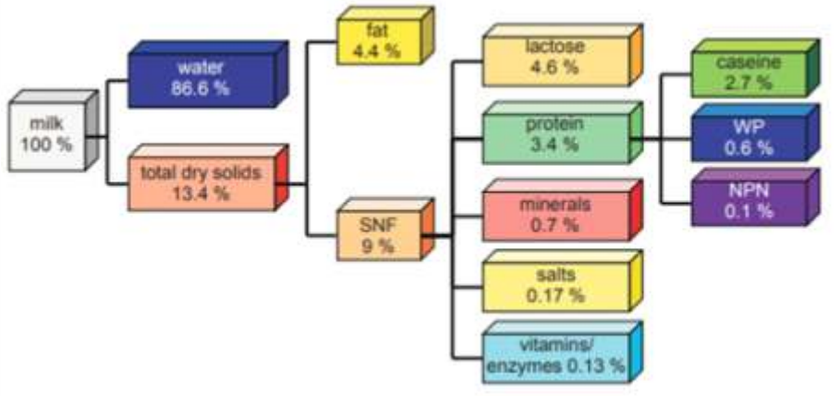


Fig.1.3: Percentage composition of milk (Source: Dairy Processing Handbook - Tetra Pak)

1.4.2 Milking Methods

Milking may be done manually or through machine. In case of manual milking, cows are milked from left side and initial strip of milk are discarded because of bacteria may accommodate themselves in the teat canal. Prior to milking, udders were cleaned with the help of clean and uncontaminated water.
In case of machine milking, all the parts were cleaned and sanitizes prior to use. Semiautomatic and fully automatic type of milking machine are available in the market.

Table 1.4: Types of milking methods

1.	**Stripping method**	
2.	**Full hand method**	
3.	**Knuckling method**	
4.	**Machine milking** **Types:** **Single bucket** **Double bucket**	
5.	**Milking Parlor**	

1.4.3 Milk Collection And Transportation Practice Available In India

The fresh milk need to be collected, tested and transported from the point of production to processing including chilling centers, processing unit and distributions points in cities.

1.4.3.1 Rural Milk Collection

It depends on the availability of milk, road
access to collection points and their distance from the site of the dairy plants.

1.4.3.2 Co-operative system

In case of co-operative society, which was generally formed by the group of villagers a collection center was establishes to receive milk twice a day. The milk were subjected to test prior to the acceptance at collection centre and paid accordingly on the basis of weight, SNF ratio or fat percentage. Further the co-operative society sells milk to nearby milk processor, (private of government dairy plant) via cans or road milk tankers (insulated).

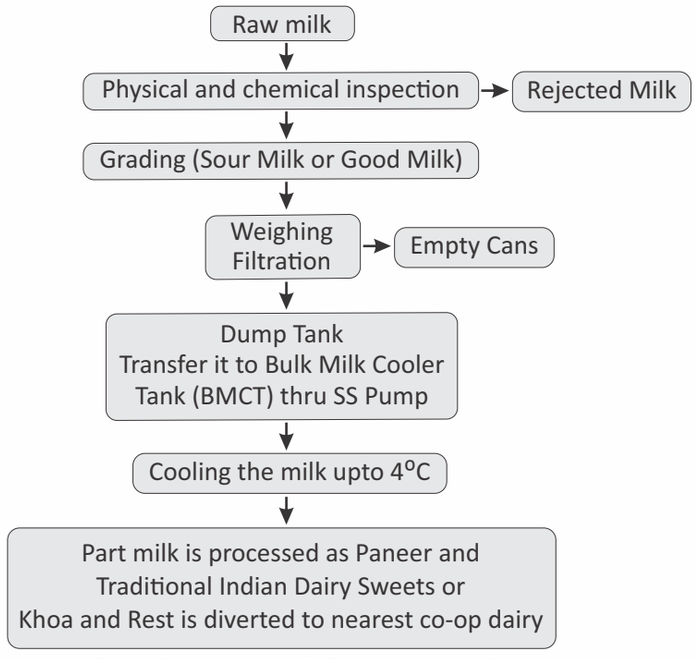
The co-operative society also provides the following services to its member of co-operative society:

1. Artificial insemination (AI)
2. Veterinary support
3. Supplies of concentrated cattle feed and fodder seeds.
4. Loan to purchase new milch animals, and small equipment.

1.4.3.3 Chilling Centre/Bulk Milk Cooling Centre

If a dairy plant is far away from the collection centre, then the collected milk is first brought to a centralized chilling centre/ bulk milk cooling unit to reduce the temperature of milk up to 4 to 5°C. Then the milk is stored in the insulated tanks of 5000-20,000 L capacity. Subsequently, the chilled milk is transported in insulated Road milk tanker to the dairy plant. The transportation of milk from the chilling centre to the processing plant usually takes place once a day.

Flow chart for Milk Receiving and Processing



Flow Chart 1.2: Milk Receiving and Processing

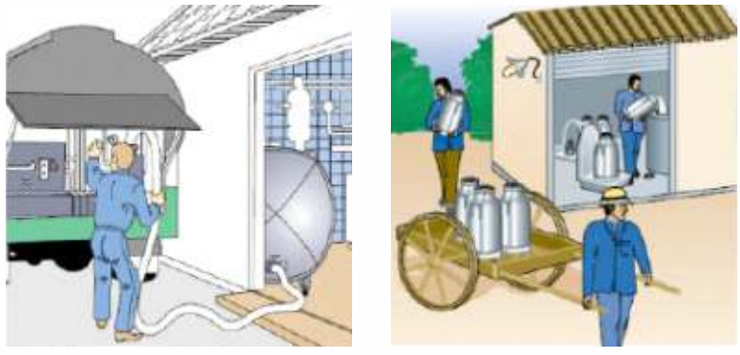


Fig. 1.5: Receiving and unloading of milk

1.4.4 Nutrients present in Milk

As per FSSAI, "Milk is a whole, fresh, clean lacteal secretion obtained by complete milking of one or more healthy milch animals excluding that obtained within 15 days before calving or 5 days after calving. Market milk must possess the pre determined percentage of milk fat and SNF (Solid Not Fat)."
Milk of different classes and types must conform to the standards laid down by FSSAI. Mixed milk means a combination of the milk from cow and buffalo. The combination also should at par with FSSAI standards. The following table explains the composition of milk are as follows:

- Protein - require for body building and repair
- Carbohydrates - provide energy
- Fats - provide energy, carries fat-soluble vitamins A, D, E and K
- Vitamins - helps in growth and shall prevents diseases
- Vitamin D - good for bones and teeth, prevents rickets
- Vitamin A - aids growth, prevents night blindness
- Riboflavin (Vitamin B2) - regulates production of energy from dietary fat, carbohydrates and protein.
- Minerals - strong bones and teeth, body regulation
- Calcium - good for bones and teeth, prevents osteoporosis
- Phosphorus - good for bones and teeth

1.4.5 Testing of Milk for quality control

It is one of the most vital component of dairy industry. The milk must be tested prior to receive from the milk producers or any middle men. Milk is prone to adulteration because of high amount of water (87%). The growth of bacteria require nutrients and water which are abundant in milk. Testing is the only method through which industry shall control the quality of milk and milk products. Storage at lower temperature (<5 deg C) helps to retain the quality of milk.
QUALITY may be check:

i) At the farm
ii) At Milk collection Centre
iii) At the Dairy Factories
iv) Within the Dairy Factory
v) During marketing of processed products

Fig. 1.6: Sampling and Testing of milk

1.4.6 Practice used for milk testing

1.4.6.1 Sampling of milk for testing

Sampling of milk sample for testing is the first most important activity after collection of milk at collection centre or at processing centre. Milk receive in the collection centre through cans while through road milk tanker at chilling/processing centre. It is advised to mix the milk with the help of plunger before the collection of sample for physical, chemical and sensory testing. All the sample must be coded and labeled with name of suppliers and date of receive. A proper records must be documented for the future use.

Fig. 1.7: Sampling device

1.4.6.2 Common test for milk sample.

1.4.6.2. 1 Organoleptic tests:

This test helps to discard the poor quality of milk at the milk reception dock itself. An experienced milk grader with effective sense of sight, smell and taste may detect any off flavor, color or smell easily. The milk may be taken into the mouth for clear opinion about the taste.

1.4.6.2. 2 Clot on Boiling (C.O.B) Test

This test is very simple and quick. Milk sample take into a test tube and heated from the bottom. If there is the formation of clot, that means milk contains acid or rennet producing microorganisms. It also confirm that such milk cannot withstand high temperature while processing and therefore be rejected. This test helps to identify the milk with low pH (<5.8) or the abnormal milk (e.g. colostral or mastitis milk).

1.4.6.2. 3 The Lactometer test

Every liquid is having a fixed value of density or specific value at a particular temperature. This value may change if the same liquid is mixed with other and this is the principle of this test. When milk is adultered with water or other materials (like, salt, urea, sugar, vegetable oil, soap solution), it's specific value get changed. The lactometer test is used to detect the change in density of such adulterated milk. Lactometer is allow to sink slowly into a specially degined measuring cylinder containing milk at temperature 20°C. One has to read and record the last Lactometer degree (°L) just above the surface of the milk. For the milk having temperature greater than the calibration temperature, a correction factor need to be added for the corrected LR. For each ˚C above the calibration temperature add 0.2°L; for each °C below calibration temperature subtract 0.2 ˚L from the recorded lactometer reading.

1.4.6.2. 4 Freezing Point Determination

Freezing point of milk is lower than water because of the dissolved solids. It varies between −0.53°C and −0.56°C and act as a more reliable property for the adulteration of milk. The freezing point value will change with the addition of water, salt, urea etc. and tells us about the adulteration. Cryoscope is used for the measurement of freezing point.

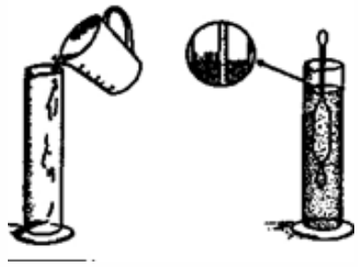
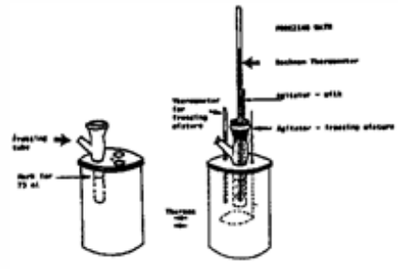
		
Clot on Boiling Test	Lactometer test	Cryoscope

Fig. 1.8: Equipment require for platform testing

Notes

Unit 1.5 Introduction to Coagulated Dairy Products

Unit Objectives

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

- Explain coagulation and their types
- Method of coagulation
- Effect of pasteurization and homogenization on coagulation process

1.5.1 Coagulation

Coagulation is a process, in which proteins presents in the milk get converted into solid form from a liquid phase. This process is not reversible, that means the protein will not converted back to liquid again. This process initiated at around 38°C and is completed between 71°C to 82°C. Coagulation process may be achieved with the help of:

- Animal or vegetable based enzymes
- acid
- heat assisted acid treatment

1.5.2 Enzyamatic Coagulation of Milk

Chymosin, or rennet, is mostly use for enzyme coagulation. The whole process is achieved in three stages described below:

(1) First Stage: In this stage, about 80% of casein present in the milk get break down into smaller casein particles with the help of enzyme at natural pH.

(2) Second Stage: The aggregation of casein particles (micelles) started in this process. All the casein micelles combined together to form a gel or clusters which traps water inside.

(3) Third stage: The ongoing development of the gel network continues in this stage. Also, the gel structure achieves firmness for further cutting or processing.

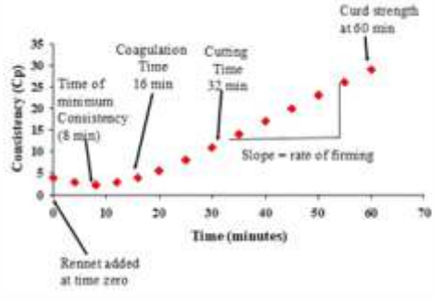


Fig. 1.9: Enzymic Coagulation of Milk (Source: University of Guelph)

1.5.3 Effects of processing parameters on enzymic coagulation

Only the first and second stages of the coagulation process is mostly affected by the addition of coagulum.

1.5.3.1 Effect of pH. The enzyme activity increases with lower pH in both primary and secondary stages of coagulation process.

1.5.3.2 Effect of Calcium content. Calcium content is a vital factor for the aggregation of the casein micelles and coagulation may be stimulate by adding adequate amount of calcium chloride.

1.5.3.3 Effect of temperature. Temperature plays an vital role in the process of coagulation. The optimum temperature for most cheese is 30-32°C. The coagulation time decrease with increasing temperature.

1.5.4 Acid Coagulation of Milk

In this process, casein micelle properties are altered by a lowering the pH of milk. With this a loosely linked aggregates was due to the denature of whey protein. The protein recovery is higher in this case.

1.5.5 Heat assisted Acid coagulation

During this process, recovery of caseins and whey proteins takes place at a same time. Whey proteins are generally acid stable but unstable with heat treatment. Ricotta cheese, Paneer and Channa, were prepared with this process. It is estimated that, bonding of whey proteins with casein micelles enhanced with the heating temperature of milk around 80 degC for at least five minutes holding.

1.6.5.1 Effects of heat treatments

1. During pasteurization, calcium and phosphate present in the milk shifted towards the insoluble form which means lesser amount of calcium is available for coagulation.
2. Addition of calcium chloride or the milk preserved at low temperature helps in the process of coagulation.
3. The time require for the formation of gel increases with the temperature greater than pasteurization temperature. A high heat treatments, casein particles absorbs whey proteins which results in the formation of weak gel.

1.5.6 Effects of Homogenization

Homogenization mainly affects the secondary stage of coagulation process. In addition, the following changes takes place:

- Aggregation of casein particles reduces but fat recovery increases
- As the size of fat globules reduces, the syneresis decrease.
- The texture of soft cheese get better and wither

Unit 1.6 Introduction to Cottage Cheese (Paneer)

Unit Objectives

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

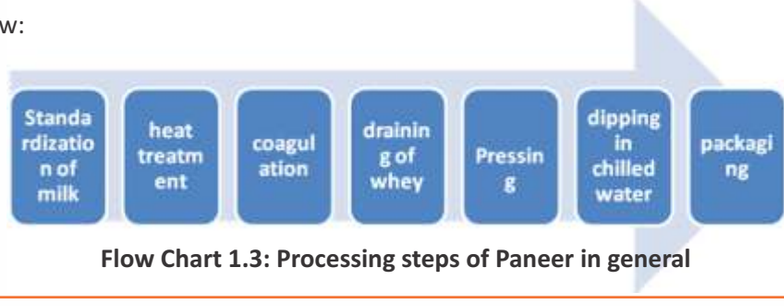
- Describe Cottage Cheese (Paneer)
- State the classification/types and composition of Cottage Cheese (Paneer)

1.6.1 Cottage Cheese (Paneer)

As per Food Safety and Standards Regulations (FSSR), 2011 Paneer is the heat assisted coagulated product resulted from the coagulation of cow or buffalo milk or a combination thereof with the help of lactic acid or citric acid. The paneer must have the moisture content less than 70 %. The fat per cent of paneer shall be greater than 50% of the dry matter. Milk powder may also be used in the preparation of paneer. The moisture and fat percent of low fat paneer shall not be more than 70 and 15% respectively on dry matter basis. According to Bureau of Indian Standards (IS 10484:1983), paneer shall contain minimum of 50% fat on dry matter basis but the moisture content shall not go beyond 60%.

1.6.2 Preparation of Paneer

Paneer may be prepared from Buffalo milk or Cow milk or their combination. The process steps are mentioned below:



Flow Chart 1.3: Processing steps of Paneer in general

1.6.3 TYPES OF PANEER

1.6.3.1 Paneer prepared from Buffalo Milk

In this process, buffalo milk with fat content 5.8 to 6.0% was heated to 90°C without holding. This milk is further cooled down to 70°C and coagulated with 1 to 1.5 % per cent citric acid solution which is also uphold at 70°C. Stirring is preferred till the separation of clear whey. Remove all the whey produce in this process and collect the coagulated mass in the hoops lined with muslin cloth. The whey temperature must be maintained above 63°C during draining. The filled hoops were further pressed (manually or pneumatically) for 10-20 minutes. After this the block of curd is removed and immersed in pasteurized chilled water maintained at 5-6°C for around 2 hours.

Dipping of paneer pieces helps to improve the body and texture of paneer along with cooling. Further, the paneer blocks/pieces were placed on the perforated tray to allow loose water to drain. The moisture per cent of final paneer also increases after dipping. Finally it is packed and stored under refrigerated environment for further sale .

1.6.3.2 Paneer from Cow Milk

Paneer may be prepared from standardized cow milk (using cream extracted from cow milk only) with a fat per cent in the range of 4.5 - 5.0% Calcium chloride is also added to this milk in the range of 0.05 to 0.10%. The milk is heated to 90°C without holding and further cooled down to 85°C. For coagulation, citric acid solution (2%), which was prepared and maintained at temperature of 85°C was mixed with the milk at this temperature only.

All others steps will remain the same as Paneer from buffalo milk.

1.6.3.3 Recombined Milk Paneer

Recombined milk means a milk which is prepared with skim milk powder, cream/butter and good quality water. This milk is standardized (fat 5.8% and SNF 9.5%) and homogenized for further process. This milk is then heated to 90°C without holding and coagulated with the help of 10% citric acid solution maintained at the same temperature.

All others steps will remain the same as Paneer from buffalo milk.

1.6.3.4 Reconstituted Milk Paneer

In this type, whole milk powder is dissolved in good quality water at 50°C and hold in a tank for 3-4 hours for proper hydration of milk components. Calcium chloride (0.1 to 0.15%) is added to the milk and the mixed milk is heated to 90°C without holding.

All others steps will remain the same as Recombined Milk Paneer.

Table 5: Composition of Paneer

Product	Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)
Paneer made from Buffalo Milk	52.3	27.0	15.8	2.2	1.9
Paneer made from Cow Milk	52.5	25.0	17.3	2.2	2.0

Table 6: Chemical/Physical criteria

Description	Standard
Smell + taste	Fresh creamy to slightly fresh sour
Colour	White to light yellow
Fat	Solid dices or blocks
Appearance + texture	No foreign particles
Foreign particles	Minimum 50% in the DM
Moisture content	52 – 53 %
Friability	Good
Acidity	20 - 23% LA or 22 - 25,5 °N
Phosphatase test	Negative

1.6.3.5 Microbiological criteria

As per 10th Amendment Regulations, 2016, Food Safety & Standards Authority of India (FSSAI) has specified microbiological requirements for process hygiene and food safety.

Table 7: Microbiological data for paneer

	Minimum	Maximum
TPC	150,000/gm	350,000/gm
Coliform (cfu/gm)	10/gm	100/gm
Yeast and mould (cfu/gm	50/g	150/gm
E. coli	Less than 10/gm	
S. aureus	10/gm	100/gm

1.6.4 Storage conditions

Paneer is stored in the freezer room at -20°C for maximum 1 month. In general, the shelf life is 15 days as mentioned on the paneer package if store under refrigerated condition.

1.6.5 Nutritional value of paneer

The information per 100 g of paneer of AMUL and Mother Dairy are shown below:

Product Details

Product Name	**Amul Fresh Paneer**
Description	Equivalent to Cream Cottage cheese
Packing	Block Paneer - 100g, 200g and 1kg

Product Specifications

Composition	Milk Solids, Citric acid

Nutritional Information

Nutritional Information*	
Amount per 100g	
Energy, kcal	289
Energy from FAT, kcal	225
Total FAT, g	25
Saturated FAT, g	15
Cholesterol, mg	66
Carbohydrate, g	2
Added Sugar, g	0
Protein, g	14
Calcium, mg	480
Not a significant source of Vitamin C, Iron and Dietary fibre.	

Fig 1.10: Product information printed on Paneer pouches

Unit 1.7 Equipment Used in a Dairy Processing Plant

Unit Objectives

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

- Enlist the machineries require for milk and milk products processing
- List the different types of machineries used for paneer processing

1.7.1 Raw Milk Reception Dock

Equipment Used in Dairy Processing

Described below are some of the equipment used in a dairy processing unit:

The dairy plant receives milk through cans or road milk tankers. Raw milk reception dock is the place where milk receives first. The following activities conducted in RMRD.

Fig. 1.11: List of activities in RMRD

The RMRD consists of the following activities in continuation i.e, sampling, testing, grading, conveying cans, dumping, unloading from road milk tank, weighing or measuring, recording, and pumping. Platform tests were conducted after the receiving of milk and depending on the quality, the milk may be accept for further processing or reject. At the end cleaning of cans and tankers were also conducted at RMRD.

1.7.1.1 Storage Tanks

The milk storage tanks are the insulated tanks in which hot or cold milk shall be store for further processing/packaging. In the dairy industry, storage tanks are classified based on structure and heat preservation capacity. Several types of storage tank are available in the dairy industry like; Horizontal milk storage tank (HMST), Vertical milk storage tank (VMST) or Silos, Flat bottom and cone bottom tanks etc. Some of them are listed below:

Horizontal milk Storage Tank

Vertical milk Storage Tank

Fig. 1.12: Milk Storage Tank

1.7.1.2 Chilling section

The milk must be immediately chilled down with the help of a milk chiller to arrest the growth of micro organisms present in the milk. Milk chiller consists of a plate pack (PHE) which chills the milk less than 5°C with the help of chilled water generated at dairy plant.

Bulk milk cooler

The farm level bulk milk chilling system consists of the following components:
a) **Bulk Milk Tank:** It is a horizontal tank of rectangular or cylindrical shape and made of AISI 304 Grade stainless steel. The tank is also fitted with accessories such as inlet and outlet connections, agitator and calibrated stick etc., all made of AISI 304 Grade stainless steel. The tank is provided with a thick insulation, generally polyurethane foam, between the inner and the outer jacket to prevent refrigeration loss.

a) Refrigeration Unit: It consists of refrigerant, compressor, air cooled condenser, condenser fan, receiver and expansion device.

Milk chiller

Bulk Milk Cooler

Fig. 1.13: Milk Chilling equipment

1.7.1.3 Milk Pasteurizer

Milk Pasteurization plant is a combination of PHE, balance tank, pumps, holding coils to achieve pasteurization. The milk goes into the pasteurization at 4°C and after pasteurization, the outlet temperature of milk is 4°C. Pasteurization is a process in which milk is heated up to 72°C and hold the same for 15 seconds in order to kill the pathogenic microorganisms.

Fig. 1.14: Pasteurization Unit

1.7.1.4 Homogenizer

Homogenization is the process used to make a uniform mix of two liquids with different densities. A homogenizer is used to reduce fat components in the milk to a uniform size and disperse them uniformly through the rest of the milk.

