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FICSI
Food Industry Capacity and Skill Initiative

Participant Handbook

Sector
Food Processing

Sub-Sector
Dairy Products

Occupation
Processing

Reference ID: **FIC/Q2004, Version 3.0**
NSQF level 4

Ice Cream Processing Technician

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

Shri Narendra Modi
Prime Minister of India

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COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

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FOOD INDUSTRY CAPACITY & SKILL INITIATIVE

for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **'Ice Cream Processing Technician'**

QP No. **'FIC/Q2004, NSQF Level 4'**

Date of Issuance: July 29th, 2021
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** Valid up to the next review date of the Qualification Pack*

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(Food Industry Capacity & Skill Initiative)

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

FICSI is thankful to all organisations and individuals who have helped us in preparation of this participant handbook.

We also wish to extend our gratitude to all those who reviewed the content and provided valuable inputs for improving the quality, coherence, and content presentation of chapters.

About this book

This book is designed for providing skill training and/or upgrading the knowledge and basic skills to take up the job of 'Ice Cream Processing Technician' 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 an Ice Cream Processing Technician.

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

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

- FIC/N2013: Prepare and maintain work area and machineries for production of ice cream
- FIC/N2014: Prepare for production of ice cream
- FIC/N2015: Produce ice cream
- FIC/N2016: Complete documentation and record keeping related to production of ice cream
- FIC/N9001 Ensure Food safety, hygiene and sanitation for processing food products
- DGT/VSQ/N0101: Employability Skills

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Unit 1.2 - Introduction to the Food Processing Industry

Unit 1.3 - Introduction to the Dairy Industry in India

Unit 1.4 - Attributes of an Ice Cream Processing Technician

FIC/N2013

Key Learning Outcomes

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

1. Explain the purpose of training
2. Discuss the National Occupational Standards and Qualification Pack
3. Define food processing
4. List the various sectors of the food processing industry
5. Describe the various stages of food processing for converting raw materials to food products
6. State the need for processing milk
7. List the various units within a dairy processing plant
8. State the roles and responsibilities of an ice cream processing technician

UNIT 1.1: Introduction to the Training Programme

Unit Objectives

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

1. Explain the purpose of training
2. Discuss the National Occupational Standards and Qualification Pack

1.1.1 Purpose and Benefits of the Training Programme

This training programme is developed to impart specific skills to individuals who wish to be an Ice Cream Processing Technician. The training programme is based upon the National Occupational Standards for the food processing sector. The National Occupational Standards have been described in the following subsection of this chapter.

The training programme will enable an individual to:

- prepare and maintain work area and process machineries for production of ice cream;
- prepare for production of ice cream;
- produce ice cream;
- complete documentation and record keeping related to production of ice cream;
- ensure food safety, hygiene and sanitation for processing food products.

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

Fig. 1.1.1. Skill cards

1.1.2 Introduction to QP and NOS

This training programme is intended for imparting basic skill and knowledge relevant to the job role, required to perform at a food processing industry. This programme is based on qualification pack called Ice Cream Processing Technician. The Qualification Pack Code for an Ice Cream Processing Technician is FIC/Q2004. This is also called a QP.

A QP consists of a set of National Occupational Standards (NOS). NOS specify the standard competency a worker must achieve when carrying out a function at the workplace.

Under Ice Cream Processing Technician QP, there are five NOSs which detail the functions to be performed at work site as an Ice Cream Processing Technician.

NOS Code	Major Function/Task
FIC/N2013	Prepare and maintain work area and process machineries for production of ice cream
FIC/N2014	Prepare for production of ice cream
FIC/N2015	Produce ice cream
FIC/N2016	Complete documentation and record keeping related to production of ice cream
FIC/N9001	Food safety, hygiene and sanitation for processing food products
DGT/VSQ/N0101	Employability Skills

UNIT 1.2: Introduction to the Food Processing Industry

Unit Objectives

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

1. Define food processing
2. List the various sectors of the food processing industry
3. Describe the various stages of food processing for converting raw materials to food products

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.