1.7.1.5 Separator

A cream separator is a device used to separate cream from milk. It helps in the mechanical separation of milk into cream and skimmed milk with the help of centrifugal force. Centrifugation is a process where milk is filled in the separator and is rotated at a very high speed. Due to this, the thicker liquid separates from the thinner liquid and settles at the bottom of the equipment.

The dairy industry uses two types of separators. They are:

- Hand-operated separators
- Power-driven separators

Fig. 1.15: Homogenizer

Fig. 1.16: Cream Separator

1.7.1.5 Standardization equipment for dairy products

The skim milk and cream were obtained from the process of centrifugal separator. Standardization is the process in which fat, solids non-fat and total solids were added back into that product in precise 'standardized' quantities. In other words, Standardized milk is milk in which the desired fat or SNF percentage were achieved either by adding/removing cream or by adding skim milk.

1.7.1.6 Multi-purpose Vat

For the processing of Indian traditional products like cheese, ghee, peda, paneer, ice cream etc., a multipurpose Vat is generally used. It may be rectangular or circular types. These Vat will have the provision of heating and cooling (via chilled water) and available in different materials of construction, capacity, shape and design. The vat is attached with steam or hot water for the heating application. The vat may be mounted with agitator as per product requirement.

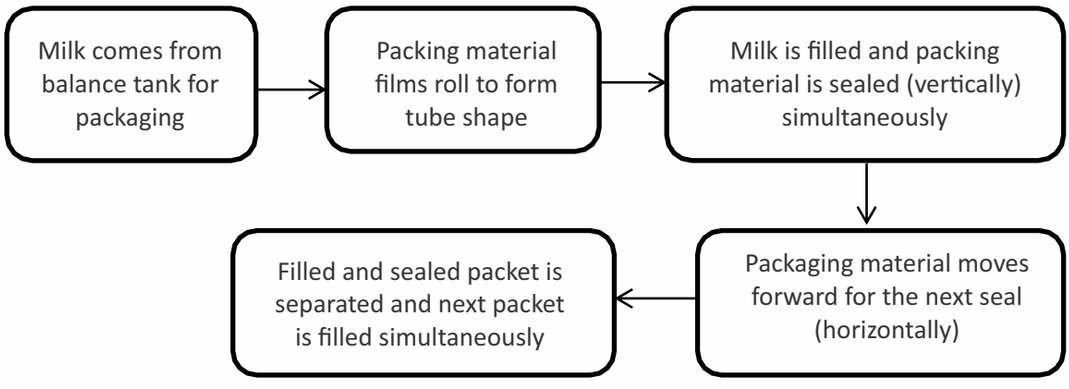
1.7.1.7 Packaging Machine

Most dairy processing plants use the Form Fill Seal (FSS) machines to package processed milk and milk products. This machine is ideal for packaging free-flowing type or granular food products.

Fig. 1.17: Multipurpose vat

Fig. 1.18: Double head Packaging Machine

Flow Chart 3: Working principle of FFS machine



1.7.1.8 Utility Section

Several types of resources or plant utilities (raw water, compressed air, refrigeration, steam and electricity, machineries and skilled/unskilled labour etc.) were required for the unit operations involved into the conversion of raw milk into value added finished products.

In addition to this a dairy plant must have ETP to treat the effluent produced in the dairy industry.

The following chart explains the process followed for packaging milk in FFS machine.

Notes

Notes

Scan this QR Code or click on below to access the video of the following:

Scan this QR Code or click on below link to access the video of
Overview of Food Processing Industry

Scan this QR Code or click on below link to access the video of
Overview of Dairy Industry

Scan this QR Code or click on below link to access the video of
Cottage Cheese Maker - Orientation Video

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Food Industry Capacity and Skill Initiative

2. Organisational Standards and norms

Unit 2.1 - Roles and responsibilities of cottage cheese maker and workplace ethics

Unit 2.2 - Standard Operating Procedures

Unit 2.3 - Personal hygiene and sanitation guidelines

Unit 2.4 - Food safety hygiene standards to follow in a work ronment (Schedule-4)

(FIC/N2018)

Key Learning Outcomes

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

1. Roles and responsibilities of Cottage cheese maker
2. How to conduct yourself at the workplace
3. Personal hygiene and sanitation
4. Food safety hygiene standards to follow in a work environment (Schedule-4)

Unit 2.1 Roles and Responsibilities of a Cottage Cheese Maker

Unit Objectives

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

1. Understand the roles and responsibilities of a Cottage Cheese (Paneer) maker
2. State how to conduct yourself at the workplace
3. Understand the importance of disciplined behavior for the success in workplace
4. Explain the generic skills needed for one to become successful production worker
5. Explain the criteria's of a good listener
6. Explain the importance of effective communication to become a successful production worker
7. State the importance of interpersonal skills to maintain good relationships at the workplace
8. State the importance of working as a team in the workplace
9. Explain the benefits of teamwork
10. Understand common reasons for interpersonal conflicts in a workplace and how to tackle with them
11. How to escalate employee grievance to the management
12. Explain the procedure of handling grievance in an organization

2.1.1 Roles and Responsibilities of cottage cheese maker

The following table provides detailed information about the roles and responsibilities of a cottage cheese (paneer) maker:

Roles	Responsibilities	for more information refer module
Handle raw material from the time of receipt till it reaches the process line	• Check the raw material for quality (Fat, SNF, TS and Acidity %LA) • Ensure minimum loss of raw material while handling	Module 1
Record-keeping and documentation	• Documentation and maintenance of raw materials, production schedule/ process and finished products	Module 5
Hygiene and sanitation maintenance	• Adopt safety and sanitation-related measures • Follow food safety norms and practices	Module 2 Module 6
Operate dairy equipment and machineries	• Optimize the use of machinery • Ensure smooth operation of machinery to complete production line	Module 3 Module 4

Inspect machines and troubleshoot issues	• Attend to minor repairs of tools and machinery when required • Ensure that safety rules and regulations are observed • Prevent accidents	Module 3 Module 2 Module 6
Plan and execute the production process	• Examine products at different stages of production • Adhere to Good Manufacturing Practices (GMP) • Inspect intermediate as well as finished products • Achieve good quality products with the correct quantity	Module 4 Module 2 Module 3
Handle finished material from the time of production till packaging	• Check the processed material for quality (Fat, SNF, TS, Acidity %LA, Fat in Dry Matter and Coliform/g) • Ensure the products meet the quality standards set by the organization.	Module 4
Follow storage and packaging norms	• Ensure safe and proper storage of raw material, packing material, and finished goods.	Module 4

2.1.2 Workplace Ethics

Workplace ethics are, by definition, the moral principles that guide a person's actions in the workplace. Ethical standards can vary from industry to industry, and from position to position within an industry. They can also vary by specific field within a larger industry.

Some important ones to remember are:

- Address seniors, assistants, and workers with respect
- Follow the processes laid out in the manufacturing unit
- Always follow food safety norms
- Do not compromise with the quality of the product at any given cost
- Perform your work with complete honesty
- Perform your roles and responsibility with integrity
- Be a team player

2.1.2.1 Disciplined behavior

Disciplined behavior is important to improve workplace performance and to provide a safe and honest working environment.

Fig 2.1. Disciplined behavior

2.1.2.2 Language skills Cottage cheese maker

To be a successful cottage cheese maker, the participant shall have the following generic skills

2.1.2.2.1 **Speaking:** Skills that give one the ability to communicate effectively and convey the message in a convincing manner.

2.1.2.2.2 **Reading and writing skills:** A cheese maker shall understand and interpret the process and flow chart required for producing different types of products. He is also responsible to note down the observation on day to day basis and inform the management.

2.1.2.2.3 **Listening:** Listening is a skill which allows one to understand what another person is saying.

A good listener can;

- Improve relationships in their personal and professional lives
- Avoid conflicts and misunderstandings and gain more clarity through listening well
- Higher confidence level as they have access to information
- A good source of information

2.1.2.3 Communication

Communication is the process of exchanging information by speaking, writing, or using some other medium. Effective communication is a basic prerequisite for the achievement of organizational goals.

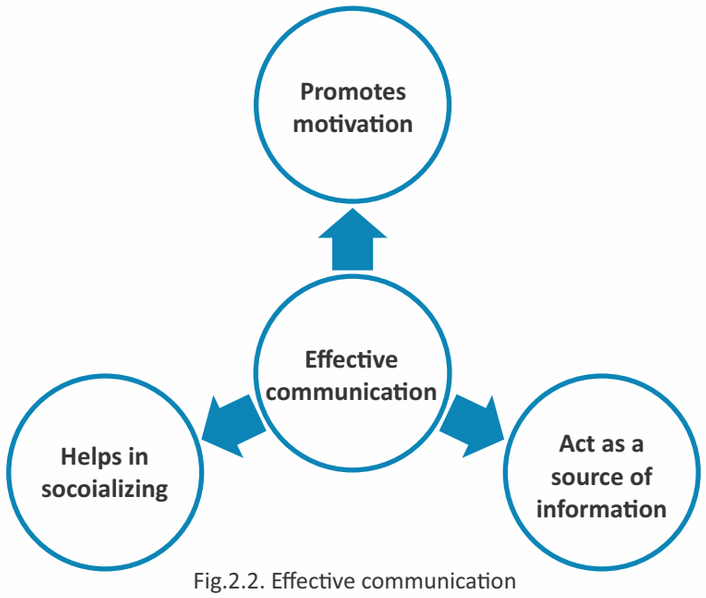
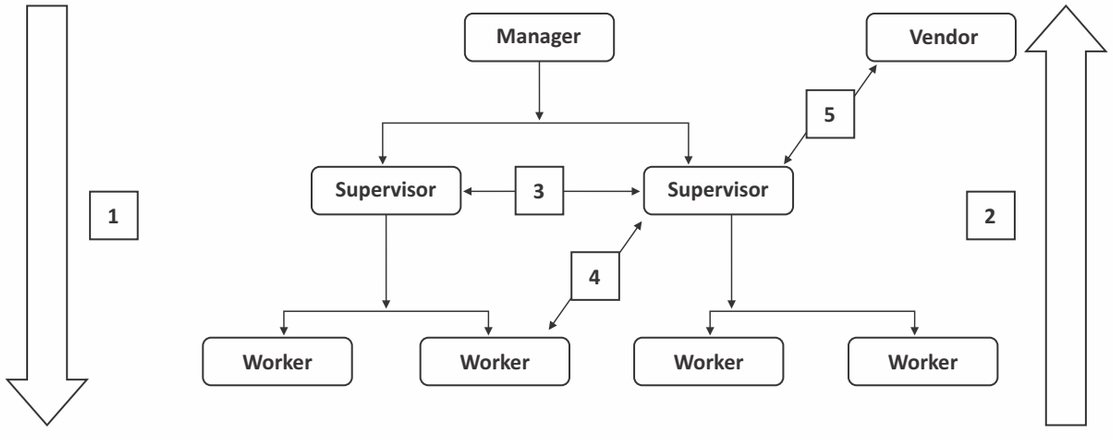


Fig.2.2. Effective communication

Communication flow in an organization

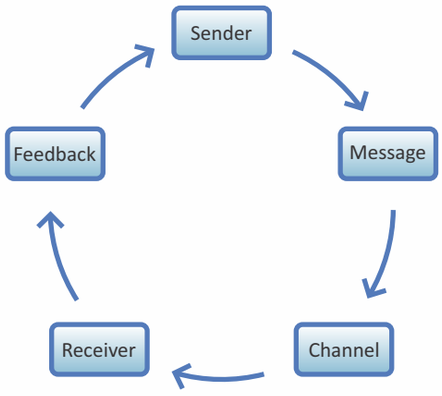
In an organization, communication flows in 5 main directions



1. **Downward:** Communication from management to subordinates is downward communication
2. **Upward:** Communication that flows to a higher level in an organization
3. **Lateral:** Communication between the same levels of hierarchy in an organization is called lateral communication
4. **Diagonal:** Communication between a supervisor-worker or worker-supervisor of other workgroups is called diagonal communication
5. **External:** Communication between a management and external groups such as - suppliers, vendors, banks, financial institutes etc.

Criteria's of a good communicator

The main components of communication process are:

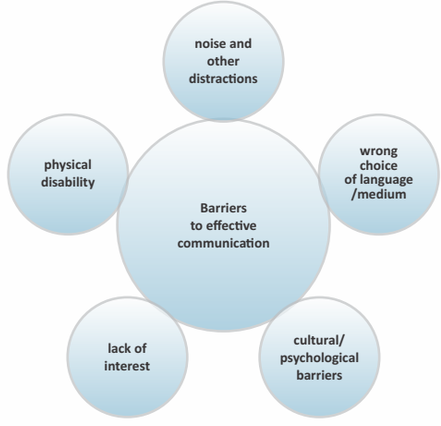
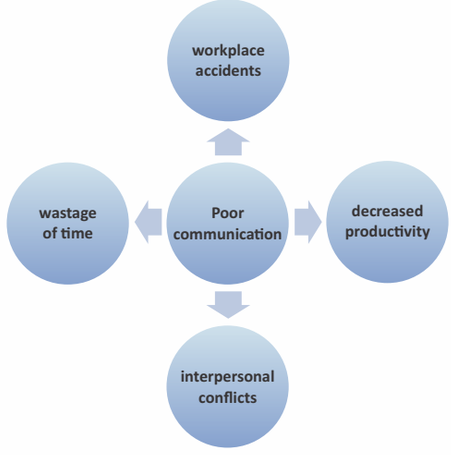


- **Context** - The context may be physical, social, chronological or cultural.
- **Sender / Encoder** - The person who sends the message.
- **Message** - The key idea that the sender wants to communicate. It is a sign that elicits the response of recipient.
- **Medium** - Medium is a means used to exchange the message.
- **Recipient / Decoder** - The person for whom the message is intended.
- **Feedback** - Feedback is the main component of communication process and it permits the sender to analyze the efficacy of the message sent.

Notes

Communication in the workplace

- ✓ Encourage two way communications in the workplace. Speak up if you are not clear about the information received.
- ✓ Provide information to others clearly which help them understand
- ✓ Provide specific and descriptive feedback
- ✓ Be a good listener

The barriers to effective communication	Effects of poor communication
	

2.1.2.4 Inter personal skills

Interpersonal skills are the ability to develop fruitful relationships with others. Knowing how to develop healthy working relationships with people at the workplace contributes significantly to your success as a cottage cheese maker

How to Develop Good Interpersonal Skills

Effective communication plays a key role in developing good interpersonal skills.

1. **Non verbal communication** which result in achieving positive interpersonal skills are:
   - Smile and eye contact
   - Correct postures and gestures
2. **Good listening skills.**
   - It conveys that "you care"
   - It enables you to understand other people's viewpoints and empathize with their situation.
3. **Verbal communication** which result in achieving positive interpersonal skills are:
   - Use of voice and intensity .

2.1.2.5 Work as a team

2.1.2.5.1 Team work

Team work promotes strong working relationships which eventually contribute higher productivity. When employees work together and succeed as a team, they are more likely to; ✓ Communicate well with others ✓ Support and get motivated ✓ Work cooperatively for the success of the organization	

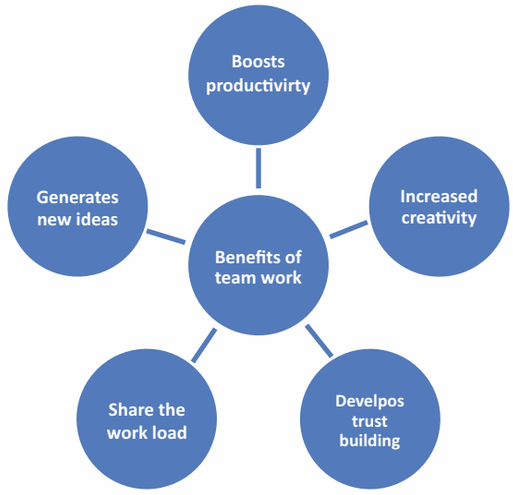


Fig.2.5. Benefits of team work

2.1.2.5.2 Conflict Resolution skills

Interpersonal conflicts: The conflict comprises a series of human affective states including anxiety, hostility, resistance, aggression, and competition. The common reasons for interpersonal conflicts in a workplace are;

- ✓ Lack of effective communication
- ✓ Individual differences on values and beliefs
- ✓ Lack of trust
- ✓ Incivility
- ✓ Stress

The conflict resolution process

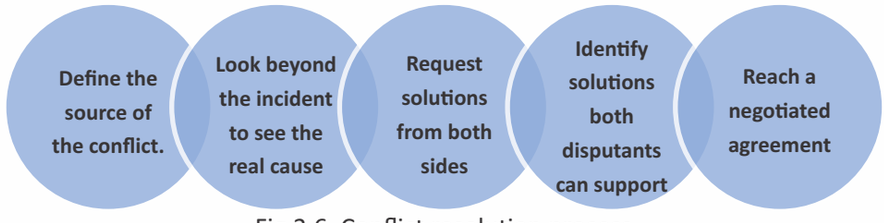


Fig.2.6. Conflict resolution process

2.1.6 Grievance management in workplace

Grievance is a concern, problem, or complaint that an employee has regarding the work/workplace, or someone they work with which made him/her feel dissatisfied.

Types of grievances in the workplace include;

- ✓ Pay and benefits.
- ✓ Bullying/ harassment.
- ✓ Work place risks and safety concerns.
- ✓ Workload.

Grievance procedure

1. The organization shall have a written grievance procedure, by which employee can escalate his/her issues
2. Investigating grievance:- the organization carryout investigation.
3. Grievance meeting: the organization holds a meeting so that the employee gets opportunity to explain the complaint.
4. Considering the evidences the organization decides whether to reject or hold the grievance.
5. The employee can go for appeal if he feels unfair to the decisions made by organization

Notes

Practical : Self quiz on work ethics

Aim: to get an understanding on how ethical person you are.

Materials required

- ✓ Stationary items, quiz format.

Name of participant:					Roll no:
Dependability	**1. Are you reliable?**				
	Never	Seldom	Sometimes	Usually	Always
	2. Do you follow rules?				
	Never	Seldom	Sometimes	Usually	Always
Responsibility	**1. Do you honor your word?**				
	Never	Seldom	Sometimes	Usually	Always
	2. While working, do you ever do other things?				
	Never	Seldom	Sometimes	Usually	Always
	3. Do you help your co-worker at work?				
	Never	Seldom	Sometimes	Usually	Always
Honesty	**1. Are you true to the words you make?**				
	Never	Seldom	Sometimes	Usually	Always
Level of rigor	**1. Are you a hard worker?**				
	Never	Seldom	Sometimes	Usually	Always
Level of initiatives	**1. Do you perform work that is not required of you?**				
	Never	Seldom	Sometimes	Usually	Always
	2. Do you work for extra time when the organization needs you (e.g. festive season)				
	Never	Seldom	Sometimes	Usually	Always

Methodology

1. Fill the quiz format given by the trainer as honestly as possible.

Unit 2.2 Standard Operating Procedures

Unit Objectives

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

- State Standard Operating Procedures
- Implications of Food Recall
- Explain benefits of Standard Operating Procedures

2.2.1 Standard Operating Procedures

Hazard Analysis & Critical Control Points (HACCP) and Food Safety plan are core to Food Manufacturer's. These facilities require some pre-requisite program. Standard Operating Procedures run on the basis of pre-requisite program.

An SOP is defined as a set of written instructions that document a food manufacturer's routine or repetitive activity. Specific to food manufacturing plants, the term SOP is commonly applied to production, manufacturing and support area processes, jobs or activities. For all sanitation-related processes, jobs or activities, the term SSOP (Sanitation SOP) is held in reserve.

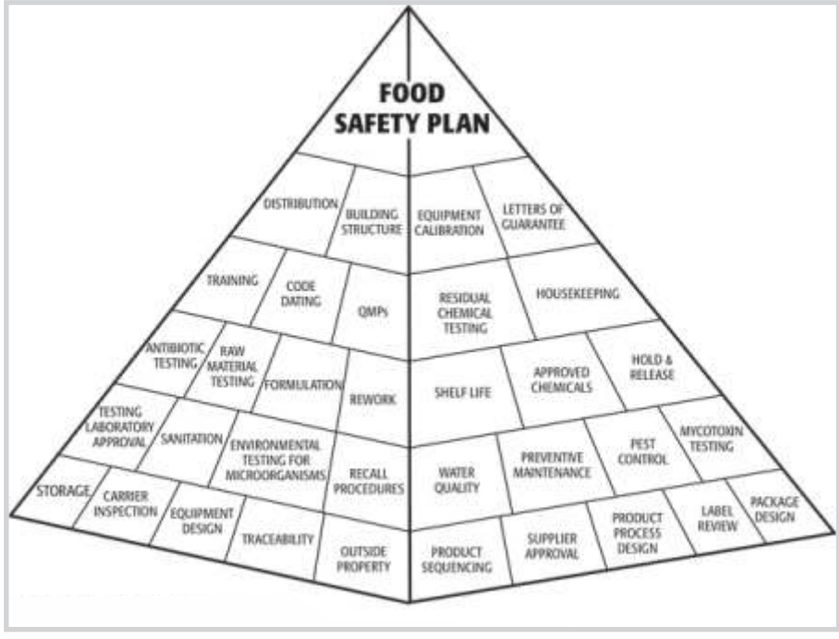


Fig 2.7 Food Safety Plant

The development and use of SOPs/SSOPs are essential parts of a successful food safety, quality and sanitation system (see Figure 2.1), as they provide all basic information to the individuals required to properly perform their jobs. Furthermore, the use of SOPs and SSOPs promotes quality through constant implementation of a process, task or job. Also, if clearly written, SOPs and SSOPs can minimize miscommunication and variation between individuals or organizations.

The term SOP may also be used synonymously with “protocol,” “job instruction” or “work instruction.”

2.2.2 Implications of a Food Recall

The significance of the development and use of food plant SOPs/SSOPs cannot be overstated. For example, according to U.S. Food and Drug Administration's Reportable Food Registry annual report (fiscal year, September 2011–August 2012), 37.9 percent of all food recalls were due to undeclared allergens. In the course of the investigations, the true cause of these recalls was traced to either an SOP/SSOP that did not exist or was insufficient, or to a non-compliance to one or more of the appropriate measures, including:

- Good Manufacturing Practices
- Label review
- Residual chemical testing
- Raw material testing
- Sanitation
- Housekeeping
- Product process design
- Rework
- Hold and release
- Recall procedures
- Storage
- Training
- Product sequencing
- Traceability
- Supplier approval

In addition to create harm and generating adverse publicity, recalls are expensive: the average cost associated with these allergen-related SOP failures has been estimated at $10 million per recall.