Food processing is the method used to convert raw materials into food products. They could be processed foods, ready-to-eat foods, food additives or foods used to prepare other food products. Besides food processing, the food industry also relies on food preservation as an important method to store food products for longer periods of time.

The food processing industry in India is divided into several sub-sectors. They are:

Fig. 1.2.1. Sub-sectors of food processing industry

The Indian food industry is a star sector in India with a bright prospect for growth and development. Indian food and grocery market is the sixth-largest in the world. Food industry, particularly the food processing sector in India, has shown immense potential due to its quick-paced growth. Food processing ranks fifth in the country in terms of its production, growth, export, and consumption. One of the recent trend that is seen in this sector is ordering food online. Even though this segment is still in its early stages of development, it is growing at an increasingly fast pace.

Food industry is implementing stringent food safety and quality measures in order to attract more investors and ensure the safety of its existing consumers. All these factors will have a positive impact on the way the sector functions and also on the job market in the country.

Women have always been associated with preparing food for the family or the household, but in modern times women are breaking this stereotype and turning entrepreneurs in this sector. Women are also becoming professional chefs and bakers, and contributing to the economy and towards the sector.

1.2.2 Journey of Food from Harvest to Consumer

The following chart shows the journey food material goes through to become a final, consumable product to various customers.

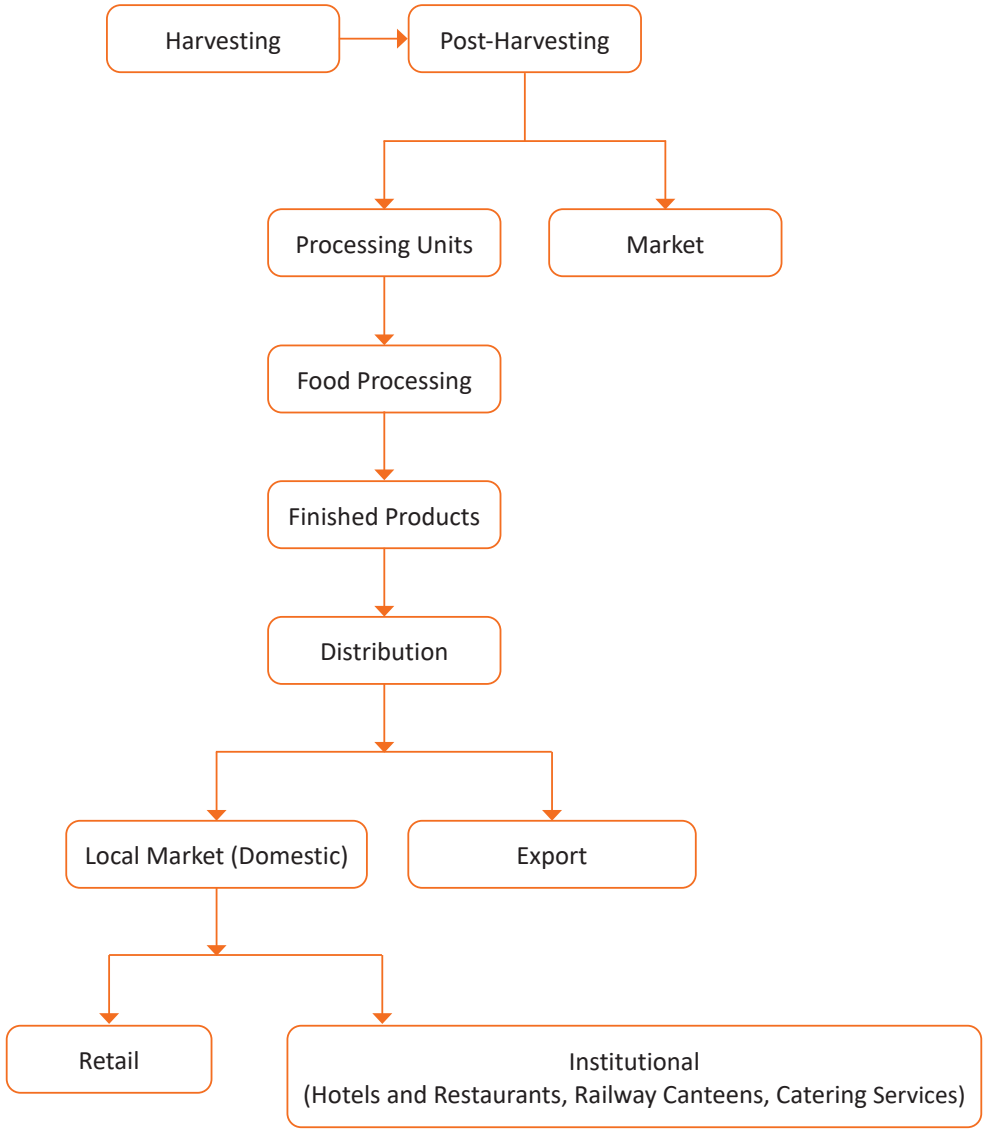

Fig. 1.2.2. Journey of harvested food

UNIT 1.3: Introduction to the Dairy Industry in India

Unit Objectives

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

1. State the need for processing milk
2. List the various units within a dairy processing plant

1.3.1 Need for Processing Milk

Milk is considered wholesome food mainly because of its high nutritive value. However, it loses its nutritive value very soon due to its perishable nature and therefore has to be processed. Besides that, milk also has to be processed because:

- It helps to prepare other dairy products like butter, cheese, paneer, etc.
- There is a huge demand for milk and milk products in the domestic as well as international market.

1.3.2 Dairy Industry in India

Dairy farming in India is moving from traditional family-run businesses to an organised dairy industry. With technological advances in the recent years, India has seen tremendous growth in dairy farming. Modern dairy farms manage a large herd of cattle and supply milk for processing to large dairy industries.