2.2.3 Benefits of SOPs

Besides help encouraging food safety and prevent food recalls, SOPs can do the following:

- Serve as the basis for implementing an effective program to include employee training as well as a tool for on-the-floor instruction and expansion.
- Identify control points, as well as their limits, to control and validate the process. Corrective actions and preventive actions can be identified to facilitate each process.
- Establish time, labor and material requirements for a job or task.
- Be used as checklists by internal audit team members during auditing the plant’s programs and procedures.

Finally, the benefits of a valid SOP are reduced work effort, along with improved comparability, credibility and legal defensibility.

2.2.4 Developing and Maintaining SOPs/SSOPs

SOPs and SSOPs should adhere to the following food industry best practices.

2.2.4.1 Key Sections

The SOP/SSOP must be formatted in such a way that it provides all felicitous information so that an employee with some knowledge of the area, equipments and tools can read and perform the functions of the task both safely and effectively.

2.2.4.2 Title Page

Firstly identify the procedure name, an identification number, date of issue and/or revision and the name of the applicable plant, division and department to which the SOP applies. This section also includes the signatures and signature dates of those individuals who prepared and approved the SOP. Electronic signatures are acceptable for SOPs maintained on a programmed database.

2.2.4.3 Table of Contents

A table of contents is helpful for immediate reference and location of specific information, changes or updates. It is principally significant for lengthy or detailed SOPs/SSOPs.

2.2.4.4 Introduction/Purpose

This section will illustrate the meaning for the SOP/SSOP and allows the reader to better understand not only the "how" but the "why" as well. Included here are any appropriate background information and a synopsis.

2.2.4.5 Responsibilities

This section will illustrate the list of accountabilities for all stakeholders, detailed by position.

2.2.4.6 Definitions

This section will illustrate a list of terms, phrases, words or acronyms and their applicable meanings. Since the reader will already have some knowledge of the task or equipment, only uncommon and unfamiliar terms should be defined. For example, in a testing procedure, Listeria may not need to be defined, whereas in an environmental monitoring procedure, Listeria may require definition.

2.2.4.7 Materials

This section illustrate about list of materials, equipments, checklists and supporting documents required to complete the activity or task.

2.2.4.8 Safety

This section includes a list of any personal injury or loss-of-life warnings, such as restricted space. This section will explain what will happen if the procedure is not followed or is followed incorrectly.

2.2.4.9 Procedure(s)

Each process, task or step to be taken in sequence will be listed in this section. One SOP/SSOP document may contain several procedures for multiple processes or sub processes.

2.2.4.10 Training

List the training requirements for the SOP/SSOP as well as the frequency of training (i.e., one-time or annually).

2.2.4.11 Documentation

Identify the forms to be used and reports to be written, as well as the data and record storage location and duration.

2.2.4.12 Compliance Verification and Validation

This section will describe any control steps and provisions for review and/or oversight. Verification will include a periodic review of the SOP/SSOP and corresponding actions like (Are we doing what we say we are doing?). On the other hand, validation will include a periodic review of the records, reports and other documentation. (Are the goals of the SOP being accomplished?) All deviations should be reported and trended, and a corrective action/preventive action plan developed to address each opportunity.

2.2.4.13 References

This section give information about list of all cited regulatory, company or facility references.

2.2.4.14 Document Revision History

This section give list of all reviews, updates and revisions made to the SOP/SSOP.

2.2.4.15 Content

SOPs and SSOPs should be clearly worded so as to be gladly understandable by a person knowledgeable about the general concept of the procedure. One can use diagrams, flow charts, pictures and computer screen shots to help break up long sections of text and to review a series of steps for the reader. These visual aids mainly help in delivering training of the SOP/SSOP.

One should be careful to include all necessary information without becoming too comprehensive.

2.2.5 Development Process

When developing an SOP/SSOP, a subject matter expert (SME) should prepare a written draft of the procedure. This draft is then reviewed by other plant or area experts. The purpose of this review is to solicit comments, suggestions and ideas for improvement and clarification.

Once the SOP/SSOP has been drafted, the content must then be verified. This is best accomplished by having the SME "walk" through the procedure, on the floor, taking into consideration all key parameters (e.g., time, equipment speed, sample location, etc.). Update the SOP/SSOP with all necessary changes. Pictures, diagrams, flow charts and computer screen shots should be inserted at this time.

Once the SOP/SSOP is in final draft form, an equipment or process expert, such as a training supervisor, should perform the procedure as written. If possible, to best identify any and all gaps, conduct more than one expert review. These experts will then provide the final updates and refinements required to complete the SOP/SSOP.

When finalized, the SOP/SSOP should then follow the appropriate approval process, as identified in the company's policy, and be published.

2.2.6 Revisions and Reviews

An SOP/SSOP is an changeable, "living" document. As such, in an effort to continuously improve a process or task, updates are required. Indeed, improvements should be actively required and changes often made. These must always be tracked and communicated effectively.

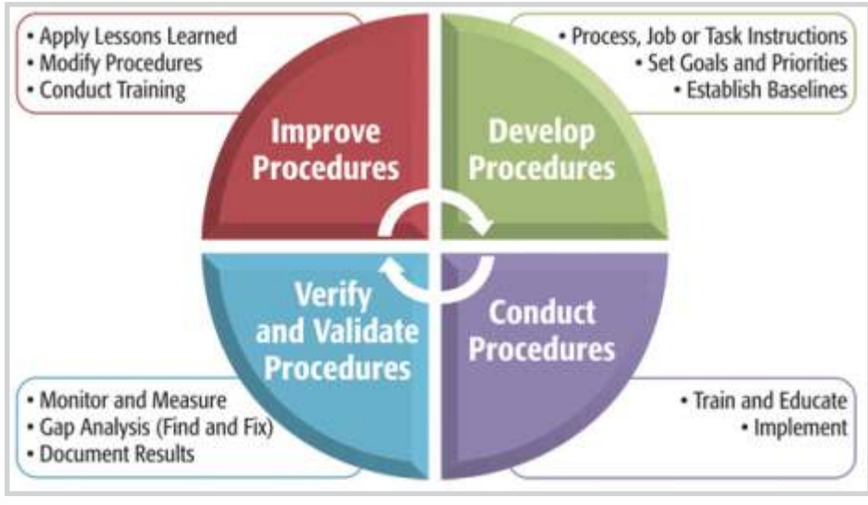


Fig.2.8 Revisions and Reviews

continuous improvement" cycle give best description by a variant of the Deming circle, also known as plan, do, check, act (PDCA).The Deming circle is an integrated, four-step method used for the control and continuous improvement of processes (Figure 2).

The PDCA steps for each consecutive Deming circle include the following four phases:

2.2.6.1 Plan (Develop Procedures)
Develop the SOPs and SSOPs, establishing the objectives and processes essential to deliver the preferred results. This will, in turn, establish objectives, priorities and baselines to achieve. Establishing these expectations makes completeness and accuracy of the SOP/SSOP a part of the targeted improvement.

2.2.6.2 Do (Perform Procedures)
Perform the SOPs/SSOPs. In other words, execute the plan, conduct the process and make the product. Collect data for charting, trending and analysis.

2.2.6.3 Check (Verify & Validate Procedures)
Verify and validate the SOPs/SSOPs by studying the actual results, as depicted in the "Do" section. Do the comparison of these results with the targets or objectives from the "Plan" section. Look for deviations between the development and the implementation of the SOP/SSOP. Making the Chart can create it much easier to see trends over several Deming cycles.

2.2.6.4 Act (Revise & Improve Procedures)
For each major difference between actual and planned results, once the root cause has been determined, develop a corrective action/preventive action (CAPA) plan. It has to be determined

where to apply changes for improvement of the process or product. If, after one or two passes through the Deming circle, the process does not improve, further refine the CAPA plan to include more detail in the next iteration of the cycle(s). Otherwise, more concentration may be required in a different stage of the process.

Category 1	This is a new/revised document. All required personnel must read this version and complete the prescribed training.
Category 2	This is a revised document in which only the area of applicability has changed. All newly impacted personnel required to follow content must read version and complete the prescribed training.
Category 3	This is a new/revised document. All personnel required to follow content must read this version.
Category 4	This is a revised document in which only the area of applicability has changed. All newly impacted personnel required to follow content must read version.
Category 5	No significant changes made to document content-no requirement to read or train.

Table 2.1 various categories of a new/revised document

SOP/SSOP revisions and updates should be categorized so that all the stakeholders understand the amount of change that has occurred as well as the degree of employee training required with the changes (Table 2.1).

2.2.7 Document Control

Document control is the process of initiating, updating, changing and "expiring" company documents. All documents and records should be maintained in either an electronic or manual system.

At a prescribed time (i.e., immediately after production, weekly, etc.), all documents and records will be collected. Once compiled, all of the documents and records will then be stored in a short- term records, in an area that will allow easy access for reference as needed.

As archived records begin to exceed the maximum length of time for short-term storage, they will be moved to a long-term storage location for a minimum of 2 years or shelf life plus 1 year, whichever is longer. Local, state and federal regulations as well as customer necessities may recommend a longer period.

Clearance of expired documents and records should be followed on a scheduled basis and in accordance with a documented policy.

2.2.8 Access

Each SOP and SSOP must be easily accessible by employees. Therefore, the most up to date version of the SOP and SSOP must be readily available. Access can be in the form of either a printed manual or electronic access. If a printed manual is used, procedures and practices must be in place that ensure the manual is controlled and the updates done are current.

For new employees or for employees working in an unfamiliar or new area, having a physical copy in hand may be especially useful. This copy can be used as quick reference for a new work assignment or for coaching activities.

Whether considered a protocol, work instruction or job instruction, SOPs and SSOPs must be integral and preliminary parts of all food manufacturing facilities' food safety program

Notes

Unit 2.3 Personal Hygiene and Sanitation Guidelines

Unit Objectives

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

- Understand the importance of personal hygiene and sanitation guidelines require to follow in a work environment

2.3.1 Personal Sanitation

Sanitation and hygiene are the most important aspects to take care of when working in the food processing industry. Some important sanitation and hygiene practices that should be followed are:

- Maintain a high standard of personal cleanliness viz. have a bath every day and wear clean clothes to work.
- Always button up your sleeves or roll them up above the elbows. Button up your cuffs and wear a protective cap.
- Wear Personal Protective Equipment (PPE) such as aprons, mouth mask, head cover, face mask, hand gloves, gum boots, and beard cover mask at all times during work hours.
- Gloves need to worn most of the time in workplace, so use suitable barrier cream to protect the skin.
- Use heat resistant gloves to prevent any types of burns.
- Wear rubber gloves when dealing with chemicals. Wear leather gloves when dealing with heavy machineries.
- Wear safety shoes always during the work.
- Take precautions, when the floor is wet or there is an obstacle in your way.
- Wear goggles or eye shield when working with chisel, grinder or a sharpening tool.
- Always keep your finger nails trimmed.
- Always keep your hair trimmed and wear hair net while working.
- Wash your hands and feet at the designated area or wash stations provided.
- Wash your hands with soap and water each time before you enter the production area.
- Avoid smoking, spitting, sneezing or coughing when present in the process hall or workplace.
- Do not handle food when suffering from a disease, illness, burns, injury or infection.
- Take proper and timely medical treatment when you are ill or if you have met with an accident.
- Visit a registered medical practitioner at regular intervals to keep a check on your health.

Table 9: Personal Protective Equipments

 Protective Gloves	 Head Cap	 Mouth Mask	 Safety Goggles
 Aprons	 Earbuds	 Sanitizer	 Safety Boots

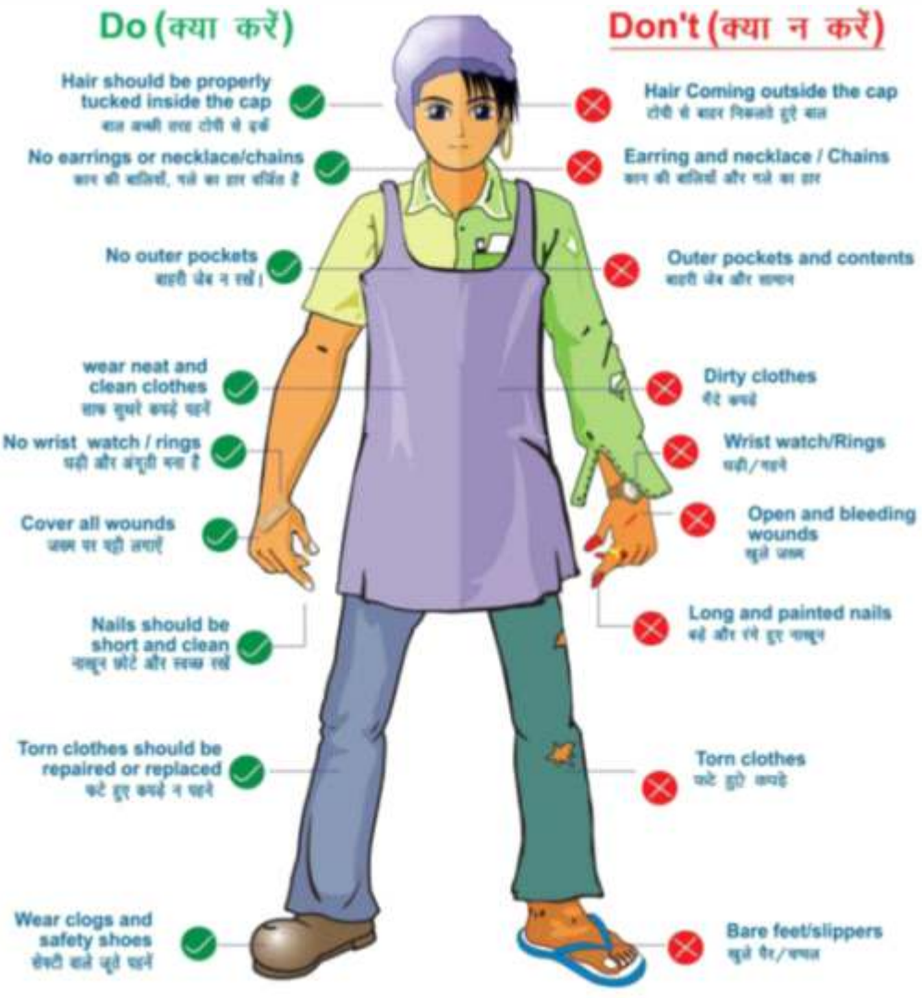


Fig.2.9 Do's and Don't in general

Fig. 2.10 Hygienic Practices

Notes

Unit 2.4 Food safety hygiene standards to follow in a work environment (Schedule-4)

Unit Objectives

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

1. Know the food safety hygiene standards to be follow in a work environment
2. Explain Schedule 4 of FSSAI and its importance
3. To introduce a single statute relating to food safety
4. List various general hygiene and sanitation practices by Food Business Operator
5. Need of Food Safety for Food Business Operator

2.4.1 General Hygienic and Sanitary practices

The Food Safety and Standards Authority of India (FSSAI), has made Schedule 4 under Food Safety and Standards (Licensing and Registration of Food Businesses) Regulation, 2011. Under these regulations, it is mandatory that every Food Business Operator has to follow hygienic and sanitary practices in the premises where food is being manufactured. Schedule 4 is a set of basic - mandatory requirements to ensure safety of the food made in any premise and Food Business Operator shall continuously try to improve hygienic conditions and sanitary practices at the premises with a aim of attaining India HACCP standards.

The Schedule 4 is divided into five parts as follows:

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

Part II - General Requirements on Hygienic and Sanitary Practices to be followed by all FBO applying for License

Part III- Specific Hygienic and Sanitary Practices to be followed by FBO engaged in manufacture, processing, storing and selling of Milk and Milk Products

Part IV - Specific Hygienic and Sanitary Practices to be followed by FBO engaged in manufacture, processing, storing and selling of Meat and Meat Products

Part V - Specific Hygienic and Sanitary Practices to be followed by Practices to be followed by FBO engaged in catering / food service establishments

The general sanitary and hygienic requirements are part of Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP). For food manufacturer/ processor/handler below indicated generic guidelines are provided which will give fair idea about the practices to be followed. The place where food is made, processed or handled shall comply with the below indicated general requirements:

1. The units/ premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.
2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.
5. The floor and walls shall be washed as per condition/requirement with an effective disinfectant the premises shall be kept free from insects. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.
6. Continuous supply of potable/ fresh water shall be ensured in premises. In case of intermittent water supply, sufficient storage arrangement for water used in food or washing purpose shall be made.
7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.
8. No container or other equipment, the use of which is expected to cause metallic contamination injurious to health shall be employed in the preparation, packing or food storage.
9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
10. All equipments shall be placed away from the walls to allow correct inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
13. Persons suffering from communicable diseases shall not be permitted to work. Any wounds or cuts shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.
15. All food handlers should keep away from wearing, false nails or other items or loose jewelery that might fall into food and avoid touching their face or hair during handling food.
16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.
17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
18. The vehicles used to transport article of foods must be maintained and kept clean.
19. Foods while in transport in packaged form or in containers shall maintain the required temperature.
20. Disinfectants /Insecticides shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

Notes

Scan this QR Code or click on below to access the video of the following:

Scan this QR Code or click on below link to access the video of
Personal Hygience and Employee Facilities

Scan this QR Code or click on below link to access the video of
Milk Nutritional Value

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

3. Prepare and maintain work area and process machineries for production of cottage cheese

FICSI
Food Industry Capacity and Skill Initiative

Unit 3.1 The materials and equipment used in the cleaning along with methods of cleaning and maintenance of the work area

Unit 3.2 The common detergents and sanitizers used in cleaning work area and machineries

Unit 3.3 Process of Preparing the Work area for scheduled production

Unit 3.4 Types of Maintenance Procedures

Unit 3.5 Process of Preparing the Work Area before Starting Production

Unit 3.6 Prepare the machines and tools required for production

(FIC/N2017)

Key Learning Outcomes

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

1. State the material and equipment used in the cleaning and maintenance of the work area
2. State the common detergents and sanitizers used in cleaning work area and machineries
3. State the methods of cleaning and sanitation
4. Perform the process of preparing the work area for scheduled production
5. Describe the functions to be carried out before starting production
6. State the different types of maintenance procedures
7. Conduct minor repairs and faults in process machineries
8. Prepare the machines and tools required for production
9. Waste Management in Dairy Industry

Unit 3.1 The materials and equipment used in the cleaning along with methods of cleaning and maintenance of the work area

Unit Objectives

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

1. Enlist the material and equipment used in the cleaning and maintenance of the work area
2. State the common detergents and sanitizers used in cleaning work area and machineries
3. State the methods of cleaning and sanitation
4. Perform the process of preparing the work area for scheduled production
5. Describe the functions to be carried out prior to production
6. State the different types of maintenance procedures
7. Conduct minor repairs and faults in process machineries
8. Prepare the machines and tools required for production

3.1.1 Materials and equipment require for the cleaning and maintenance of the work place

3.1.1.1 Manual cleaning

Industrial brushes and gloves must be available for manual cleaning. Only mild chemicals are used (pH value between 4 and 9) like Acetone pH: 7, isopropyl alcohol pH: 8, etc. It is difficult to achieve consistent results because the human factor is involved in manual cleaning. Motivation, training, supervision and education are required for efficient cleaning.

3.1.1.2 Scrubbers and polishers

Scrubbers and polishers are used for floors and the selection is mostly depends on the weight of machine so, that brushes shall rotates easily on the contact surface. Most suitable for open and large area. In case of heavy congestion on floor, manual cleaning may applied.

Fig. 3.1 Manual cleaning

Fig. 3.2 Scrubbers and polishers

Fig. 3.3 Steam cleaners

3.1.1.3 Steam cleaners

Steam cleaning is very much require because of fat, oil and greasy materials present in the food industry. Some model may have in-built steam generators for effective and easy use.

3.1.1.4 High pressure cold/hot water cleaners

High pressure (1000 to 5000 kN/m^2) water jet with a rate of 8 Lit/minute or above is used in the food industry to clean the corners, floor, equipments etc.

3.1.2 Objectives of Cleaning

The degree of cleanliness is associated with the following:

1. **Physical cleanliness** – cleaning of all visible dirt
2. **Chemical cleanliness** –cleaning of microscopic residues along visible dirt
3. **Bacteriological cleanliness** – achieve disinfection of all the equipment
4. **Sterile cleanliness** –micro organisms free environment

3.1.3 Cleaning procedures adopted in dairy industry

Dairy industry accommodates heavy equipments, hence circulatory cleaning-in-place (CIP) systems is generally adapted for cleaning and sanitization.

The CIP cycle in a dairy industry comprises the following:

- Recovery of product residues prior to cleaning: water or compressed air is used for flushing/pushing the raw/processed products available in the pipelines or processing equipment.
- Pre-rinsing with cold/hot water to eliminate dirt in loosen condition;
- Cleaning with detergent;
- Rinse with clean water;
- Disinfection by chemical agents (optional)

Each stage need certain duration of time to achieve desirable result.

3.1.4 Cleaning and Sanitization Protocols

Cleaning and sanitization are the two processes employed in the dairy industry to ensure hygiene and product safety. Cleaning refers to the soil/dirt removal from the surface of the equipment/pipelines. Sanitization is destruction of all organisms that will affect the quality of a product or raw material. Cleaning and sanitization are complementary processes.

During the course of processing, milk constituents deposit on the surface of the equipment. These deposits are typically known as “dairy soil” and consist of milk or milk product residues.

Common equipment used in a typical dairy industry for cleaning are:

- Cleaning or washing tank
- Cleaning or sanitizing agents
- Cleaning brushes and scrubbers
- High-spray nozzles

Table 10: Levels of Cleaning in a Food Processing Unit

Physical	Chemical	Microbiological
Focuses on cleaning non- food contact surfaces	Focuses on cleaning the food-contact surfaces	Focuses on cleaning all direct and indirect food-contact surfaces

3.1.5 Detergents Used for Cleaning Processes

Detergents are used for washing and cleaning. The detergents used for cleaning a dairy processing unit should be:

- Highly penetrable
- Capable of dissolving calcium deposits
- Check re-deposits
- Possess moderate foam generation capacity
- Non-corrosive
- Non-toxic

Some commonly used detergents in the dairy industry are:

- Alkaline detergents
- Water softeners
- Acid cleaners

Notes

3.1.6 Sanitizers Used for Cleaning Processes

Sanitization involves destruction of pathogens and reducing microorganisms to a level acceptable. The following table explains the classification of sanitizers:

Table 11: Levels of Cleaning in a Food Processing Unit

Thermal Sanitizers	Chemical Sanitizers
• Used to eliminate microorganisms	• Used to reduce microorganisms to a level acceptable
• Also called high temperature sanitizers	• Also called low temperature sanitizers
• E.g. Steam, hot water	• E.g. Chlorine-based sanitizers, iodine

3.1.7 Clean-In-Place (CIP)

CIP is a method used for internal cleaning of machineries. It is done without dismantling pipes, storage tanks, process equipment, filters and fittings. In this process, a sanitizing agent is circulated through the entire processing unit with the help of a spray ball. The turbulence created removes soil ensuring removal of bacteria and chemical residues.

3.1.7.1 Tips to conduct an effective CIP process:

- Use the right vessels for the right process
- Use the right cleaning and sanitizing solutions
- Ensure correct flow rate
- Ensure all connections are clean
- Monitor and verify the entire process

3.1.7.2 Cleaning sequence

Based on the availability of heated surfaces (like pasteurizers, UHT) in the dairy plant, CIP programs differ accordingly. Acid circulation is require for the heated surface to get rid off of encrusted protein and salts.

A detailed sequence for CIP cleaning is as follows:

1. Recover product residue from drainage
2. Remove non-retrievable residue with water or compressed air
3. Rinse for 10 minutes with warm water (50-60°C)
4. Circulate alkaline detergent (0.5-1.5 % solution) at 75°C for 30 minutes
5. Rinse with warm water (50°C) for 5-8 minutes
6. Circulate acidic detergent (0.5-1.0 % solution) at 75°C for 20 minutes
7. Rinse with warm water (50°C) for 5-8 minutes
8. Use thermal disinfection (90-95°C) and cooling for 10 minutes or chemical disinfection with a suitable sanitizer

3.1.7.3 Advantages of CIP

The major advantages of implementing CIP are:

- Proven and repeatable quality assurance step
- Reduction in cleaning costs by recycling cleaning solutions
- Possibility to clean inaccessible areas on the equipment
- Better safety to operators because hazardous cleaning materials are not handled
- Reduction in time between two production runs
- Safety operators are not required to enter the plant to clean it
- Reduction in labour requirements
- More effective use and control of cleaning materials
- Reduction in water consumption

3.1.8 Sterilizing-In-Place (SIP)

SIP is the process by which food processing equipment is sanitized after the CIP process. It helps to eliminate any residual microbiological contamination. SIP is a combination of three processes viz. sterilization, disinfestation, and sanitization.

Table 12: Process under Sterilizing-In-Place (SIP)

Sterilization	Chemical Sanitizers	Sanitization
➢Uses steam or hot water	➢Uses disinfectants or chlorine solution	➢Uses soap solution or washing soda

Unit 3.2 Common detergents and sanitizers used in cleaning work area and machineries

Unit Objectives

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

- List the common sanitizers and detergents used in cleaning work area and machineries
- List Pre-requisites for effective cleaning and sanitization
- Types of detergents used in cleaning
- What should be quality of water used for cleaning
- State various precautionary measures to be taken while cleaning and sanitization

3.2.1 Pre-requisites for effective cleaning and sanitization

The primary purpose of cleaning food processing equipments after each use is to remove all residues. Residues provide harborage for bacterial growth that affect product quality and shelf life and have a potential to cause disease. Secondarily, excessive soil buildup will be detrimental to those processes where heat transfer is involved.

➢ **Good Quality Water**

a) The water used at food processing plant shall specify to IS 10500.
b) Only potable water, with appropriate facilities for its storage and distribution shall be used as an ingredient in processing and cooking.
c) Water storage tanks shall be cleaned periodically and records of the same shall be maintained in a register.
d) Non potable water can be used provided it is intended only for cleaning of equipment not coming in contact with food, which does not come into contact with food steam production, fire fighting & refrigeration equipment.
e) Worker must understand potable and non portable water pipe lines.

➢ **Types of chemicals**

Chemicals used in cleaning can be simple or formulated cleaning detergents. If formulated cleaning detergents are used, supplier recommendations must be followed fully. The chemicals used depends on:

➢ **The Soil type:**

a) Chlorinated alkalis are used for cleaning protein oils
b) Chemicals with high alkalinity (NaOH, KOH) are used for removing carbohydrated soils.

Table 13: Detergent solutions are recommended by BIS

Purpose	Detergent solution	Quantity per 1000 g
For general use	sodium phosphate Wetting agent	850g/1000 g 100g/1000 g
For aluminium utensils	sodium phosphate, sodium metasilicate, Wetting Agent*	650g/1000 g 200g/1000 g 150g/1000 g
Cleaning In Place (CIP)	Caustic	1-1-2%

Wetting agent: Acinol-N, Idet-10, Teepol, or equivalent compound

Maintain strength of detergent solution between 0.8% - 1%.

➢ **Chemical concentration**

- The chemical concentration of the detergent depends on the kind of soil to be removed.
- Heated surfaces often require higher concentrations than cold ones.
- Also, when dosing equipment is used, the concentration of detergent should be adjusted so as not to interfere with the proper functioning of the machinery.
- A conductivity measurement with a guarding and recording function is sometime required.
- Semi-automatic and manual cleaning units are used in heat exchangers cleaning
- Either a dosing device should be constructed or a premix of ready to use detergents solution must be prepared in sufficient amounts(For cleaning the circuits).

➢ **Contact between the chemical and processing equipments**

- A good turbulent flow is required between the circulating liuid and inner surface of pipes. To remove sediment and trapped air.
- Due to flow restrictions and a special ''cleaning pump' may be necessary.
- A spray device is also required after every two meters in horizontal tanks.

➢ **Exposure Time**

- It is different for both, alkaline clean and acid clean surface.
- Acid clean usually takes a less time than alkaline clean.
- Pre-rinse and intermediate rinse and final rinses take about five to ten minutes.

➢ **Contact Temperature**

- The temperature of the pre rinse should be above the fat melting points, but below the denaturation temperature for proteins.
- Cleaning utilizes chemicals. All chemical reactions are very much temperature dependent.

➢ **Microbiological Load**

- Sanitizer activity depends upon the type of micro-organism present.
- Spores are more resistant than vegetative cells

3.2.2. Disinfection

Disinfection of food contact surfaces may be carried out by means of:

- Steam - Steaming should be done for 10- l5 minutes after the condensate has attained 85˚C.
- Hot water - Hot water at 80˚C (use soft water only to prevent deposition of salts) for at least 20 minutes in circulation cleaning for 15 minutes at 85˚C

Table 3.2.2: Some common types of cleaners and sanitizing agents used for food contact and non- food contact surfaces are:

Cleaning agents	Used for	Risk	Safety measure
Hypochlorites like potassium hypochlorite, sodium hypochlorite, and calcium hypochlorite	Cleaning stainless steel food contact surfaces	Leads to corrosion	Ensure pH and concentration levels are maintained
Liquid chlorine	Internal cleaning of stainless steel equipment and vessels	Leads to corrosion	Ensure concentration levels are maintained
Hydrogen peroxide	Killing bacterial spores, pathogens, spoilage organisms, and other microorganisms	Has a strong odour	Use in well-ventilated and open spaces
Ozone	Cleaning food-contact and non-food-contact surfaces like equipment, walls, floors, drains, conveyors, tanks, and other containers; Killing microbes	No risk involved since it leaves no residue	Safe to use

Yeasts, molds, fungi, and viruses have different effectiveness for sanitizers.

3.2.3 Storage of Sanitizers and Disinfectants

Sanitizers and disinfectants are packed and labelled in a proper manner. They are kept in a safe area within the storeroom. The cleanliness of this area is maintained at all time

3.2.4 Precautionary measures during Cleaning and Sanitization

The precautionary measures to be taken before cleaning of any equipment/machine are as follows;

- Obtain a Work Permit before carrying out any equipment internal cleaning activity in respective section as per SOP.
- All energy sources are de-energized before carrying out cleaning activity.
- Use appropriate PPE (Mask, gloves, goggles, safety belts, ladder, etc.) People required to enter into a vessel/equipment should wear a safety belt, mouth cover, hair-net, helmets, dedicated safety shoes or new shoe covers.
- Always clean the equipment followed by floors cleaning
- If the cleaning process requires human entry into the vessel/equipment, ensure that the Confined Space Entry permit / Cold Work permit (as the case may be) has been received and all due safety measures have been taken.
- Equipment used for handling raw and perishable food products must be cleaned and disinfected after each process.
- Equipment handling products high in fat (butter, ghee and cheese)must be cleaned after the process.
- All equipment shall be stored when not in use in a clean and dry place that prevents contamination.
- The temperature of detergent solution in manual cleaning shall be such that it does not affect the hands of user.
- Wherever manual cleaning is involved, it is recommended that the hands and eyes of the operator be adequately protected by the use of gloves, goggles, etc.

Notes

Unit 3.3 Preparing the Work Area before Starting Production

Unit Objectives

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

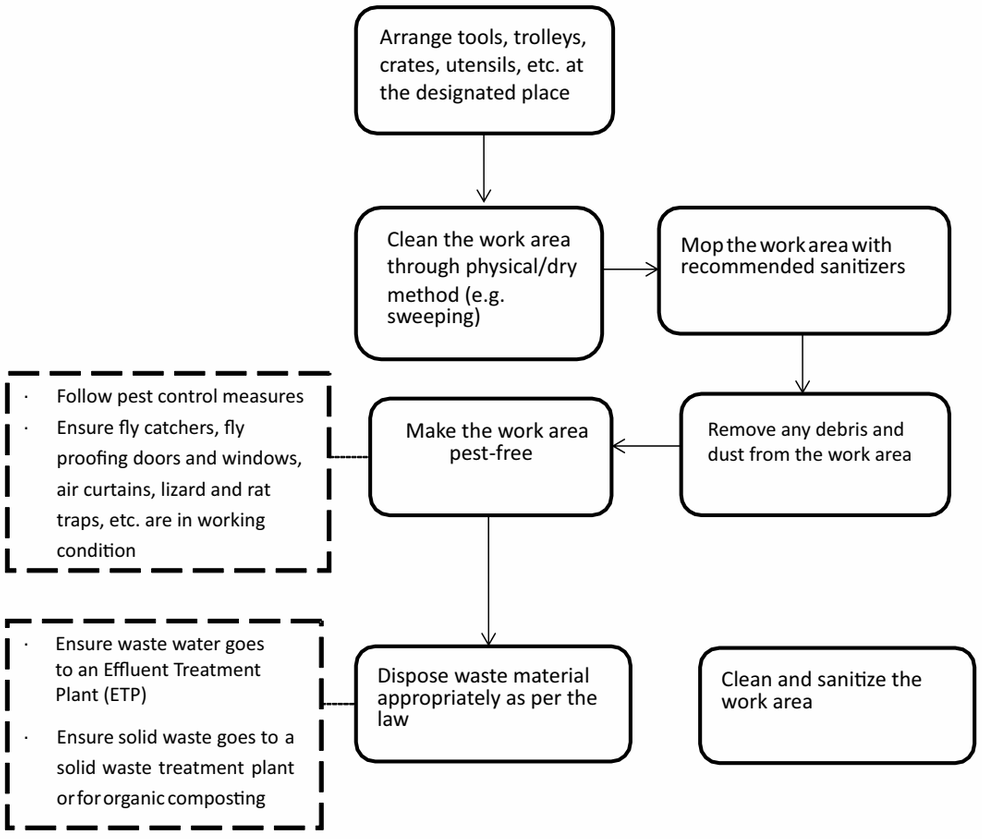
- Know the process of cleaning the Work area before starting production
- Explain pest control measures
- Explain the Process of preparing the work area for scheduled production
- Explain the Process of cleaning tools and equipments

3.3.1 Functions of preparing workplace area for Scheduled production

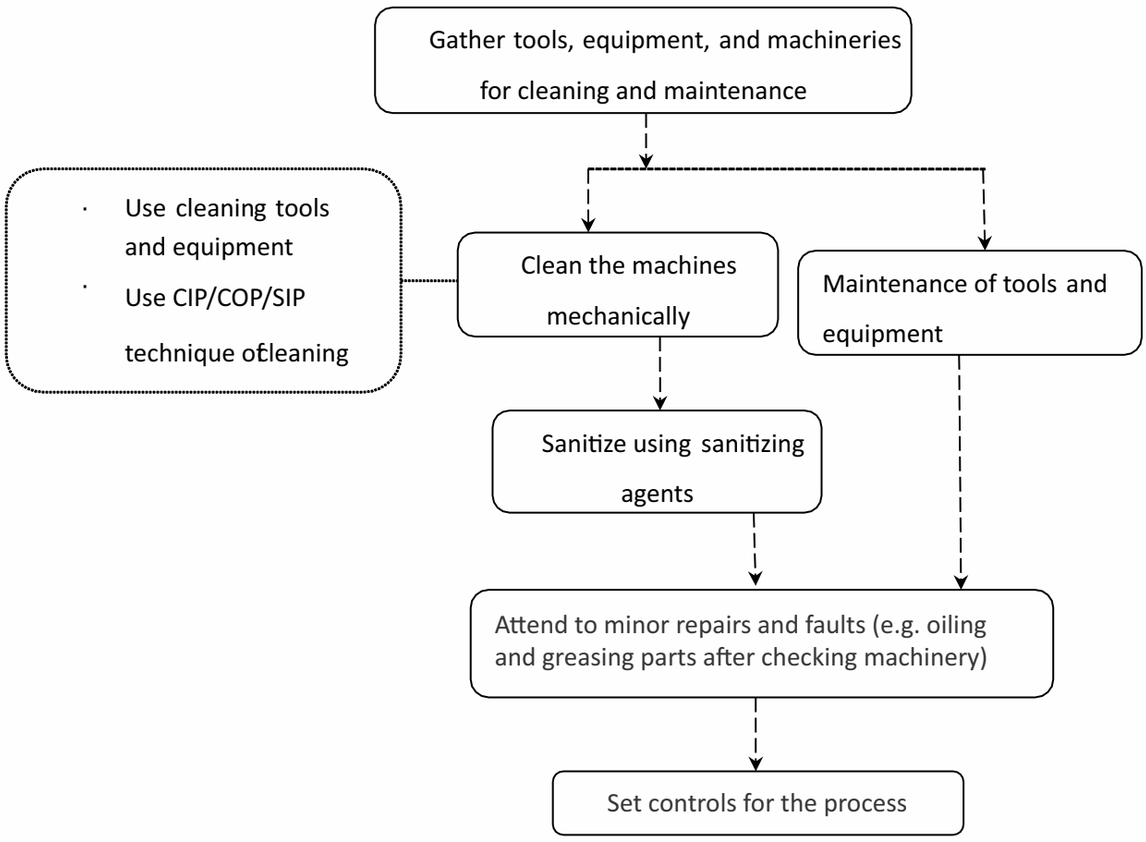
As per food safety norms, all food processing premises should follow high standards of hygiene and cleanliness in order to check contamination of products.

The following chart explains the process of cleaning the work area before production. The dotted boxes explain pest-control measures and methods used for waste material disposal in detail.

Flow chart 4: Process of Cleaning process of cleaning work area



Flow Chart 5: Process of cleaning and maintenance for tools and equipment



3.3.2 Managing Work Place Area

- There should not be any mixing/contamination in raw and processed products.
- A separate storage facility shall be available for the raw materials, process/products ingredients, packaging materials and finished goods.
- Toilet should not be near to processing section. A separate facilities for the same is advisable.
- In food industry, there must be sufficient space for weighing, inspecting and storage of raw material. Simultaneously, there must be sufficient space for production, packing and storage of products. Space must be allocated for the maintenance and repair of equipments along with first aid box, sand buckets and fire extinguishers.

Unit 3.4 Maintenance procedures and their types

Unit Objectives

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

- Explain the various different types of maintenance procedures

3.4.1 Preventive Maintenance

In order to ensure smooth functioning of all equipment and machineries, the dairy industry follows a preventive maintenance schedule. This schedule includes four processes namely:

- Cleaning
- Inspection
- Oiling
- Retightening

3.4.1.1 Advantages of preventive maintenance are as follows:

1. Minimize production lag
2. Very less or no repairs of large volume
3. No wastage of raw and finished material
4. Operational life of equipment will increase
5. Improved spare parts control management
6. Better work safety with less manufacturing costs

3.4.2 Types of Maintenance

The maintenance procedures followed in the dairy industry are broken into four categories. The following table explains the differences:

Table 15: Type of Maintenance

Periodic maintenance	• Involves routine inspection, servicing, and cleaning for the machineries • Involves periodic replacezarts to prevent unexpected breakdown
For aluminium utensils	• Involves predicting the service life of key parts/equipment on the basis of analysis/identification • Parts/equipment are used only till their service life
Corrective maintenance	• Tack care of equipment and its parts to ensure better preventive maintenanceInvolves redesigning of equipment to improve reliability
Breakdown maintenance	• Involves repairing of equipment after breakdown • in case of equipment failure leads to the losses which is more than repair cost

Dairy plant maintenance requires a well established step by step process to get maximum output from it. Following records/schedule are required to be update time to time

1. Equipment/machineries records
2. Inspection schedules

a. On the basis of log book entries

b. Along with schedule servicing

c. For lubrication

3. Spare parts control report
4. Maintenance taken report

A sample equipment record card is presented here for an example which will have all the record related to maintenance, lubrication and change of spare parts

DESCRIPTION	(NAME OF PLANT)	MODEL	CAPACITY	SERIAL NO.	INVENTORY NO.
NAME ADDRESSES TELEPHONES TELEXES CONTACTS CONTRACTS					
MANUFACTURER			SERVICE CONTRACT COMPANIES		
DRRAWING No.		SPARE PARTS SHEET No.		SERVICING MANUAL No.	
LAYOUT DRAWING No.		MAINTEANCE INSPECTION SECHEDULE No.		LUBRICATION SCHEDULE No.	
STATUTORY INSEPECTIONES					
GOVERNMENT		INSURANCE		OTHERS	
ORDER No.		RECEIVED (DATE)	INSTALLED (DATE)	COMMISSIONED (DATE)	COST
DETAILS RELEVANT TO MAINTENANCE PROCEDURES					
MECHANICAL		ELECTRICAL		GENERAL	
DRIVES		MOTERS		SPECIAL TOOLS	
GEARS					
BELTS/CHAINS					
BEARINGS		OTHER APPLIANCES		LUBRICANTS	
RECORD ON THE REVERSE ALL CHANGES, ADDITIONS, MODIFICATIONS, MAJOR REPAIRS & OTHER RELEVANT INFORMATION					

Fig. 26 Equipment record card

Unit 3.5 Process of preparation the work area, tools and equipment prior to the production along with minor repairs

Unit Objectives

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

- State the procedure to be require to conduct prior to the production
- State the maintenance procedure to be followed for dairy processing machineries before starting production
- Explain the lubrication system followed in the dairy industry
- State the various types of maintenance procedures

3.5.1 Preparation of Machineries for Production

Before beginning with the actual production process, a cottage cheese (paneer) maker must prepare and maintain the process machineries and tools. Following is a step-by-step guide to preparing machineries for production:

1. Make sure about the safety and hygienic processing at the work area.
2. Plan, schedule, and organize machineries
3. Ensure proper installation
4. Ensure periodic inspection
5. Ensure adequate lubrication of machineries
6. Adjust machineries and instruments, if required
7. Replace worn and damaged parts

Apart from this, a paneer maker must also:

- Record and report observations, any type of repairs, and replacements
- Periodically review records on inspection, lubrication, repairs, and performance of equipment
- Keep an sufficient quantity of spare parts
- Determine maintenance costs
- Ensure regular cleanliness and painting of machineries
- Inspect and maintain all the protective types of instruments in case of any emergency
- Ensure maintenance of all the utilities as well
- Inspect the equipment for any physical damage and report the same, if necessary

- Follow manufacturers' instructions for maintaining, cleaning, repairing, lubricating, and servicing the equipment
- Ensure timely lubrication of gears, compressors,
- Look out for refrigerator gas leaks, air leaks, and milk leaks in equipment
- Maintain the oil, water, air, and lubrication levels at all times
- Balance the bowl in the separator and clean it thoroughly after each use
- Dismantle the ventilator occasionally for complete cleaning
- Maintain the product temperature and check the flow diversion valve regularly

3.5.2 Spare Parts Used in the Dairy Industry

Following is a list of spare parts used in the dairy industry:

- Pipes and gaskets
- Fittings
- Bolts
- Nuts
- Washers
- Bars
- PHE Plates and gaskets
- Electric bulbs, parts and relays
- Seal for pumps
- Springs and bearings
- Automatic switches
- Aluminium capping foils

3.5.3 Lubrication System

Insufficient lubrication while operation is the major causes of equipment breakdown in the dairy industry. Hence, it is important to follow the following:

- Lubrication chart for each machine along with schedule of lubrication
- List of places to be lubricated along with frequency of lubrication

3.5.4 Following are the mandatory requirements for starting production:

- Ensure to do careful planning, scheduling and organizing usage of equipments during production.
- Ensure that proper maintenance is performed on equipment and acting as a communications connection between the ground-level work of a company and the higher management executives.
- Ensure that workplace is up to federal labour standards and everybody is conscious about the safety training.
- Ensure Production equipments/utensils must be cleaned and sanitized after the completion of production.
- Replace brushes with loose bristles
- Check the cleanliness of product surfaces of the equipment.
- Be sure no tools and attachments are lying lose in production area.
- Availability of pests or flies, insects, mice droppings must be reported to supervisors/seniors.
- Scrappers for equipments and table-tops are not to be used on the floor.
- Repair worn and damaged parts immediately.
- Use white cloth to wipe hands regularly and use yellow clothes to clean the floor.
- No moist clothes should be left in work place area and also dispose of soiled clothes without any delay.
- Ensure proper installation of equipment and adequate lubrication of machineries
- Ensure periodic inspection of equipments.
- Adjustments of machineries and equipments, If required
- Ensure that all containers, are kept covered and designated.
- Garbage bins containers must be covered.
- Make sure the fresh ingredients were used for the production.
- Brooms and dust pans are to be placed at stations provided.
- Wipe or mop up spilled liquid milk immediately
- Monitor and maintain proper temperatures of machines.
- Ensure that no tools and hazards were present in the work area prior to the production.

Unit 3.6 Waste Management in Dairy Industry

Unit Objectives

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

- Define Waste Management
- Elaborate the method of managing and disposing waste material

3.6.1 Introduction

All food processing industries encompassing varied products generate waste in some or the other forms. The products manufactured by these industries contain huge amount of essential nutrients such as carbohydrates, protein, fats, vitamins and mineral salts which during various equipment operations enter the drainage thereby favoring the growth of anaerobic and aerobic bacteria.