Some interesting facts about the consumption of milk and milk products are:

- More than 6 billion people worldwide consume milk and milk products; the majority of these people live in developing countries.
- Since the early 1960s, per capita milk consumption in developing countries has increased almost twofold. However, the consumption of milk has grown more slowly than that of other livestock products. Meat consumption has more than tripled and egg consumption has increased fivefold.
- In India, about 50 % of milk is consumed on-farm .

These facts indicate the need for processing milk.

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	HACCP/ISO
Process Section	Cheese Section
Butter Oil Section	Pizza Section
Powder Section	Pouch Section
Ice-Cream Section	RTF
APS Section	Frozen Foods Dispatch
Utilities	FPS - Dry Dispatch

Stores & Purchase	Pouch Dispatch
ETP Section	Administration and Accounts
Quality Assurance Section	Milk Marketing Section

Table 1.3.1: Units of a Dairy Processing Plant

Fig. 1.3.1. Outer view of a large-size dairy processing plant

Fig. 1.3.2. Milk reception section

Fig. 1.3.3. Butter and ghee packaging section

Fig. 1.3.4. Storage area for packed products

Fig. 1.3.5. Cheese section

UNIT 1.4: Attributes of an Ice Cream Processing Technician

Unit Objectives

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

1. State the roles and responsibilities of an ice cream processing technician

1.4.1 Roles and Responsibilities

The following table provides detailed information about the roles and responsibilities of an ice cream processing technician:

Roles	Responsibilities
Handle raw material from the time of receipt till it reaches the process line	• Check the raw material for quality • Ensure minimum loss of raw material
Record-keeping and documentation	• Document and maintain records of raw materials, production schedule, and process • Document and maintain records of finished products
Hygiene and sanitation maintenance	• Adopt safety and sanitation-related measures • Follow food safety norms and practices
Operate dairy equipment and machineries	• Optimise the use of machinery • Ensure smooth operation of machinery to complete production line
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
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 of the correct quantity • Ensure the products meet the quality standards set by the organisation
Follow storage and packaging norms	• Ensure safe and proper storage of raw material, packing material, and finished goods

Table 1.4.1: Roles and responsibilities

Exercise

1. Fill in the blanks with the correct option.

a. Ice cream _____ is responsible for handling raw material from to process line.