3.6.2 Definition of Waste Management

Waste management may be defined as the process of collection, transportation, processing, recycling or disposal, and monitoring of waste substances. Waste materials are generally categorized as:

- Solid waste
- Liquid waste
- Oily waste
- Gaseous waste/ water vapours

3.6.3 Solid wastes

The waste attained in the solid state during operations such as processing or generated during maintenance are referred to as solid wastes.

Some of the examples are:

1. Minute dust particles in the exhaust air released from drier,
2. Solid residue from ghee in ghee section,
3. Ash from Boiler, in case of solid fuel,
4. Packaging section, where substantial packaging items may be scrapped in the form of cartons, bottles, LDPE films etc.
5. Waste generated from uncertain events. (Explosions, fire etc.).
6. Impaired or contaminated equipment and polluted soil.

Most dairy processing units have an Effluent Treatment Plant (ETP) within them to treat waste material and water before disposal. This is crucial to ensure the processing unit remains clean and hygienic. There are strict laws and norms that should be followed for running an ETP. Violating these laws will lead to severe legal consequences. It will also lead to compromised quality of treated waste.

3.6.4 Liquid wastes

The waste generated in the liquid form, during various operations performed in the processing industries such as washing, cleaning, flushing, manufacturing etc. are referred to as Liquid wastes. Operational deterioration leading to the generation of by-products, un-reacted raw materials or impurities may be include the waste obtained from processing., e.g., delayed pasteurization of milk may lead to coagulation resulting in sour taste, which makes it necessary to be drained. Clean-in-place (CIP) which involves the use of acid and lye along with water used for cleaning purposes is also considered under liquid wastes.

3.6.5 Oily wastes

The wastes which involves oil lubrication such as coolant leakage and motors, along with leakage from hydraulic machines, crankcases, compressors etc. are termed as oily wastes. Separate disposal methods are adopted for oily wastes, differentiating them from liquid wastes.

3.6.6 Gaseous wastes/water vapors

The waste released in the air either in gaseous state or in the form of volatile vapors are termed as Gaseous wastes. The odious fume from the chimney which consists of various gases like CO_2 and CO polluting the environment to a great extent, refrigerant leakage from pipe lines of the compressors are example of gaseous waste. The energy in the water vapours generated in the concentration section, increase the relative humidity of the surrounding in processing plants and are considered as the gaseous waste. Steam leakage from various points causes corrosion with time thereby decreasing the life of the tees and knobs used for regulation purpose, nuts and bolts.

3.6.7 Waste Minimization

Waste minimization being the necessity of time, can be accomplished through various waste management plans, which is a requirement as per Industrial Waste Management Policy for the premises which are subject to works approval. Hence, all the food processing industries should assess opportunities for reducing waste generated during various operations.

Several waste management measures include:

- Optimal utilization of water and its recycling
- Controlled use of chemicals and its recycling
- Recovery and reuse of raw material and products,
- off-spec material being reused/ reprocessed

3.6.8 Process Control

The waste generated in a dairy plant is basically depends on the following:

- The design parameters of the plant
- Operational factors within the plant
- Availability of adequate process monitoring, and procedure alarms.
- Degree of automation in the plant
- Training and commitment of operator
- Schedule of routine maintenance programme for equipment.

3.6.9 Avoidable losses

Some examples of avoidable losses are:

- Quantity lost may not be large by the pipelines, leaking valves, pumps or some other fittings but they may be huge source of pollutants.
- Whatever may be the cause of spills whether poor handling and malfunctioning of process or any overflows leads to pollution. Spills generally occur for a short span of time but unfortunately the volume and concentration of product lost is very high which increase environmental pollution load.
- Losses from manufacturing plants as well as the wastage during cleaning these operated plants and equipment aids to the pollution load to a great extent.
- These type of losses also includes the discharged materials which is not worth recovering like whey, spent cleaners and others
- Production of liquid milk also results in the generation of large amount of waste water and solid waste. Also it leads to generation of noise and odour.
- Fatty and viscous milk products like butter, ghee and cream also generate huge amount of waste and residues which are difficult to remove as these substances get stick to equipment very strongly. The most effective and feasible way for removing residues left during cream, ghee and butter processing is hot water treatment and the temperature of water should be less than 65°C.

3.6.10 Surface deposits

There are certain ways to prevent the buildup of surface deposits include

- Minimizing the surface area could be one way.
- Measures should be taken to prevent deposits of milk stone
- Preparation done before filling must be accurate.
- Over-working of the batches must be avoided.
- To prevent overflow all the collection or holding facilities should be large enough to accommodate the entire quantity without ant loss.

- Also have a proper and regular check on leakage.
- To reduce waste, buttermilk and solids recovered from butter wash water can be dried and used as animal feed
- Preventive measures should be taken for avoiding wastes during processing milk and milk products like cheese, milk powder, butter and others.
- Byproducts should be reused wisely.

3.6.11 Waste reduction

Different measures to achieve waste reduction are as follows:

1. To prevent curd loss during paneer preparation, avoid overfilling of vats.
2. Before rinsing of vats there must be complete removal of whey and curds from the vats.
3. The whey which is being drained from paneer must be segregated properly.
4. The small and fines particles of curd must be removed properly prior to the drainage of whey.
5. In evaporation and powder production plant, the reduction in waste may be achieved by the following:
   a. Maintaining a comparatively low level valve to stop boil-over product before spilling.
   b. Longer runs should be avoided as these results in higher pollution due to the blockage of tube. It also create problem during cleaning.
   c. To avoid carry-over of milk droplets effluent entrainment separators must be used during condensation of evaporated water.
   d. Keep recirculate the feed stock like low concentrated milk until required concentration is being achieved.
   e. Wet scrubbers or air filters must be used to reduce air emission

Notes

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4. Carry out production of cottage cheese (Paneer)

Unit 4.1	Machineries are clean and in good working conditions and Controlling Parameters
Unit 4.2	Demonstrate assembling of all components of machines, Production Sequence and conduct a pre check
Unit 4.3	State the working of machineries involved in the production
Unit 4.4	Demonstrate the entire production of Paneer
Unit 4.5	Packaging, storage of paneer and analyze the quality of finished product
Unit 4.6	Post production cleaning and maintenance

(FIC/N2018)

Key Learning Outcomes

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

1. List the different machineries involved in manufacturing of cottage cheese
2. State the working of machineries involved in the production
3. Demonstrate assembling of all components of machines
4. Perform a pre check on all machineries
5. Demonstrate the entire production of cheese
6. Analyze the quality of finished product
7. Demonstrate cleaning the machineries used with recommended sanitizers following CIP (clean-in-place) procedure
8. Demonstrate cleaning the equipment and tools used using recommended cleaning agents and sanitizers

4.1 Machineries are clean and in good working conditions and Controlling Parameters

Unit Objectives

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

1. List various machineries used for manufacturing cottage cheese
2. Know how we can check machineries are in good working condition and clean
3. State how to check the machines are clean
4. Understand importance of control parameters

4.1.1 Machineries required for cottage cheese production

List of Major Machineries Required for Production of cottage cheese

1. Plate chiller for milk
2. Raw milk silo
3. Bactofuge
4. Milk Pasteurizer
5. Cream Separator
6. Homogenizer
7. Multipurpose vat
8. Paneer Press
9. Packaging machine

(a) To check machines are in Good Working Condition, below indicated points to be followed

1. All the contact surface of food must be cleaned through approved CIP procedure.
2. The non food contact surfaces shall be kept dry.
3. There should not be any noise while operating the equipment. The difference in noise will lead to a clear idea about the state of machineries.
4. The preventive maintenance (as discussed in maintenance section) should be followed as per standard operating procedure.
5. No lubricant application over food contact surfaces.

(b) Control Parameters

The efficiency and ease of working is based on controlling all the set parameters and following the standard operating procedure.

(c) Factors Affecting Efficiency

Effective operation of a dairy plant is possible only when all factors involved work in sync. This can be achieved only by optimizing the use of available resources and facilities. Some of the factors that affect the plant operation efficiency and their corrective measure are:

Table 16: plant operation efficiency and their corrective measure

Factors	Corrective measure
Services and utilities	Uninterrupted supply of services and utilities
Supply of raw material	Adequate supply of raw material and its scheduled arrival
Quality of raw material	Quality checks for milk used for production
Work schedule	No wastage of working hours
Efficient labour	Employing skilled labour
Proper processing units	Using the floor space efficiently
Utilities	Easy availability of water, electricity, refrigeration, and steam
Stock supplies and spare parts	Adequate supply of stocks and spare parts

(d) Standard Operating Procedures (SOPs)

A dairy products processor is required to follow the Standard Operating Procedures (SOP) set by the dairy processing plant. SOPs must be followed in order to guarantee quality and safety of the processed products.

A typical dairy processing plant uses the same pipeline for carrying milk to different sections. For a dairy products processor, it is important to understand the opening and closing process of valves for specific purpose of production.

Steam and chilled water are a major part of milk product processing. It is important to understand the precaution set by the dairy industry to keep in mind while operating the steam and chilled water line.

Before starting production, both the lines must be checked properly in co-ordination with utility section (boiler and refrigeration section). The production process must be in sync with the operation of the utility section. This is necessary because if there is any change in the supply of steam or chilled water, there are chances of getting low quality product. This can also be dangerous from the safety point of view.

(e) Ingredients Required for Production

The general ingredients in a dairy plant are:

- Chemicals for testing of raw and processed products
- Milk powder
- Natural and artificial flavours
- Citric acid
- Cream
- Colour
- Butter
- Vegetable fat
- Stabilizer and emulsifiers like monoglycerides, gelatine, and alginate

Based on the product requirement and production planning, a dairy products processer is required to inform the raw material store to be ready with the raw material of the desired quantity.

Unit 4.2 Demonstrate assembling of all components of machines, Production Sequence and conduct a pre check

Unit Objectives

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

- Demonstrate assembling of all components of machines
- Explain the process of planning production sequence for maximize resource utilization

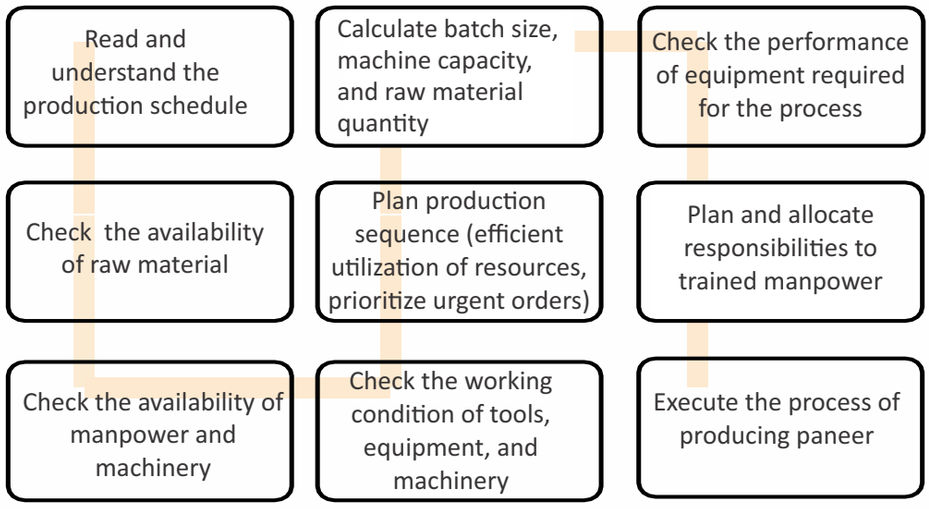
4.2.1 Assembling of all components of machines

All the machineries or equipment are require to check for the following:

1. Presence of screw, nut and bolt
2. Fully tight screw, nut and bolt
3. Leakage prior to the production
4. proper assembling of machine

4.2.2 Production Sequence

The following chart provides an overview of the production planning process:



Flow chart 6: Process sequence for maximum utilization

4.2.3 Process Loss

This is defined as the losses that occurs while converting raw material into finished product. The following may be the reason of losses:

- Quality of raw material
- Mishandling of raw material/machinery

Unit 4.3 State the working of machineries involved in the production

Unit Objectives

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

- Define pasteurization
- State the production procedure of pasteurization
- State the different types of pasteurization methods
- State the process of HTST pasteurization
- Demonstrate the process of HTST pasteurization
- State the importance of standardization process
- Explain the method for standardize milk to desired fat and SNF levels
- Explain the various calculations required for standardization of cream
- State the need of homogenization in milk
- State the method of homogenization of milk

4.3.1 Pasteurization

Louis Pasteur (French scientist) developed a process in the year 1860, through which the shelf life of wines increase after heating at high temperature. The process is termed as pasteurization after his name. Latter in 1880, Germany and Denmark dairy industries adopted this method on commercial scale. Pasteurization destroys all the pathogenic microorganisms present in milk. Heat treatment also inactivate the enzymes present in the milk.

4.3.1.1 Definition

International Dairy Federation (IDF), defined pasteurization as a process, in which a product is subjected to the heat treatment to minimize the pathogenic microorganisms along with a minimal chemical, physical and sensory changes in the product.

4.3.1.2 Importance of Pasteurization

- It destroy all the pathogenic microorganisms present in the milk.
- It helps to increase the shelf life of milk by killing spoilage organisms (about 88-99%).
- It helps to inactivate enzymes.
- It helps to eliminate some of the gaseous, tainting substances.

4.3.1.3 Drawbacks of Pasteurization

- It diminishes the cream line or cream volume.
- Renneting time may increase after pasteurization.
- bacterial toxins may not be destroyed after pasteurization.

4.3.1.4 Types of Pasteurization method

Pasteurization of milk is done by two methods:

a) Batch method known as Low Temperature Long Time (LTLT)

b) Continuous method known as High Temperature Short Time (HTST)

The following table explains the two processes in detail:

Table 17: Pasteurization process

Low Temperature Long Time (LTLT) High	Temperature Short Time (HTST)
• Heating Temperature: 63°C • Holding time: 30 minute • Outlet temperature of milk: 5°C or below • Heat transfer take place through double jacket tank via a circulation of heating/cooling media. • Mostly used for cream and ice-cream pasteurization	• Heating Temperature: 72°C • Holding time: 15 seconds • Outlet temperature of milk: 5°C or below • Heating and cooling are automated procedures • Mostly used for processing large volumes of milk

4.3.2 Pasteurizer

Pasteurizer is plate-type equipment that helps in the exchange of heat. Each plate has the corrugation to direct the milk and the heating or cooling media.

Following operations take place during pasteurization:

a) Filration and clarification

b) Separation of milk (separators)

c) Bactofugation

d) Standardization of milk

e) Homogenization of milk

f) Heat exchange

g) HTST pasteurization

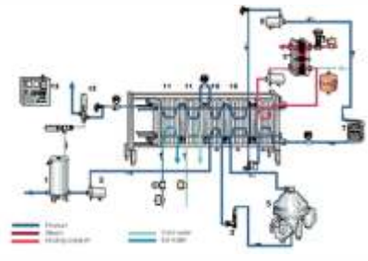


Fig. 27 Pasteurization module

4.3.3 Filtration and Clarification

Following operations take place in this process:

4.3.3.1 Pre-heating

Heating of milk before actual processing

4.3.3.2 Straining

Helps remove large, foreign material like straw, hair, insects, grass, dirt, flies, etc.

4.3.3.3 Filtration

Removes visible sediment (foreign matter) by centrifugal force

4.3.3.4 Clarification

Removes dirt and foreign matter more efficiently to improve appearance and marketability of milk

4.3.4 Working of HTST Pasteurizer

4.3.4.1 Preparing the pasteurizer for production

Before preparing the pasteurizer for production, the following steps must be followed:

1. The plant must be sterilized
2. All water remaining in the plant must be drained
3. Filter clothes should be cleaned
4. Nylon filters should be fitted in the filter

4.3.4.2 Steps for starting the pasteurizer

1. Switch on the air compressor and electrical control panel mains
2. Fill the hot water tank with water and switch on the hot water pump and inspect the tank after 2-3 minutes to check the level.
3. Open all the air vents in the pipes
4. let the milk flow towards the balance tank with float by starting milk pump
5. Close the air vents when the milk comes out from them.
6. Set the temperature controller at pasteurization temperature (minimum 71.7°C) and adjust the air reducing valve so that the supply gauge registers 1.76 kg/cm^2 pressure.
7. Turn on the steam to the hot water system via 'solenoid valve' for controlling steam passage into the heater.
8. Turn on the chilled water brine as soon as forward flow takes place.
9. Once the chilling temperature is reached, the plant will set itself to forward flow.

Note: The diluted milk that comes out first should not be collected in the balance tank.

4.3.4.3 Steps for shutting down the plant

1. The moment last drop of milk is about to leave from the balance tank, fill the balance tank with water almost equal to the capacity of pasteurizer. This will push the milk towards the outlet of the pasteurizer.
2. Shut the 3-way valve for the pasteurized milk outlet and put a hose pipe in the balance tank, so that surplus water diverted to the floor. It allows the flushing completely with the help of water.
3. Turn off the chilled water pump, milk pump, air and steam supply.

4.3.4.4 Maintenance of Milk Pasteurizers

The following guidelines should be followed for maintaining the pasteurizer:

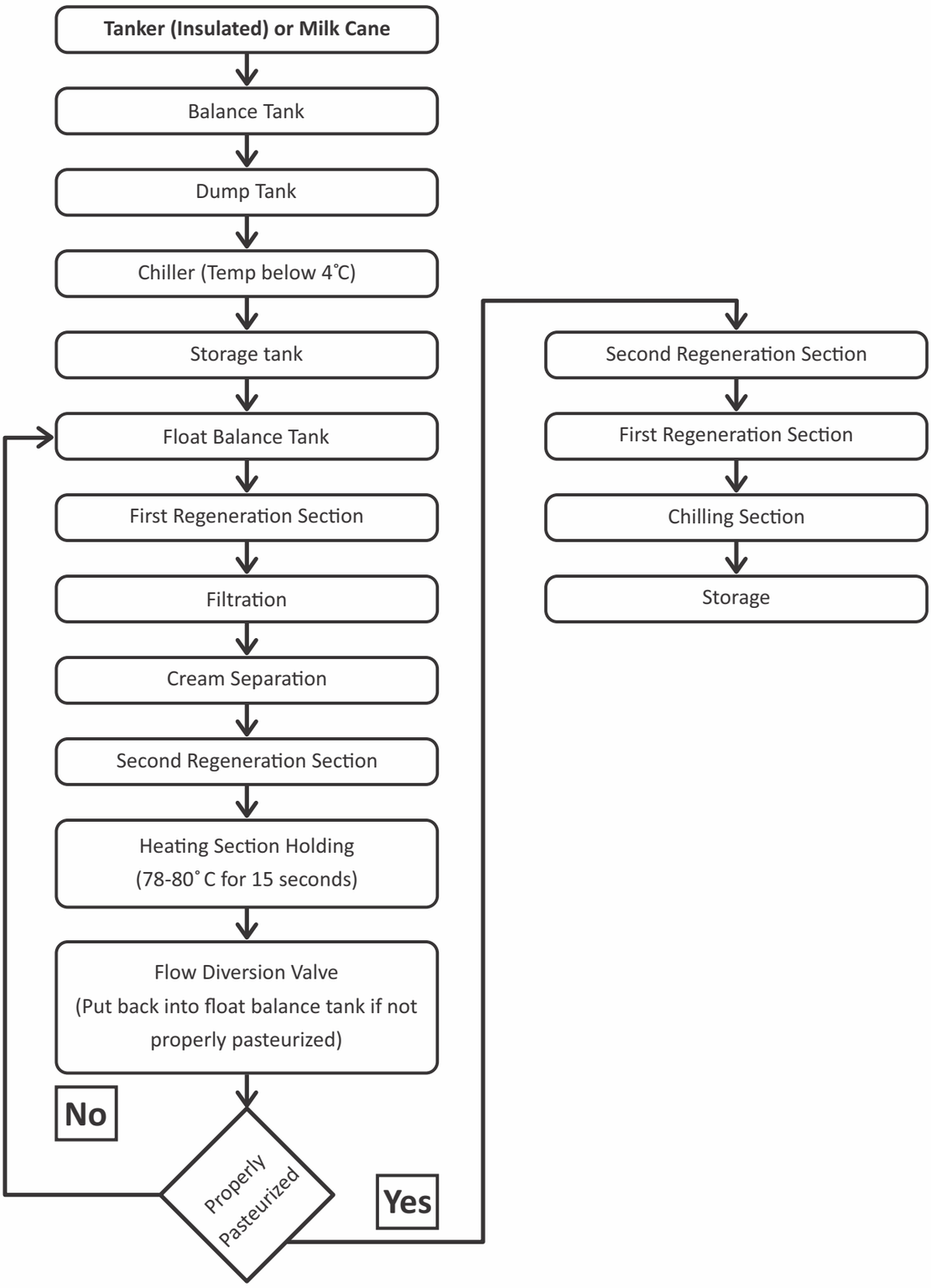
1. Pasteurizer should be inspected every day for any leakage and to ensure cleanliness.
2. The filter cloth or filter bag must be changed at regular intervals.
3. Periodical inspection of individual plate surface and gaskets must be done when the pasteurizer is dismantled for manual cleaning.
4. Any loose or broken gasket must be replaced using proper adhesive.
5. The surface of the plate bar and the tightening spindle must be coated with grease.
6. The equipment require air should be supplied with clean and dry air.
7. All recording instruments, thermometers, etc. must be checked for accuracy periodically.

4.3.5 Efficiency of Pasteurization

Alkaline phosphatase test is based on the detection of the activity of enzyme phosphatase, which is present in raw milk, but is completely inactivated at the temperature-time adopted for effictive pasteurization. Enzyme phosphatase is more resistant than most heat-tolerant vegetative pathogenic bacteria.

The alkaline phosphatase enzyme present in the raw milk release phenol with the help of disodium para-nitro phenyl phosphate and forms a yellow coloured complex at alkaline pH. The intensity of yellow colour is based on the enzyme activity and the same is measured by direct comparison with standard colour discs in a Lovibond comparator. This test is not appropriate for sour milk. For more detail refer IS:8479 (Part-1)-1977, method for determination of Phosphatase activity in milk and milk products

Notes



Flow Chart 7: Process flowchart for Pasteurization, Homogenization, and Separation of Milk

4.3.6 Standardization of Milk

Various types of milk is available in market with different per cent of fat and SNF content. The process through which fat and solids not fat (SNF) levels of milk is adjusted is known as standardization. This may be require for the manufacturing of certain milk products like paneer, cheese, ice cream etc. Standardization helps to provide uniform taste/texture throughout the product and also meet the legal requirements for any specific milk products.