i. post production
ii. pre production
iii. receipt
iv. delivery

b. Food _____ is an important method to store food products for longer periods of time.

i. preparation
ii. preservation
iii. consumption
iv. allocation

c. Journey of food from harvest ultimately reaches the _____ .

i. consumers
ii. bankers
iii. builders
iv. packers

d. Ice cream processing technician is responsible for handling raw material from _____ to process line.

i. post production
ii. pre production
iii. receipt
iv. delivery

e. _____ is the backbone of the Indian economy.

i. Agriculture
ii. Fishing
iii. Mining
iv. Meat and Poultry

f. _____ sub-sector produces juices, jellies, pulps, pickles, jams etc.

i. Dairy
ii. Grains and cereals
iii. Fisheries
iv. Fruit and Vegetable processing

g. Workplace ethics are set of _____ that are followed to ensure smooth and effective functioning of a workplace.

i. guidelines
ii. rules
iii. principles
iv. standards

h. Ice cream processing technician must follow _____ at all times.

i. food spoilage norms
ii. food safety norms
iii. food breakage norms
iv. food control norms

i. _____ sub-sector produces whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese, etc.

i. Consumer foods
ii. Grains and cereals
iii. Fisheries
iv. Dairy

j. Ice cream technician does not compromise with the _____ of the product at any given cost.

i. quantity
ii. quality
iii. quantity and quality
iv. characteristics

Notes

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

https://www.youtube.com/watch?v=J-2EiMVNtpM&t=23s

Overview of Food Processing Industry

https://www.youtube.com/watch?v=4XuvGYvKGnE

Overview of Dairy Industry

https://www.youtube.com/watch?v=jTcvrizLEP4

Orientation video

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

Introduction to Ice-cream processing

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

Roles and Responsibilities

2. Food Safety, Hygiene and Sanitation for Processing Food Products

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Unit 2.1 - Sanitation and Hygiene

Unit 2.2 - Safety Practices

Unit 2.3 - Good Manufacturing Practices (GMP)

Unit 2.4 - Hazard Analysis and Critical Control Point (HACCP)

FIC/N9001

Key Learning Outcomes

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

1. State the personal hygiene and sanitation guidelines
2. State the food safety and hygiene standards to follow in a work environment
3. List the different sanitisers used in the process area and equipment
4. Follow health and safety practices in the work area
5. State the importance of safety, hygiene, and sanitation in the dairy processing industry
6. Follow the industry standards to maintain a safe and hygiene workplace
7. Follow HACCP principles to eliminate food safety hazards in the process and products

UNIT 2.1: Sanitation and Hygiene

Unit Objectives

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

1. State the personal hygiene and sanitation guidelines;
2. State the food safety hygiene standards to follow in a work environment.

2.1.1 Personal Sanitation

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

Maintain a high standard of personal cleanliness viz. have a bath every day and wear clean clothes to work.

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.

Always keep your finger nails trimmed.

Always keep your hair trimmed and wear a hair net while working.

Fig. 2.1.1. Personal sanitation

Fig. 2.1.2. Washing hands with soap and water

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.

Refrain from smoking, spitting, chewing paan, sneezing or coughing over any food when in the production area.

Do not handle food when suffering from a disease, illness, burns, injury or infection.

Fig. 2.1.3. Do not smoke, spit, cough

Fig. 2.1.4. Timely medical treatment

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.

2.1.2 Personal Hygiene

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

2.1.3 Importance of Personal Hygiene

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

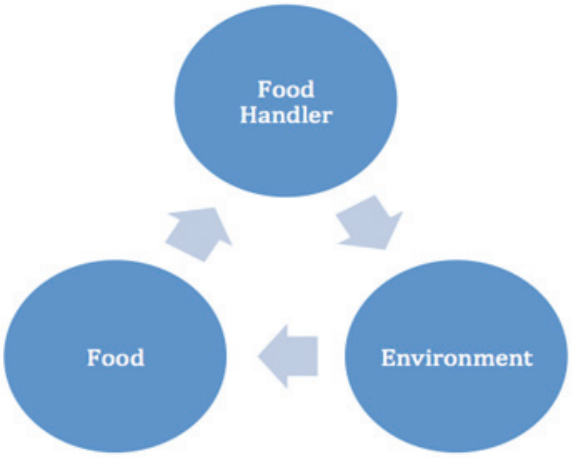


Fig. 2.1.5: Importance of Personal Hygiene

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

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

Fig. 2.1.6: Personal hygiene

2.1.4 Hand Washing

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

Fig. 2.1.7: Methods of washing hand

How to Use Sanitizer?

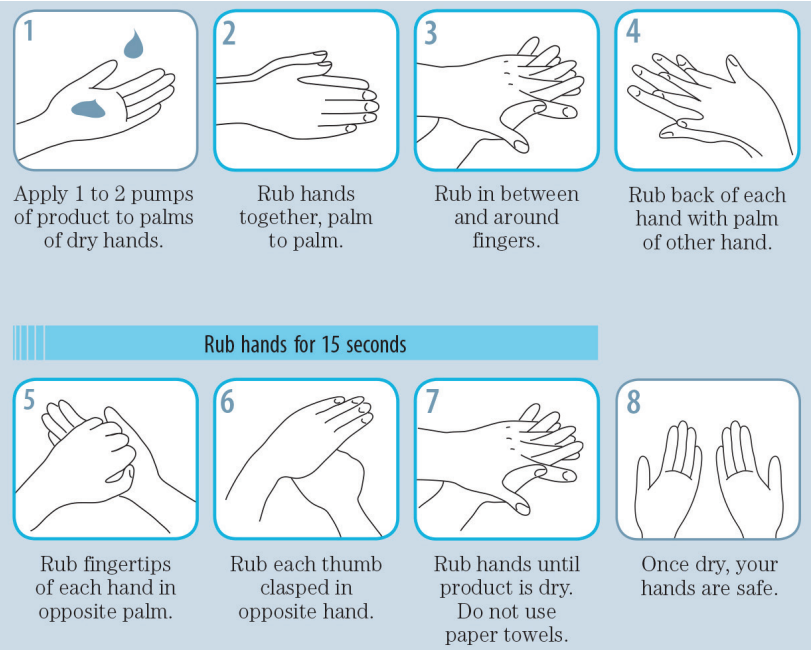


Fig. 2.1.8: Usage of Sanitizer

When to Wash and Sanitize Hand?