The paneer may be prepared from buffalo milk or cow milk or the combination of both. The fat percentage of milk need to be standardized prior to the paneer production. The level of fat in buffalo milk should be 5.8% to 6.0% for paneer preparation, while in case of cow milk, the fat percentage in the cow milk should be 4.5% to 5.0% for paneer preparation. Adjusting fat content to a higher as well as a lower side may affect the fat loss and yield of paneer. It is advisable not to add water for the reduction of fat in final product.

Standardization shall be achieve by any of three methods discussed below:

4.3.6.1 Batch standardization

In this process, raw milk is store in a silo and its fat content is determined. Based on the final value of fat content, a portion of milk is subjected for separation into skim milk and cream. Some amount of cream is added back into the bulk milk under continuous agitation so that the final percent of milk will be higher compare to initial milk. The fat adjustments was done on the basis of calculation in a batch. The demerits of batch standardization are the time require for agitation, testing and final mixing.

4.3.6.2 Continuous standardization

An inline sampler along with a testing device is attached in a continuous standardization machine which helps to samples, measures and displays the fat content present at the outlet stream at every 20 seconds. Based on the desired level of fat content, the operator adjusts the values to combine skim milk or cream into the milk line, just before the sampling point.

4.3.6.3 Automatic standardization

In this system, separator is replaced by a microprocessor/controller unit which is actually linked to the sampler/tester system. This unit has a set value of desired fat content and flow rates of the whole and skim milk. Accordingly, It responds by opening or closing a valve, which regulates the amount of skim milk added to the whole milk. Standardization process is depends on correct sampling, accurate testing of fat content, efficient separation and the correct amount of skim milk or cream needed.

4.3.6.3.1 Tri-process Machine

Tri-process machine is similar to a cream separator but is intended to clarify, separate, standardize milk in a single unit. The needle valve in the bypass line of the tri-process machine is adjusted in such a way that the bypass cream when mixed with the skim milk would result in the desired fat % in the standardized milk.

4.3.6.4 Standardization of milk is done by the following method:

Certain mathematical calculations are used for the Standardization of milk. They are:

- Arithmetical calculations
- Pearson's Square Method

a) Arithmetic method of calculation

Example:

Example 1. To prepare 10,000 litre market milk with 4.5 % fat and to estimate required quantities of raw milk of 6.5 % fat and skim milk of 0.01 % fat.

Answer: - Assume the required quantities of raw milk be A and skim milk be B.

Fat Balance : 6.5 A + 0.01 B = 4.5 x 10,000

Mass Balance : A + B = 10,000

The following formula can be directly used to estimate required quantities of skim milk and raw milk :

Skim milk , kg = Standard milk in kg x (% fat in Raw milk - % fat in standard milk)/(% fat in Raw milk - % fat in skim milk)

Raw milk, Kg = Standard milk in kg x (% fat in standard milk - % fat in skim milk)/ (% fat in Raw milk - % fat in skim milk)

On solution : 6.5 % fat milk required A = 6147.9 kg

0.01 % skim milk required B = 352.1 kg

b) Milk Standardization Using Pearson's Square Method

Pearson's Square method is a simple mass balancing process for food standardization. A square is drawn with the final constituent content is assigned at the center (say for example, f_x).

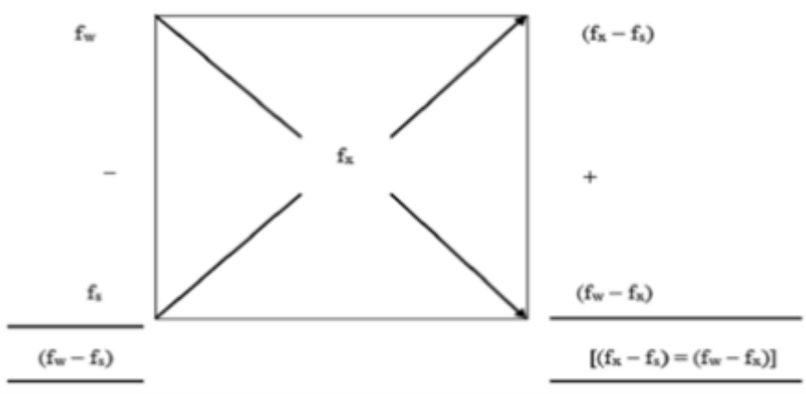


Fig. 28: Pearson's Square for Milk Standardization

Example 1

How much whole milk with 3.9% fat and skimmed milk with 0.04% fat content will require to produce 2000 kg of standardized milk with 2.5% fat?

Solution:

1. Using mass balance method:

Total Mass Balance:

Whole milk + Skim milk = 2000

Mass Balance for Fat:
0.039* Whole milk + 0.0004* Skim milk = 0.025*2000
Solving for Whole milk = 1274.6 kg and Skim milk = 725.4 kg

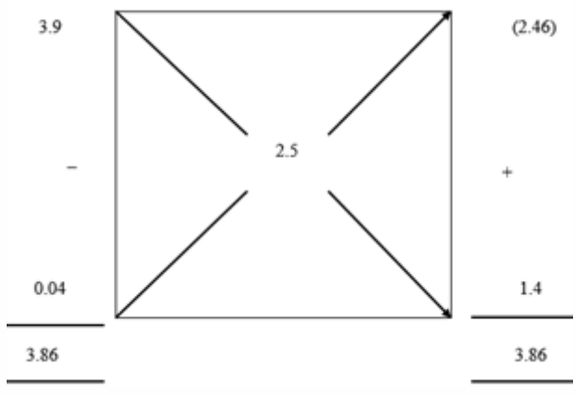
2. Using Pearson's Square method:

Proportion of the whole milk = 2.46/3.86

Amount of whole milk required =
(2.46/3.86)*2000 = 1274.6 kg

Proportion of skimmed milk = 1.4/3.86

Amount of skimmed milk required =
(1.4/3.86)*2000 = 725.4 kg (or 2000 – 1274.6)



Pearsons square for Standardising 2 fluid streams

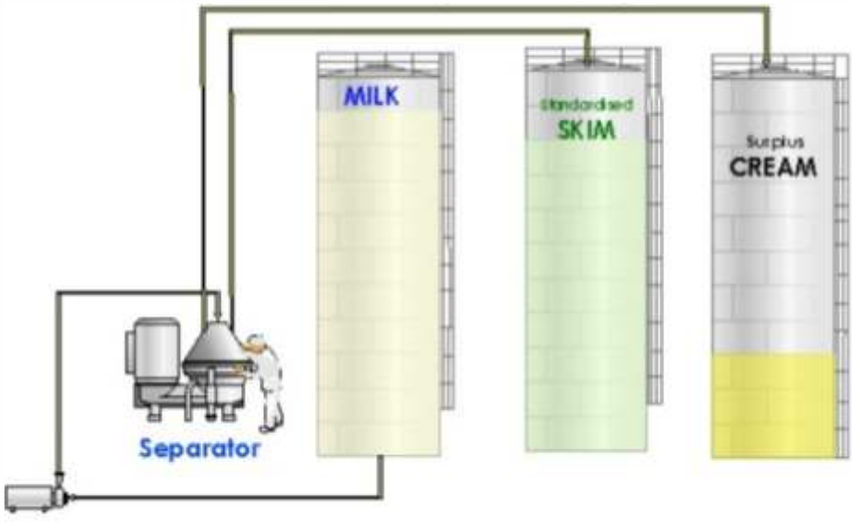


Fig. 29: Process for separating and storing cream and skim milk

The fat molecules present in the milk will rise to the surface of milk and form a thick layer of cream because of density difference. The fat globules were break down into a smaller sizes with the help of homogenizer so that of they will uniformly mixed in the milk. Homogenization generally take place after pasteurization of milk.

4.3.8 Homogenization of Milk

Homogenization implies mechanical treatment to break fat globules into smaller size of 2µm or less. The milk is forced through a narrow opening so that fat globules present in the milk shall split into smaller sizes and uniformly disperse them in milk.

4.3.8.1 Advantage of homogenization

- No cream-line formation after process
- Milk will be more whiter
- Chances of fat oxidation will be less
- Better mouth feel and flavour
- High stability or firmness of cultured milk products

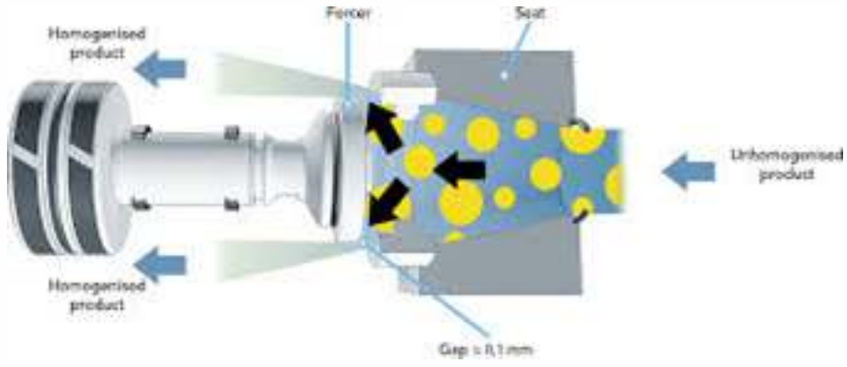


Fig. 30: Homogenization process

4.3.8.2 Disadvantage of homogenisation

- Fat may not be effectively separate from homogenised milk.
- The surface are of fat globules will be more after homogenization, which leads to high sensitivity to light may result into "Sunlight flavour"
- There will be a chance of fat clumping after single-stage homogenisation.
- The milk will not be suitable for production of semi-hard or hard cheeses.

Notes

Unit 4.4 Demonstrate the entire production of Paneer

Unit Objectives

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

- Know the process flow chart of paneer
- State the method of preparation

Unit 4.4.1 Procedure of Paneer Production

1. Take standardized milk (fat : SNF 1:1.65) in a clean and sterilised SS vat. The milk will be heated up to 82°C. Maintain the same temperature for 5 minutes and then cool the milk to 70°C.
2. 1% citric acid solution with respect to the milk is used as a coagulant. The temperature of coagulant is maintained at 70°C, which is same as the temperature of milk at the time of addition of coagulants.
3. The coagulant should be added in optimum quantity so that a clear whey separation shall be achieved. The green colour of the whey indicates proper coagulation. Stirring should not be intense otherwise this will lead to the break up the curd mass.
4. When the pH of whey reached in the range of 5.7 to 6.0, allow the curd mass to be settle for about 5 - 10 minutes. Allow the whey to be drained out through a muslin cloth and the coagulated curd remains in the vat/cloth. It is advised that the whey temperature should not fall below 63°C during the whole process.
5. The curd mass shall be filled in the SS hoops lined with muslin cloth and pressed for 15-20 min. Pressing can be achieved through a manual press or pneumatic press.
6. Immersed the pressed paneer blocks in chilled water (4- 6°C) or 5% brine solution (4- 6%) for 2 - 3 hours to achieve firmness. Further the paneer blocks were cuts and dried to remove extra free water.
7. At last the paneer slices were packed in a vacuum-package made of high density polyethylene (HDPE) and stored at 5°C - 8°C for further sales/distribution.

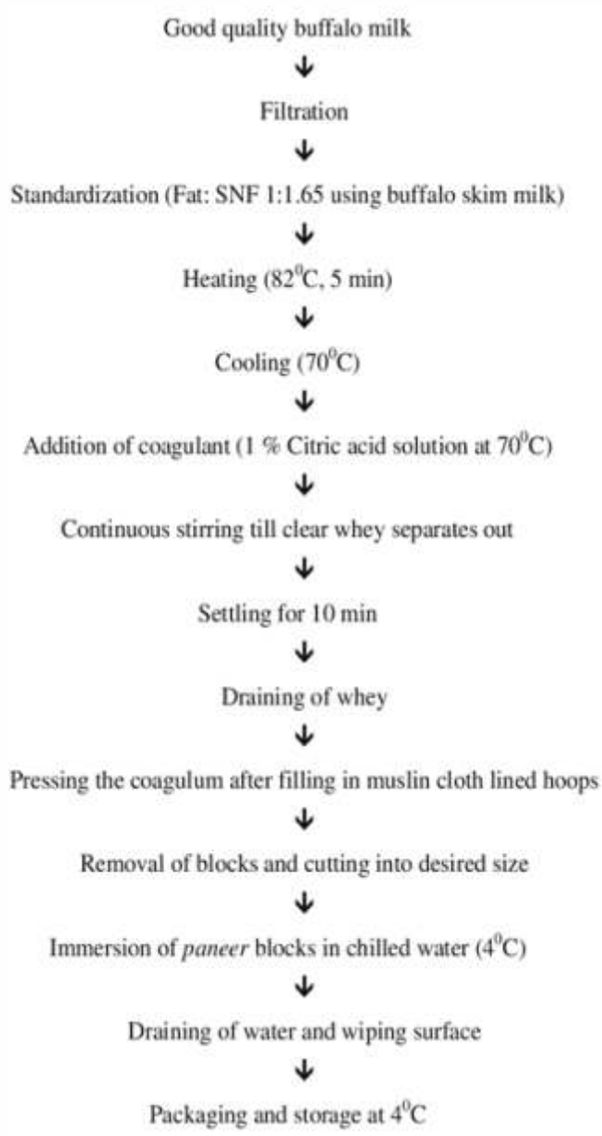


Table 18: process detail of paneer manufacturing (step wise)

Process Detail	Pictorial depiction
Testing of raw milk sample after the receiving. The following test were carried out in general 1. COB 2. Standard Plate Count (SPC) 3. FAT 4. SNF 5. Acidity 6. Added Water and Milk Freezing Point	
Plate chiller: When the milk leaves the udder, bacteria grow well at the ambient temperature and milk starts deteriorating. Hence freshly drawn raw milk must be quickly cooled to 5°C or below and held at that temperature till it is processed. Chilled water from Ice bank tank is used for this purpose. MOC (PHE): SS316	
Raw Milk Silo: Milk stored in raw milk silo after chilling the milk at 4°C. These are insulated storage tanks. A slow speed agitator is attached at the side of the silo to prevent cream from forming. MOC: SS316 (inner) SS 304 (outer)Bactofugation	
Bactofuge are special type of separator with high separation accuracy that can remove microorganisms from milk based on their density difference (skim milk – 1.036; bacteria – 1.07 – 1.13 g/cm^3). Used for heat resistant spores like (Bacilli/Clostridia), which does not inactivated by pasteurization.	

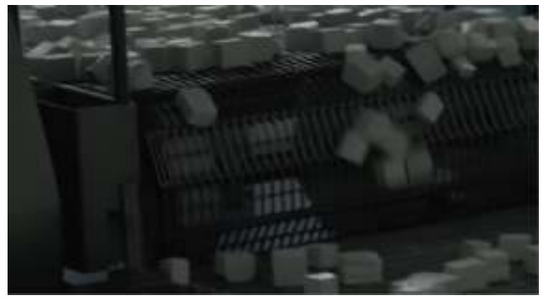
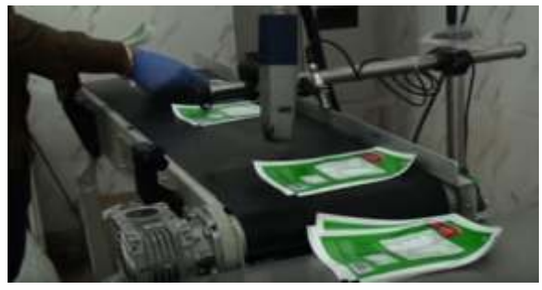
Cream Separator: the fat from the milk separates in form of cream. The working principle depends on the density difference. The effective separation take place at 40 to 45° C.	
Pasteurization: Milk will be subjected to the pasteurization in a continuous flow. The milk enters in the pasteurizer at 4 deg C and leaves at 4 deg C. Milk pasteurizer is available with 90 - 95 % regeneration efficiency.	
After pasteurization, milk stored in the pasteurized milk silo at 40C for further process. A side mounted agitator in the silo (at very low rpm) facilitates uniform temperature and product quality during storage. Pasteurized milk silo is a insulated tank	
Cleaning: prior to the start of process	

Sanitization: with the help of hot water or saturated steam	
Receiving milk in a multipurpose vat: Standardized milk	
Heating at **90°C** as per process requirement. The protein present in the milk denature at this temperature.	
Cooling at **70°C** as per process requirement for the addition of coagulant.	

Testing: Final testing of milk prior to the addition of Acid Coagulant	
Preparation of Acid Coagulation: Citric acid at 1-2 % concentration is the most widely used coagulant for paneer making. The optimum pH of coagulation suggested by researchers should be in the range of 5.3-5.35 for buffalo milk and 5.20-5.25 for cow milk paneer. With the decrease in pH, the moisture retention in paneer also decrease. This results in reduced yield and profit.	
Mixing of Acid Coagulation at **70°C**	
Formation of curd	

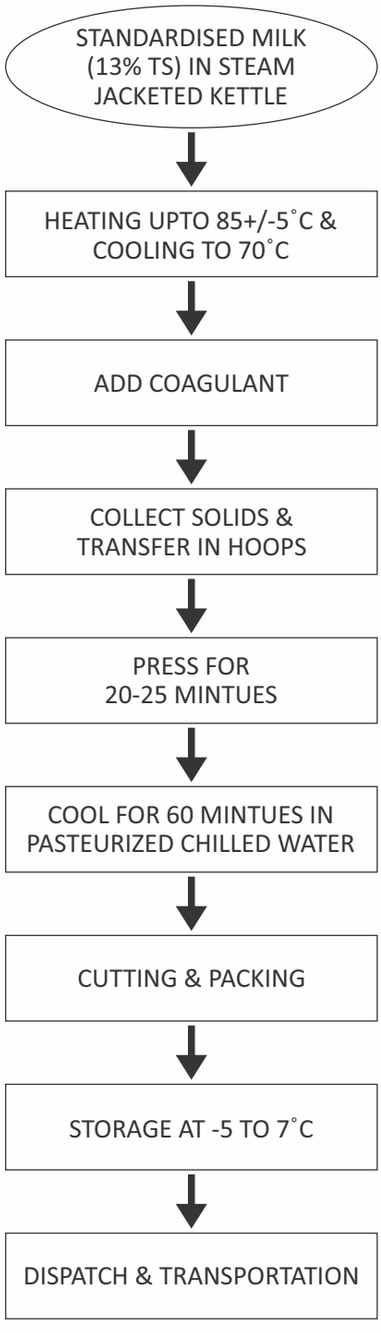
Sideline the curd for easy whey removal from the outlet	
Whey Removal: Whey may be stored for further use	
Straining with muslin cloth	
Hooping: The coagulated mass were collected from the vat and transferred manually to a hoop, lined with muslin cloth. MOC: SS304	

Pneumatic Press: The pressing of paneer mass placed in the hoops (MOC: SS) were subjected to pressing with the help of compressed air. The excess whey drained in this process and resulted compact block of paneer.	
Cooling: After pressing, the paneer blocks are immersed in the pasteurized chilled water maintained at 4-5°C for 2 hours. This process facilitates cooling of paneer blocks. It enhances the moisture content of paneer and improves the body and texture of final paneer blocks.	
Paneer Slicer: As per requirement	
Manual slicing: As per requirement	

Convening and draining of extra moisture Paneer having 51-54% moisture is expected to exhibit yield of 21-23% and 17-18% when made out of standardized buffalo and cow milk respectively.	
Printing of packaging details on the package like 1. MRP 2. Batch number 3. Manufacturing code 4. Date and time of packaging	
Packaging, weighing and vacuum sealing in 200 gms, 500gms	
Shelf life of paneer packaged in laminated pouches is 30 days under refrigeration **(6°C)**. Secondary Packaging for storage and transportation under refrigerated conditions.	

PROCESS FLOW CHART FOR PANEER MANUFACTURE (in term of utilities requirement)

Process Flow	Dairy Operations Requiring Utilities (stepwise)



Steam	**Water**	**Electrical**	Refrigeration
Heating & cleaning	Cleaning	Light	NA
Heating	NA	Light	NA
NA	NA	NA	NA
NA	Cleaning of hoops	NA	NA
NA	Cleaning	Manual pressing	NA
NA	Cleaning	NA	Chilled water
NA	Cleaning of floor	Vacuum packing m/c, air fan	NA
Cleaning	Cleaning of floor	Air blower, motors, light	Refrigerant supply to air blower unit
Cleaning of floor	Cleaning of floor	Light	NA

Unit 4.5 Packaging, storage of paneer and analyze the quality of finished product

Unit Objectives

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

- Enlist the method of packaging and storing paneer
- Understand the quality parameter for paneer

4.5.1 Packaging materials used for packing Paneer

Paneer requires protection from heat, light, O_2, microbial contamination, moisture loss, odour absorption, acid resistance, oil and grease resistance. Therefore the package should have barrier properties and possible for heat sealing.

1. Vegetable parchment: paneer can keep well 3-4 days at 21-27°C, 10 days at refrigerated storage.
2. Vegetable paper parchment treated with Na-propionate increases the keeping quality of paneer.
3. Wax/plastic coated paper: 55-60 gsm / 0.02 mm ---0.009-0.02 mm.
4. Poster paper/Al-foil/LDPE - 150 gauze.
5. MST Cellulose (300)/LDPE – 150 gauze.
6. Poster paper/Al-foil (0.02 mm)/LDPE.
7. Al-foil 0.009 mm, 4-5°C 100% RH Poster paper laminate (0.02 mm).
8. Al-foil 0.009 mm is found superior to MST-300/LDPE which has minimum keeping quality.

Vegetable parchment paper and PE bags are generally used. PE gives greater keeping quality (7 days at 5°C) than that given by vegetable parchment Paper. The Cryovac system using shrink film is being successfully used. Retortable tins are also used. Long life can be given by Metallized polyester or Nylon – PET / METPET/ PE or Aluminium foil or Nylon or LDPE/LLD. Paneer is packed in laminated tin container along with the brine. These tins are sterilized and it may be having a slight cooked flavour and maillard browning which will increase with storage period.

Notes

4.5.2 Vacuum packaging

Paneer is high in fat compare to milk and subjected to decrease in quality. The shelf life of paneer is normally 1 day in an ambient temperature but the same may be enhance significantly with the help of vacuum packaging. A laminated or co-extruded pouches along with vacuum also helps in enhancing the shelf life further. As reported in literature, the shelf life of paneer packed in a oxygen barrier film along with vacuum and heat treatment at 90 °C for one min may reaches up to 90 days under refrigeration.

4.5.2.1 Advantages

1. Extended Shelf Life - As reported in literature, the shelf-life of paneer packed in vacuum packaged may improve from 50%-400%. This type of packaging is available with the organized dairy sector throughout the world.
2. Minimized Product Loss – The moisture present in the paneer will retain with the vacuum type of packaging methods as the packaging films is not permeable for water. This will maintain the package weight throughout the storage period.
3. In case of vacuum packaging, no need of chemical preservatives for the extended shelf life.