Fig. 2.1.9: Times to wash and sanitize hand

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

2.1.5 Good personal hygiene can prevent food poisoning

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

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

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

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

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

UNIT 2.2: Safety Practices

Unit Objectives

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

1. Follow the fire safety practices in the work area.

2.2.1 Symbols

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

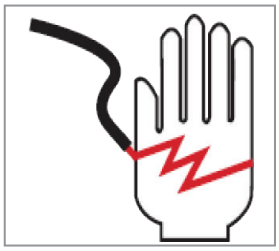
Caution

Danger Fragile Roof

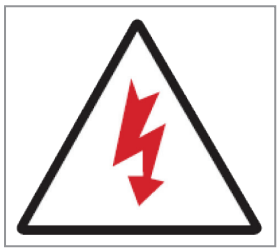
Dangerous Chemicals

Do Not Enter

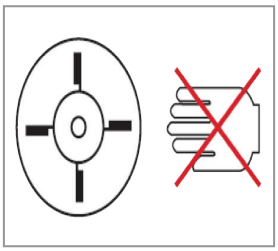
Danger Scaffolding Incomplete



Beware of Electric Shock



Electric Hazard

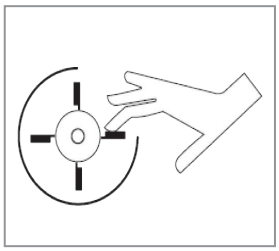


Never put your Hand Inside During the Operation

Highly Flammable

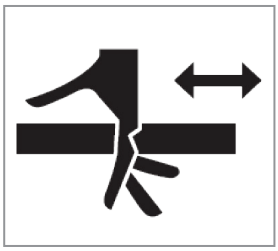
Hot Surface Do Not Touch

Mind Your Head

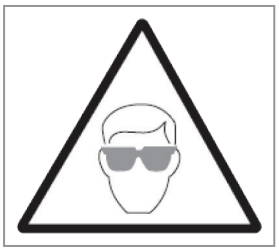


Never Open the Cover During the Operation

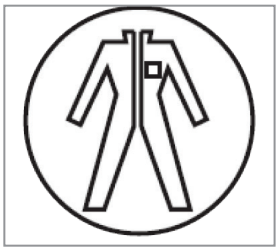
Use the Dustbin



Never Touch Moving Part



Wear Eye Protection



Wear Protective Clothing

Warning Slippery Floor

This is a Tobbacco Free Workplace

Assembly Point

Fire Exit

Fig. 2.2.1. Safety symbols

2.2.2 Emergency Measures

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

- Do not panic
- Respond to your senior immediately or inform 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

After the emergency, you must:

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

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

Types of Fire and Fire Extinguishers

Choosing the right extinguisher can prevent property damage and save lives				
Types of Fire Extinguishers → / Types of Fire ↓	Water	Foam	CO_2	Dry Chemical
Class A: Paper, Wood, Plastic Fabric, Rubber, Trash	✓	✓	✗	✓
Class B: Oil, Petrol, Some Paints and Solvents	✗	✓	✓	✓
Class C: Electrical Equipment, Appliances, Computers	✗	✗	✓	✓

Fig. 2.2.2. Types of fire and fire extinguishers

How to use the Fire Extinguisher?

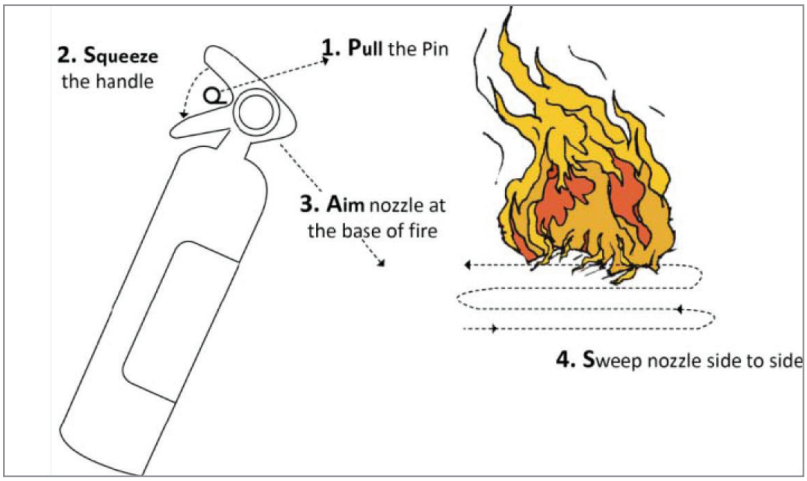


Fig. 2.2.3. Fire extinguisher

How to use the Fire Buckets?

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

Fig. 2.2.4. Fire bucket

UNIT 2.3: Good Manufacturing Practices (GMP)

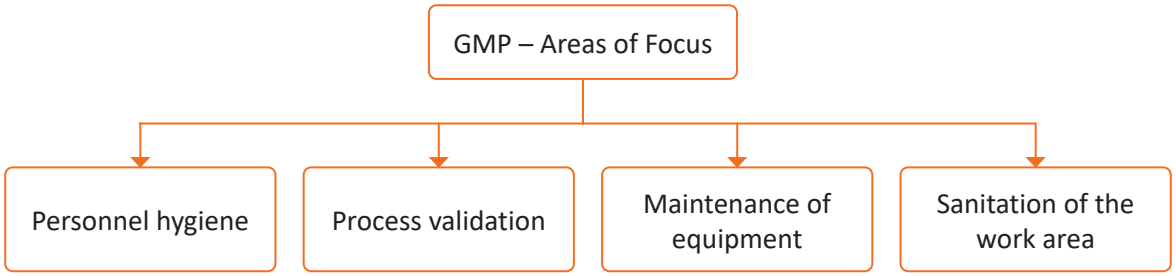
Unit Objectives

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

1. State the importance of safety, hygiene, and sanitation in the food processing industry;
2. Follow the industry standards to maintain a safe and hygienic workplace.