4.5.3 Coding and Labelling of Packaging Material

As per food industrial norms, a food package must possess a label with the information as follows:

- Manufacturer's name and address
- Marketer's name and address
- Brand name of the Manufacturer (if any)
- Net quantity in weight or gram or any other unit as per market practice
- Time and date of manufacturing
- Nutritive or calorific values
- List of ingredients
- Information about the permitted color, stabilizer, emulsifier etc.
- Best before uses
- MRP for the processed food

4.5.4 Quality Analysis of Finished product

4.5.4.1 Preparation of Sample of Paneer (Ref:- IS 12758 - 1989 / I.S.O 1735-1987 Cheese and Processed Cheese products - Determination of fat content by gravimetric method - reference method. Bureau of Indian Standards, New Delhi).

Grate the paneer sample quickly through a suitable grater. Mix the grated sample thoroughly. Transfer the grated sample to an air-tight container to await analysis, which should be carried as soon as possible after grinding. Keep sample in an airtight container until the time of analysis. If delay is unavoidable, take all precautions to ensure proper preservation of the sample, and to prevent condensation of moisture on the inside surface of the container. The storage temperature should be below 10°C.

4.5.4.2 Determination of Moisture in Paneer (Ref: IS:2785:1979; Reaffirmed 1995).
The moisture content of paneer is the loss in mass, expressed as a percentage by mass when the product is heated in an air oven at 102 ± 2°C to constant mass

- **Apparatus require**

  A. Flat-bottom dishes with lid: Dishes of nickel, aluminium or of other suitable metal not affected by boiling water, 70 to 80 mm in diameter and not more than 25 mm deep, provided with short glass stirring rod having a widened flat end. The dishes shall have lids which fit well and can readily be removed.

  B. Hot air oven: Maintained at 102 ± 1°C.

  C. Desiccator: Containing an efficient desiccant.

  D. Sand: Which passes through 500 µ sieve and is retained by 180 µ sieve. It shall be prepared by digestion with concentrated HCl, followed by thorough washing with water. It shall then be dried and ignited till it is dull red.

- **Procedure**

  A. Heat the flat-bottomed metal dish containing 20 g of prepared sand and a stirring rod, in hot air oven for about 1 h. Allow to cool in an efficient desiccator for 30 to 40 min. Weigh accurately 3 g of the prepared sample of channa into a flat-bottomed dish (with a cover) previously dried and weighed containing about 20 g of prepared sand and a stirring rod.

  B. Saturate the sand by careful addition of a few drops of distilled water, and thoroughly mix the wet sand with the channa sample by stirring with the glass rod, smoothing out lumps and spreading the mixture over the bottom of the dish.

  C. Place the dish on a boiling water-bath for 20 to 30 min, then wipe the bottom of the dish. Transfer the dish containing the material, along with glass rod after uncovering in an oven maintained at 102.1°C for about 4 h.

  D. After 4 h replace the lid, transfer the covered dish to the desiccator, allow it to cool to room temperature and weigh it accurately and quickly to the nearest 0.1 mg.

  E. Heat the uncovered dish and lid in the oven at 102 ± 1°C for further 1 h, replace the lid, allow the covered dish to cool to room temperature in the desiccator and weigh it. Repeat the process of drying, cooling and weighing, until the successive weighing do not differ by more than 0.5 mg. Record the weight.

4.5.4.3 Calculation

Moisture % by mass = (M1 - M2) / (M1 - M) X 100

Where, M = mass in g, of the empty dish with containing glass rod; M_1 = Initial mass in g of the dish, lid, glass rod along with the material taken for analysis; M_2 = the final mass in g of the dish, lid, glass rod along with the material after drying.

Express the results to the nearest 0.01% (m/m). (Ref:-IS 2785 -1979 (Reaffirmed 1995). Specification for Natural cheese (Hard Variety), Processed Cheese, Processed Cheese Spread and Soft Cheese. Bureau of Indian Standards, New Delhi; IS 10484 -1983 (Reaffirmed 1999). Specification for Paneer. Bureau of Indian Standards, New Delhi).

4.5.4.3 Determination of Fat (by Acid Digestion Method) in Paneer (Ref:- IS 2785 -1979 (Reaffirmed 1995). Weigh accurately 1-2 g of prepared sample in a 100 ml beaker. Add 10 ml of conc. hydrochloric acid. Heat on a Bunsen burner, stirring continuously with a glass rod, or on a boiling water bath until all solid particles are dissolved. Cool to room temperature. Add 10 ml of ethyl alcohol first to the beaker and later transfer the contents to the Mojonnier fat extraction flask or the Rohrig tube Transfer to the Mojonnier fat extraction flask. Proceed as in determination of milk fat by acid digestion.

Notes

Unit 4.6 Post production cleaning and maintenance

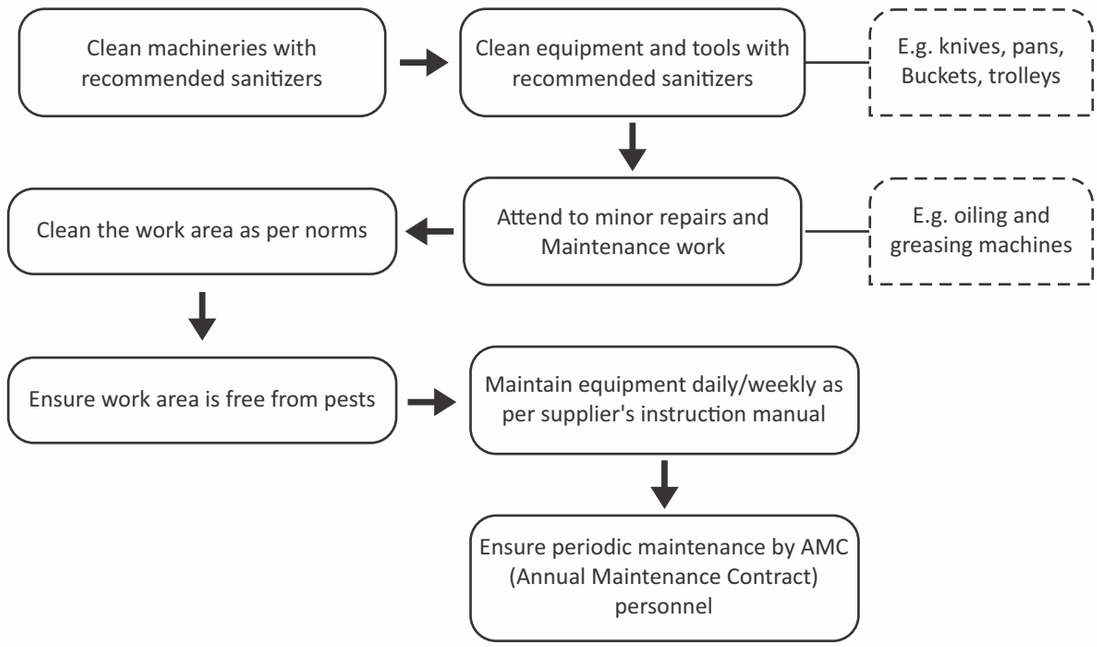
Unit Objectives

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

- Exhibit the post production cleaning methodology for work area and the machineries
- Demonstrate cleaning the machineries used with recommended cleaning agents and sanitizers

4.6.1 Post-Production Cleaning Method

This chart explains the method of cleaning the work area after production:



Flow chart :Cleaning procedure after production

Notes

Notes

Scan this QR Code or click on below to access the video of the following:

Scan this QR Code or click on below link to access the video of
Packaging and Storage of Food

Scan this QR Code or click on below link to access the video of
https://www.youtube.com/watch?v=HcI3v1d22CM

Scan this QR Code or click on below link to access the video of
https://www.youtube.com/watch?v=ra7rP1xvWH0&list=PL_mT5DU_smK29UU-KvwC9W5NvCDivatBA&index=15

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& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

5. Complete documentation and record keeping related to production of cottage cheese

FICSI
Food Industry Capacity and Skill Initiative

Unit 5.1 Documentation and Record-Keeping for Raw Material, and Finished Product

Unit 5.2 Process of Documenting Record for production plan, process parameters, and finished products

(FIC/N2019)

Key Learning Outcomes

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

1. Documentation and Record-Keeping for Raw Material, and Finished Product
2. Process of Documenting Record for production plan, process parameters, and finished products

Unit 5.1 Documentation and Record-Keeping for Raw Material, and Finished Product

Unit Objectives

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

1. Explain the process of documenting and recording for the raw material, processed products, packaging material etc
2. Exhibit the process of documenting records related to procurement of raw material, production plan, process parameters, and processed products

5.1.1 Need for Documentation

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

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

5.1.2 How to Keep Records

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

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

Product quality can be maintained only when:

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

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

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

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

Notes

Paneer Preparation (Record)

Date		Batch No.	

	Parameters	Batch 1	Batch 2	Batch 3
Milk	Fat %			
	SNF %			
	Ratio of SNF to Fat			
	TS%			
	Acidity % LA (= ºN x 0.9/100)			
	Coliform count per gram			
Processing	Qty of Milk (kg)			
	Heat Treatment ºC (85 ºC)			
	Time taken for heating in minutes			
	Coagulation Temp. ºC (78-79 ºC)			
	Time taken for cooling in minutes			
	Temp of Citric Acid solution ºC (80 ºC)			
	Concentration of Coagulants (2%)			
	Qty of citric acid used per litre of milk (1.65 g/L)			
	Quantity Coagulants (82.5 ml/L milk)			
	Dipping time			
	Hooping Temp ºC			
	Load in kg of Pressing			
	Time of Pressing in min.			
	Temp of Chilled Water ºC			
	Soaking Time in min.			
	Temp of Paneer after Soaking ºC (40 ºC)			
	Drying Temp.ºC			
	Drying Time			
	Temp. After Drying in ºC			
	pH of Whey			
Paneer	Moisture %			
	Acidity % LA			
	Fat %			
	Fat on Dry matter %			
	Qty in kg			
	Yield %			
	SPC per gram			
	Coilform per gram			
	Colour			
	Texture			
	Flavour & Taste			
	Friability			
	No of 200g pack made			
	Actual yield in kg			
	Handling losses in %			

(Paneer Maker) **(General Manager)**

Unit 5.2 Process of Documenting Record for production plan, process parameters, and finished products

Unit Objectives

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

- Understand the term document,record and audit
- Understand what is meant by self-evaluation and review
- State process of documentation and record keeping.

5.2.1. Self-evaluation and review

- The FBO must undertake a self-evaluation method for the process to verify the effectiveness of the implemented food safety system through internal and external audits at least twice in a year. Necessary corrective actions related to the self-evaluation results shall be taken. Records to be maintained.
- FBO shall also undertake a complete review of the systems including self- evaluation results, customer feedback, complaints, new technologies and regulatory updates at periodic intervals, but at least once in a year for continual improvement.

5.2.2. Documentation and records

5.2.2.1 Appropriate documentation & records of processing, production and distributions must be maintained in a legible manner, retained in good condition for a period of one year or the shelf life of the product, whichever is more.

5.2.2.2 The major records that must be documented as follows:

A. Legal

i. FSSAI License and Registration of Manufacturer/Supplier/Dealers/Retailers

ii. Pollution Control Board Certificate of plant/manufacturing unit

iii. Record of Discharge Effluent & its Compliance with statutory requirements - ETP Compliance

B. Procurement/Quality

1. Raw material receiving and traceability records (including records for milk being received from Milk Collection Centre, BMCs, Chilling Centre).
2. Receiving records for raw materials and additives (other than milk)
3. Quality Control / Lab test reports records/Compositional analysis/Microbial test records – raw milk, processed milk and milk products.
4. External testing reports - Microbiological / chemical test reports pertaining to milk and milk products, water, other food ingredients, additives etc
5. Certificates of Analysis/COA
6. Internal and external audit records/ Corrective action (CAPA).
7. Records for receipt of packaging materials and COA/Supplier certification.
8. Certificate for Virgin / food grade Packing material
9. Certificate of Ink approved for use for milk and milk products packet.
10. Testing record of Packaging materials.
11. Records of samples picked up FSSAI/State FDA authorities.

C. Production/Processing

1. Daily production records
2. Raw material consumption/utilisation records
3. Process monitoring records – CCP's/OPRP's
4. Temperature records of cold room (s)/ storage tanks/silos (when in operation), pasteurizer, chillers, driers etc.
5. Consolidated daily production records.
6. Packing/Packaging records
7. Dispatch records

D. Cleaning, Sanitation and Pest Control

1. Cleaning, plant hygiene and sanitation records.
2. Pest Control and routine treatment records.
3. CIP Record - Processing Level
4. Record of Equipment Swabs for Monitoring Effectiveness of Cleaning
5. Record - Periodic Review of Residual Chemical after Cleaning
6. Records of Cleaning and Disinfection for Cold Stores/ Freezers
7. Cleaning and sanitation records – milk tankers
8. Vehicle inspection record – milk tankers, trucks – raw milk handling and material dispatch

E. HR/Manpower related

1. Training record of Food handlers
2. Health record of the employees (involved in milk handling operations)
3. Record of system to prevent entry of Person from other Department suffering from diseases/Visitor entry records
4. Record of Hygiene monitoring of operators/ Workers
5. Training Records of Officer's (new Joinees/ on job training or Identified Training)

Notes

Notes

Notes

Scan this QR Code or click on below to access the video of the following:

Scan this QR Code or click on below link to access the video of
Documentation and record keeping

6. Food Safety, Hygiene and Sanitation for Cottage Cheese

(FIC/N9001)

Key Learning Outcomes

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

1. Importance of Food safety (Good Manufacturing Practices (GMP))
2. HACCP Principles
3. Safety Practices

Unit 6.1 Importance of Food safety (Good Manufacturing Practices)

Unit Objectives

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

1. Describe the significance of safety, hygiene, and sanitation in industry
2. Follow the set standards to maintain a safe and hygienic workplace

6.1.1 Good Manufacturing Practices (GMP)

GMP is a set of guidelines proposed by the Food Safety Standards Authority of India (FSSAI) to ensure the production of high quality and safe processed foods. It requires a qualitative approach towards manufacturing to reduce chances of microbial contamination, spoilage, and errors. (GMPs) ensure that raw materials, ingredients, finished products and packaging materials are handled safely and that food products are processed in a appropriate environment.

In general there are ten points needed to achieve GMP

1. Writing procedures
2. Following written procedures
3. Documentation for easy traceability
4. Designing facilities and equipments
5. Maintaining facilities and equipments
6. Validating work
7. Job competence
8. Cleanliness
9. Component control
10. Auditing for compliance

GMP'S is applicable in the following area/domain:

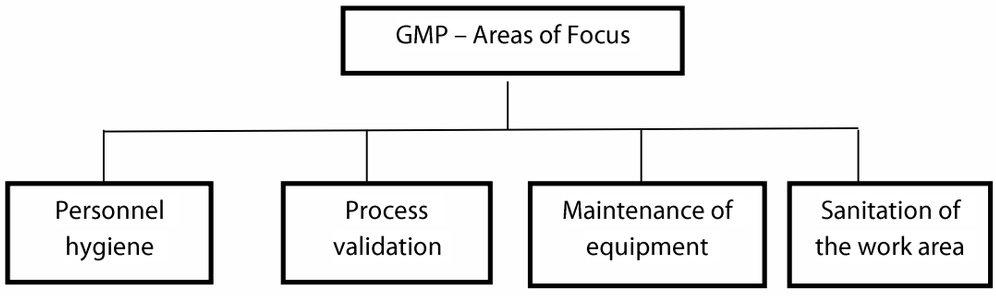
i. Personal practices in the work place

ii. Course of action for sanitary operation and production

iii. Building and services for the plant

iv. Warehouse or storage area

v. Equipment design and laws thereof



Area of focus	GMP
Personnel hygiene	• Follows strict hygiene and sanitation guidelines as per organization • Remember the training on Good Manufacturing Practices (GMP) • Ensure sound health condition during working hours • Must follow high standards of cleanliness • Ensure that the processing unit has enough facilities for toilets and wash stations
Sanitation of the work area	• The processing unit where you work is located in a clean, pollution-free area. • The entire processing unit is well ventilated and has adequate lighting. • The entire work area follows high standards of cleaning and sanitization. • There is a designated area for keeping utensils and equipment. It is kept clean and pest-free at all times.
Equipment maintenance	• The equipment used for processing foods is protected against contamination from lubricants, metal fragments, fuel, and contaminated water. • The cleaning and maintenance of tools, materials, and equipment is an easy process. • The organization follows a cleaning and sanitizing drill as per daily, weekly, and monthly schedules.
Process validation	• All processes of production like raw material procurement, execution, storage, packaging, and logistics follow strict organizational parameters. • Quality checks are conducted at each step of production. This helps to ensure that food quality is maintained as per prescribed norms and standards. • The stock rotation of finished product follows the FEFO and FIFO methods. This is to ensure that there is a minimum chance of food spoilage. It will also help to retain the taste of processed foods.

Unit 6.2 Risk Analysis Framework

Unit Objectives

At the end of the unit, participant will be able to:

- Explain Risk Analysis Framework
- State what is risk assessment
- State Various terms related to Risk Assessment
- Know the procedure of Risk Assessment
- Define Food Safety Management System
- State documentation

6.3.1 Risk Analysis Framework

It is an uncomplicated part having risk assessment as a scientific component. It utilizes output of the assessment to be put in place of actions to manage hazards. Risk communication is the discussion among interested parties related to the output of Food Safety.

6.3.1.1 Risk Assessment is a scientific based process consisting of the following steps:

- Hazard identification
- Hazard characterization
- Exposure assessment and
- Risk characterization

6.3.1.2 Risk Management is the process which is distinct from risk assessment, of weighing policy alternatives in consultation with all interested parties, considering risk assessment and other factors relevant for the health protection of consumers and for the promotion of fair trade practices, and, if needed, selecting appropriate prevention and control options. It is the involvement of top management and food safety team in finding the ways through consultation for reducing the Risk level, identified during risk assessment.

6.3.1.3 Risk Assessment Framework is a simple Module in which the scientific element is risk assessment. It uses the output from the assessment to put in place actions to control hazards. Risk communication is the dialogue between interested parties regarding the outputs of the Food Safety.

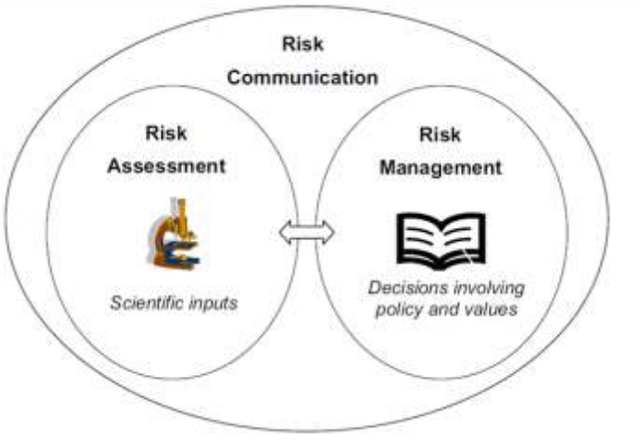


Fig. 31

6.3.1.4 Risk Assessment is the process of identifying a hazard and estimating the risk presented by that hazard. It may be quantitative or qualitative. Detailed quantitative risk analysis is not possible. Main advantage of Risk Analysis is that it takes account of various factors such as quality, acceptable risk, technical feasibility, cost along with developing more effective HACCP Plans. Risk assessment contributes to better understanding of whole food systems and changes. It is used to compare risk between foods or various hazards within the same food.

Fig. 32

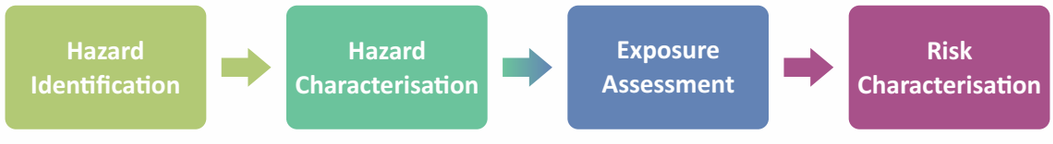
6.3.1.5 4 Steps of Risk Assessment

1. **Hazard Identification**
   - It is the identification of agents capable of causing adverse health effects
   - It Identifies micro- organism, toxin etc of concern and evaluates whether it is a hazard.

2. **Hazard Characterization**
   - It is the assessment of the nature of the adverse health effects associated with hazard.
   - It provides an estimate of the nature, severity and duration of effects. Adverse health effects depend on:
     - The agent
     - The individual/ consumer
     - The food
     - The consumption pattern
     - Dose response: Number or quantity of agent that causes adverse response
     - Range of symptoms
     - Micro- organisms (Infectious or toxicogenic)
     - Food Attributes (Food matrix or Fatty foods)

3. **Exposure Assessment**
   - It evaluates the levels of hazardous agent in food at the time of consumption.
   - This may be actual or anticipated human exposure due to consumption.
   - It is science based method directly affected by production, processing, handling, distribution, preparation, packaging, hygiene conditions, etc.

4. **Risk Characterization**
   - It is the assessment of the nature of the adverse health affects associated with a hazard which may be present in foods
   - It provide an estimate of the nature, severity and duration of the adverse effects
   - It helps to bring together data and analysis both. Example of Risk characterization is risk to public health from food borne Listeria monocytogenes among selected categories of ready to eat foods (US DHHS / USDA)



Unit 6.3 Hazard Analysis Critical Control Point (HACCP)

Unit Objectives

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

- Know the obligation of HACCP
- Follow HACCP principles in the workplace.

6.3.1 Necessity of HACCP

Food safety is very significant to us as this may leads to many hazards to human being. Several rules and regulation were formed and adopted by the food industry to protect people against foodborne diseases and food adulteration. Many more reasons are listed below:

- Food habits are also changing now's a day and high number of people are eating outside the home.
- Due to high number of vulnerable people (elderly, less-immune, undernourished) who are susceptible to various diseases.
- Foodborne diseases is becoming a threat to the modern world irrespective of the knowledge advancement in the field of food science and technologies.
- The threat of food contamination also increase because of mass production or the contamination of the environment.
- The advancement in scientific and analytical methods leads to the methods of detection of contaminants in food.
- Also, the awareness of food safety has significantly increased among the consumer.

In respect to the above reasons, the concern about food safety increases on large scale. In this situation HACCP system is consider to be a reliable, cost effective and highly recognized method for the food safety assurance method.

Notes

6.3.2 What is HACCP

HACCP is an international food safety regulation that is followed to reduce the risk of hazards in a food processing unit. It is a system that identifies possible hazards and controls them at various points of the production process. The HACCP is based on seven principles. They are:

Conduct hazard analysis

- Identify the production process and categorize the points where hazards (physical, chemical, and biological) maybe introduced

Identify critical control points

- Recognize the critical points in the process plan to prevent any type of hazard
- Plan preventive measures at that critical point to control the risk

Establish critical limits

- State the boundary line between safe and unsafe processes
- State the limit until which a critical point maybe controlled

Establish a monitoring system

- State the process of monitoring critical points and critical limits

Establish corrective measures

- Specify the corrective actions that should be followed when critical limits are crossed

State verification procedures

- State the verification process to check whether HACCP principles are applied and followed
- Test the HACCP plan and ensure compliance on a regular basis
- Check whether the HACCP plan helps to prevent hazards effectively

Follow record-keeping procedures

- Keep records of all the critical points
- Maintain a log of situations when critical limits were exceeded
- State the corrective measures that were applied
- Must have the records related to the of the maintenance of the equipment

Example for HACCP plan for procurement of raw materials

Operational Step	Hazard	Control Measure	Critical Limit	Monitoring Method	Corrective Action	Responsibility	Record
Procurement of raw material	Physical (dirt, stone particles)	Supplier adhere the specifications provided by quality assurance Team	As per company internal specificati -ons	Supplier guarantee certificate is visually confirmed	Reject materials if not accomp-anied by supplier Guarantee	Store manager	Supplier guarantee
	Chemical (toxins, pesticides from raw material)	Relative humidity of the store to be maintained					
	Microbiological (high microbiological load of raw materials, presence of pathogenic bacteria	FIFO system should be established		Monitor temperature and humidity of storage			Store temperature logs

6.3.3 Application of HACCP system for milk and milk products

6.3.3.1. HACCP Implementation steps

- **Assemble HACCP team**

  The food operation shall ensure that the appropriate product specific knowledge and expertise is available for the development and implementation of an effective HACCP plan. A multi disciplinary team shall be assembled either in-house or if such expertise is not available on-site , expert advice shall be obtained from other sources, such as trade and industry associations, independent experts, regulatory authorities, HACCP plan shall be identified and shall describe which segment of the food chain is involved and the general classes of hazards to be addressed (all or selected classes).

- **Describe product**

  A full description of the product shall be drawn up, including relevant safety information such as composition (including raw materials ingredients, allergens), origin, physical/chemical properties that impact food safety (including Aw, pH, etc.),microbial/static treatments (heat treatment, freezing, brining, smoking etc.), packing, labelling, durability and storage conditions and method of distribution. Within businesses with multiple product for example, catering operations with similar characteristics or processing steps may be grouped for the purpose of development of the HACCP plan.

➢ **Identify intended use**

The intended use of the product shall be defined based on the expected uses of the product by the end user or customer. The suitability of the product for vulnerable groups of the population such as pregnant women, infants, elderly should be considered, as necessary.

➢ **Construct flow diagram**

The flow diagram shall be prepared to cover all steps in the operation for each specific product or product category. When applying HACCP to a given operation, consideration shall be given to steps preceding and following the specified operation.

➢ **On-site confirmation of flow diagram**

Steps shall be taken to confirm the proceeding operation against the flow diagram during all stages and hours of operation and amend the flow diagram where appropriate. The confirmation of the flow diagram should be performed by a competent person or persons. On-site verification activities shall be carried out whenever there are any changes in the process.

➢ **List of all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control identified hazards (SEE PRINCIPLE 1)**

The HACCP team should list all potential hazards (physical, chemical, biological) that may be reasonably expected to occur at each step according to the scope. It should then conduct a hazard analysis to identify for the HACCP plan which hazards are of such a nature that their elimination or reduction to acceptable levels is essential to the production of safe food. In conducting the hazard analysis, the following should be included as appropriate:

- The likely occurrence of hazard and severity of their adverse health effects;
- The qualitative and/ or quantitative evaluation of the presence of hazards;
- Survival or multiplication of micro-organisms of concern;
- Production of persistence of foods of toxins, chemicals or physical agents; and
- Conditions leading to the above. For selection of control measures, consideration shall be given to what control measures, if any, can be applied to each hazard. More than one control measure may be required to control a specific hazard and more than one hazard may be controlled by a specified control, measure. Where elimination of hazard is not practical, justification for acceptable levels of the hazard in the finished product shall be determined and documented.

➢ **Determine Critical Control Points (SEE PRINCIPLE 2)**

For each hazard that requires control, control measures shall be identified. The control measures shall be reviewed to identify those that need to be addressed through the HACCP plan and for which CCPs shall be identified. There may be more than one CCP at which control is applied to address the same hazard or there may be cases where there is no CCP identified. The CCP in the HACCP system shall be determined and this may be facilitated by a logic reasoning approach such as the application of a decision tree (see dia 2). The application of a decision tree should be flexible. This example of a decision tree may not be applicable to all situations and alternative approaches may be used. If a hazard has been identified at a step where control is necessary for safety, and no control measure exists at that step, or any other, then the product or process should be modified at that step, or at any earlier or later stage, to include a control measure.

- **Establish Critical Limits for each CCP (SEEPRINCIPLE 3)**

  Critical Limits shall be specified and validated for each CCP. In some cases more than one critical limit may be elaborated at a particular step. These critical limits shall be measurable, Critical Limits based on subjective data (such as visual inspection of product, process, handling) shall be supported by instructions or specifications and / or education and training.

- **Establish a monitoring system for each CCP (SEE PRINCIPLE 4)**

  A monitoring system shall be established for each CCP to demonstrate that the CCP is under control. The monitoring shall be able to detect loss of control at the CCP and in time to make adjustments to regain control of the process and prevent violation of the critical limits. Where possible, process adjustments should be made when the results of monitoring indicate a trend towards loss of control at a CCP. The adjustment should be taken before a deviation occurs. Data derived from monitoring shall be evaluated by a designated person with knowledge and authority to carry out corrective actions when indicated. If monitoring is not continuous, then the amount or frequency of monitoring shall be sufficient to ensure that the CCP is under control. The monitoring system shall cover the following:

  a) Measurements or observations that provide results within an adequate time frame
  b) Monitoring device used
  c) Applicable calibration method
  d) Monitoring frequency
  e) Responsibility and authority related to monitoring and evaluation of monitoring results
  f) Records.

  All records and documents associated with monitoring CCPs shall be signed by the person(s) doing the monitoring and by the responsible reviewing official(s) of the company. The monitoring methods and frequency shall be capable of determining when the critical limits have been exceeded in time for the product to be isolated before it is used or consumed.

- **Establish corrective actions (SEE PRINCIPLE 5)**

  Specific planned corrective actions shall be developed for each CCP in the HACCP system in order to deal with deviations when they occur and to prevent their recurrence. This may require identification of the causes of deviation. The action shall ensure that the CCP has been brought under control. Actions taken shall also include proper disposition of the affected product. Deviation and product disposition procedures shall be documented. Records of deviations and disposition shall be maintained.

- **Establish Verification Procedures (SEE PRINCIPLE 6)**

  The verification procedures consist of two activities, verification activities and validation activities. The food business operator shall have in place a system to verify the HACCP plan at a set frequency. Procedures for verification shall be established. The frequency of verification should be sufficient to confirm that the HACCP system is working effectively. Verification should be carried out by someone other than the person who is responsible for performing the monitoring and corrective actions. Where certain verification activities cannot be performed inhouse, verification should be performed on behalf of the business by external experts or qualified third parties. The HACCP system, including the HACCP plan, shall be reviewed (atleast once in a year) and necessary changes made when any modification is made in the product, process, or any step. Verification activities shall include:

Self-evaluation;

- Review of the HACCP system and plan and its records
- Review of deviation and product dispositions
- Confirmation that CCPs are kept under control

The results of verification shall be maintained and communicated to the HACCP team/ relevant staff. The food business operator shall periodically validate the HACCP plan and necessarily before its implementation and after any changes are made. The objective of the validation process is to ensure that identified hazards are complete, correct and effectively controlled under the HACCP plan. Validation activities should include actions to confirm the efficacy of the HACCP system. Records of validation shall be maintained. An annual review of the complete HACCP system shall be carried out. Verification and validation activities are also important for maintenance of the system as well as continual improvements.

➢ **Establish Documentation and Record Keeping (SEE PRINCIPLE 7)**

HACCP procedures shall be documented. Documentation and record keeping shall be appropriate to the nature and size of the operation and sufficient to assist the business to verify that the HACCP controls are in place and being maintained.

➢ **Documentation shall include (as a minimum) the following:**

- HACCP team composition
- Product description
- Intended use
- Flow chart
- Hazard analysis
- CCP determination
- Critical limit determination
- Validation process
- HACCP plan

6.3.4 The HACCP plan shall include the following information for each identified CCP:

- Food safety hazard(s) to be controlled at the CCP
- Control measure(s)
- Critical limit(s)
- Monitoring procedure(s)
- Corrections and corrective action(s) to be taken if critical limits are exceeded
- Responsibilities and authorities for monitoring, corrective action and verification
- Record(s) of monitoring

6.3.5 Records to include

- CCP monitoring activities
- Deviations and associated corrective actions
- Disposition of non-conforming products
- Verification procedures performed
- Modifications to the HACCP plan
- Validation record
- Product release records
- Testing records

Notes

Unit 6.4 Safety Practices

Unit Objectives

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

- Follow the safety practices while working in any industry

6.4.1 Safety Signs

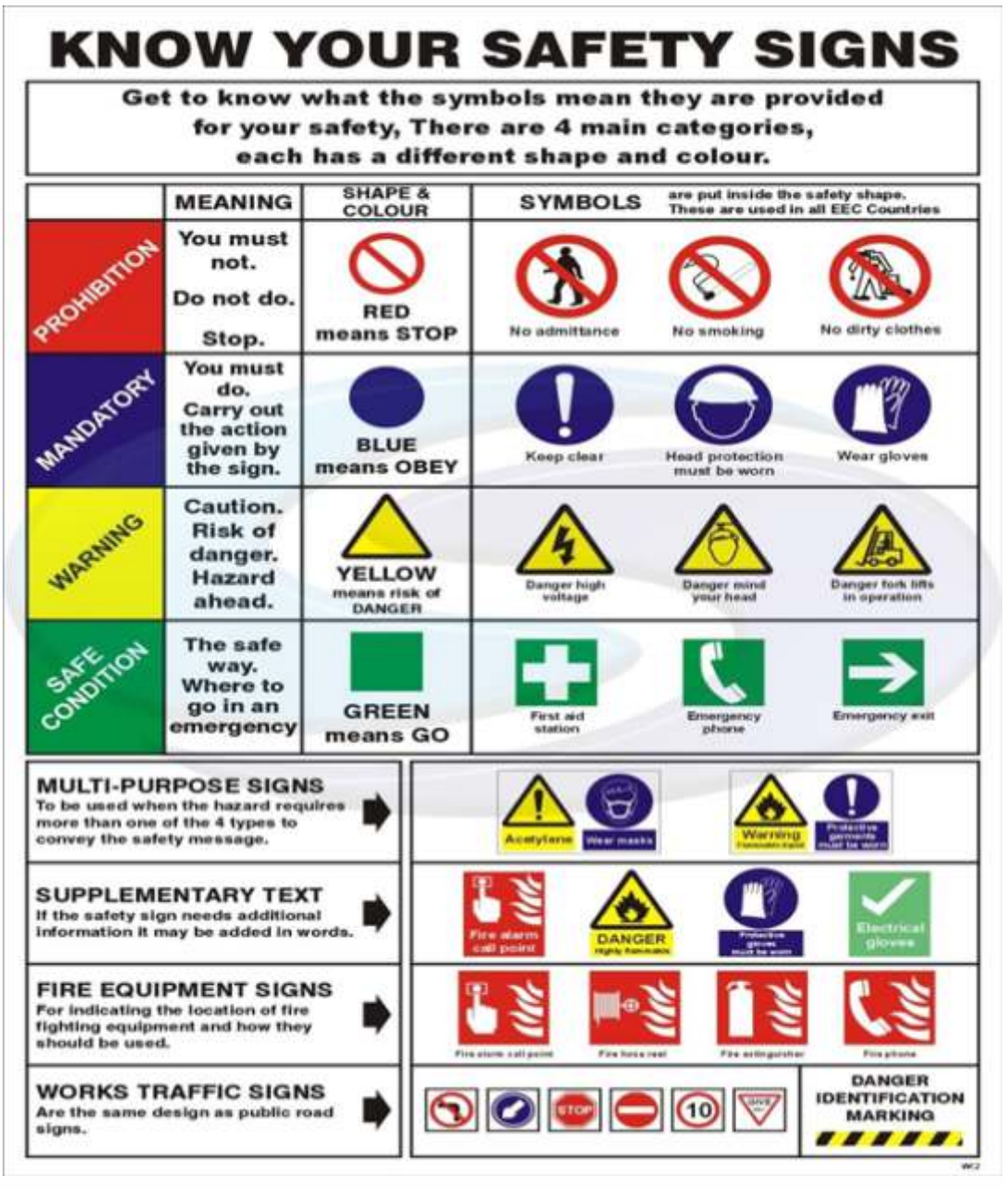


Fig. 33: Safety signs

6.4.1 Cause of fire

- **Sparks** (caused by short circuit)
- **Flames** (caused by open fires, torch, boilers, etc.)
- **Hot surfaces** (machinery, overheating, friction, etc.)
- **Radiant heat** (electric fire, open fire, etc.)

6.4.2 Fire Safety Practices

There are some symbols that you must know and understand to ensure safety in case of an emergency or fire. They are:

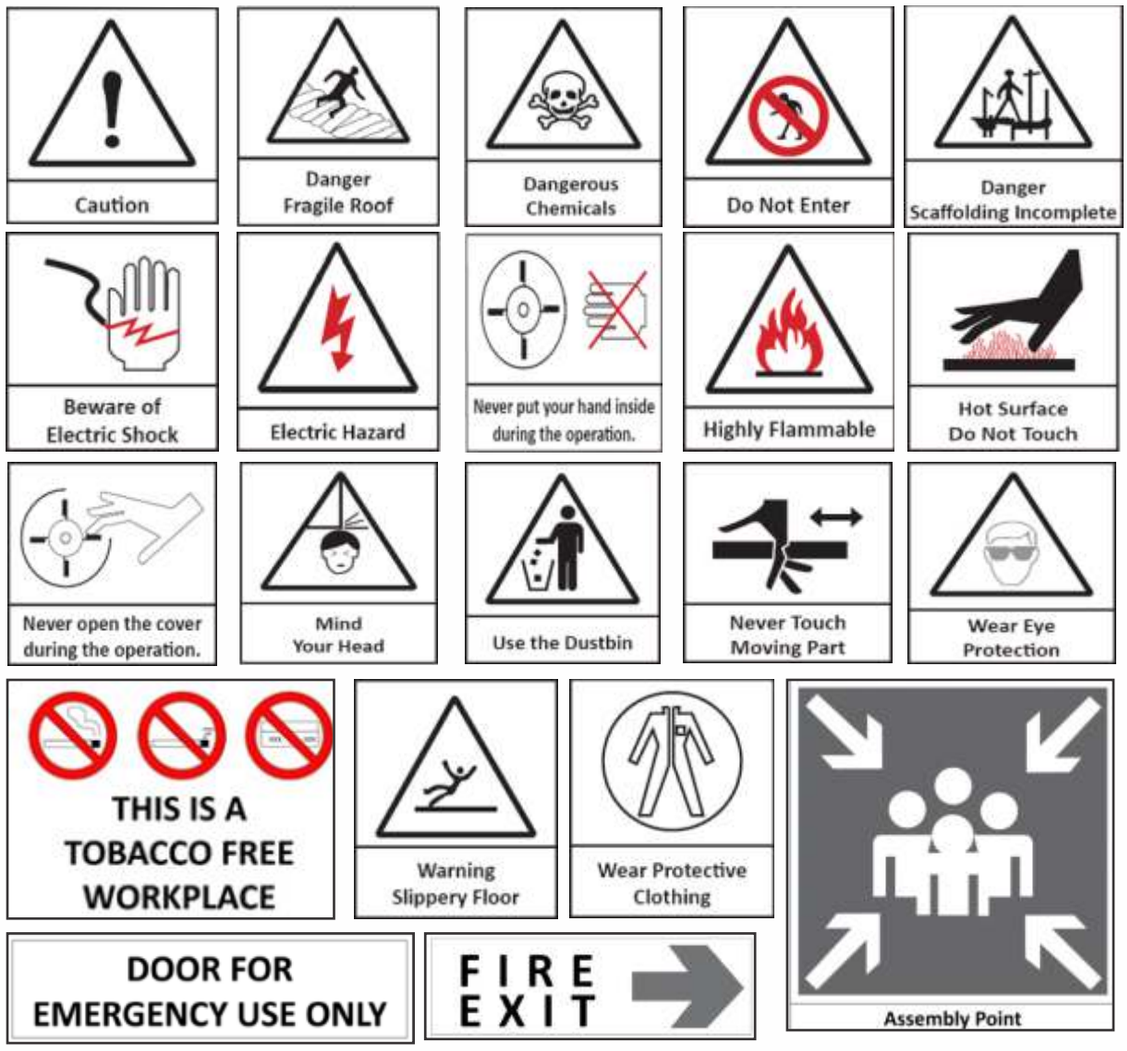


Fig. 34: Fire Safety Practices

6.4.3 Hazards Warning Signs

These warning signs should be displayed in the workplace.

Fig. 35: Hazards warning Signs

6.4.4 Emergency Measures

During an emergency, you must follow certain measures to tackle the situation in an organized manner. These measures are:

- Do not panic
- Report to your senior immediately or escalate the matter to the concerned person
- Prepare against the emergency situation by keeping a fire bucket and a water source handy Evacuate the work area safely

After the emergency, you must:

- Report the situation to a senior or the concerned authority
- Undertake recovery measures

6.4.5.Fire Safety Measures

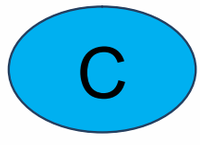
Just like emergency measures, some common fire safety measures must be followed in case of fire. They are:

- Press the closest fire alarm button (if available)
- Call the fire brigade
- Assemble at the assembly point or designated area for safety
- Evacuate the building from the closest fire exit

6.3.5.1 Fire extinguisher

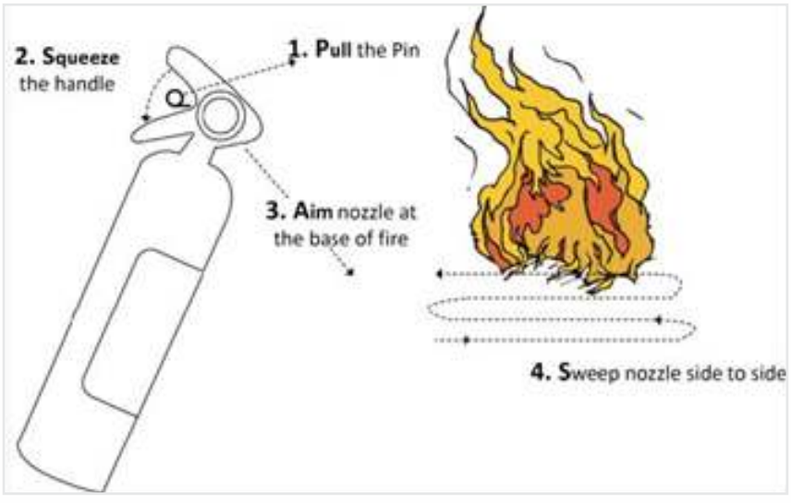
There are mainly four types of fire extinguishers used against the fire:

Type of Extinguisher	Colour of Flash
Water	Red
Foam	Cream
Carbon Dioxide	Black
Powder	Blue

TYPE	CLASS	SYMBOL
Class A fire caused by solid materials of an organic origin like wood, paper, cloth, rubber and plastics. These material will not melt with fire.		
Class B fire caused by flammable liquids like petrol, diesel, thinners, oils, paints, wax, cooking fat and plastics that can melt.		
Class C fire caused by electricity.		
Class D fires caused by flammable metals like sodium, magnesium, potassium, aluminum and titanium.		

Here is what they look like:

Steps to use fire extinguisher



Steps to Use the Fire Buckets

Use the fire bucket filled with sand/water → Dump the sand/ water on the fire → Refill the fire bucket

Fire bucket

Notes

Scan this QR Code or click on below to access the video of the following:

Scan this QR Code or click on below link to access the video of
HP, GMP & HACCP

Scan this QR Code or click on below link to access the video of
Personnel hygiene and employee facilities

7. Employability Skills

Scan the QR code below to access the eBook

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

DGT/VSQ/N0101

8. Annexures

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1.	Introduction to the Training Program and Overview of Food Processing Industry (FIC/N2017)	28	https://www.youtube.com/watch?v=J-2EiMVNtpM&t=11s	Overview of Food processing industry
		28	https://www.youtube.com/watch?v =4XuvGYvKGnE&list=PL_mT5DU_smK29UU-KvwC9W5NvCDivatBA&index=5	Overview of Dairy Industry
		28	https://www.youtube.com/watch?v=sbjL4ppSj9w&list=PL_mT5DU_smK29UU-KvwC9W5NvCDivatBA&index=11	Cottage Cheese Maker - Orientation
2.	Organizational standards and Norms (FIC/N2018)	52	https://www.youtube.com/watch?v=daNjRoP_I0c&t=87s	Personnel Hygiene and Employee Facilities
		52	https://www.youtube.com/watch?v=v1ME8wBSXyk&list=PL_mT5DU_smK29UU-KvwC9W5NvCDivatBA&index=14	Milk Nutritional Value

S. No.	Module No.	Page No	Link for QR Code (s)	QR code (s)
4.	Carry out production of cottage cheese (Paneer) (FIC/N2018)	106	https://www.youtube.com/watch?v=Ta18d6JIO3o	Packaging and storage of food
		106	https://www.youtube.com/watch?v=HcI3v1d22CM	Storage of finished products
		106	https://www.youtube.com/watch?v=ra7rP1xvWH0&list=PL_mT5DU_smK29UU-KvwC9W5NvCDivatBA&index=15	Packaging and storage of milk product
5.	Complete documentation and record keeping related to production of cottage cheese (FIC/N2019)	116	https://www.youtube.com/watch?v=HesWbNFSQS4	Documentation and record keeping
6.	Food Safety, Hygiene and Sanitation for Cottage Cheese (FIC/N9001)	136	https://www.youtube.com/watch?v=RS4A-uczS6E&t=554s	HP, GMP & HACCP
		136	https://www.youtube.com/watch?v=daNjRoP_I0c&t=87s	Personnel hygiene and employee facilities
	Employability Skills (30 Hrs)		https://www.skillindiadigital.gov.in/content/list	

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