2.3.1 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.



Area of focus	GMP
Personnel hygiene  *Fig. 2.3.1. Personnel hygiene*  *Fig. 2.3.2. Facilities for toilets*	• Your organisation follows strict hygiene and sanitation guidelines • You are provided training on Good Manufacturing Practices (GMP) • You are in a sound health condition during working hours • You follow high standards of cleanliness • Your processing unit has enough facilities for toilets and wash stations
Sanitation of the work area  *Fig. 2.3.3. Designated area for keeping utensils*  *Fig. 2.3.4. 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 sanitisation • There is a designated area for keeping utensils and equipment. It is kept clean and pest-free at all times

Equipment maintenance

Fig. 2.3.5. Equipment maintenance

Fig. 2.3.6. Monthly schedule

- 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 organisation follows a cleaning and sanitising drill as per daily, weekly, and monthly schedules

Process validation

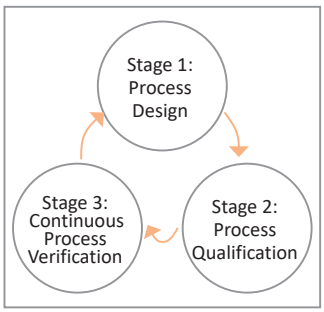


Fig. 2.3.7. Process validation

Fig. 2.3.8. Quality checks

- All processes of production, like raw material procurement, execution, storage, packaging, and logistics follow strict organisational 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 2.4: Hazard Analysis and Critical Control Point (HACCP)

Unit Objectives

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

1. Follow HACCP principles to eliminate food safety hazards in the process and products.

2.4.1 What is HACCP?

Hazard Analysis and Critical Control Point (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 a hazard analysis

- Evaluate the production process and identify the points where hazards (physical, chemical, and biological) may be introduced

Identify critical control points

- Identify the critical points in the process plan where a hazard may occur
- 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
- Include records of the development and maintenance of the system

Example of HACCP Plan

Operational step	Hazard	Control measure	Critical limit	Monitoring method	Corrective action	Responsibility	Record
Procurement of raw material	Physical (dirt, stone particles)	Supplier guarantee specifications established by quality assurance department	As per company internal specifications	Supplier guarantee certificate is visually confirmed	Reject materials if not accompanied 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

Table 2.4.1: Example of HACCP Plan

UNIT 2.5: Introduction to Food Safety

Unit Objectives

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

1. Identify types of hazards and risks at work place

2.5.1 Food Safety

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

2.5.2 Food Safety Hazard and Risk

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

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

Types of hazards and risks at work place

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

Food Safety Hazard

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

Microbiological hazards

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

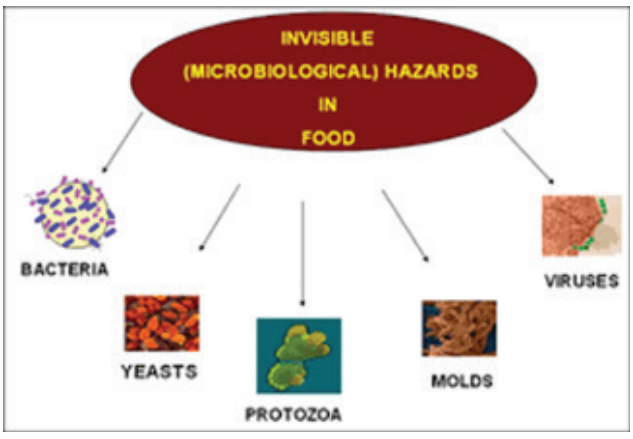


Fig. 2.5.1: Microbiological Hazards

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

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

Fig. 2.5.2: Food Spoilage

Physical Hazards

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

Fig. 2.5.3: Physical Hazards

Chemical Hazards

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

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

Allergen

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

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

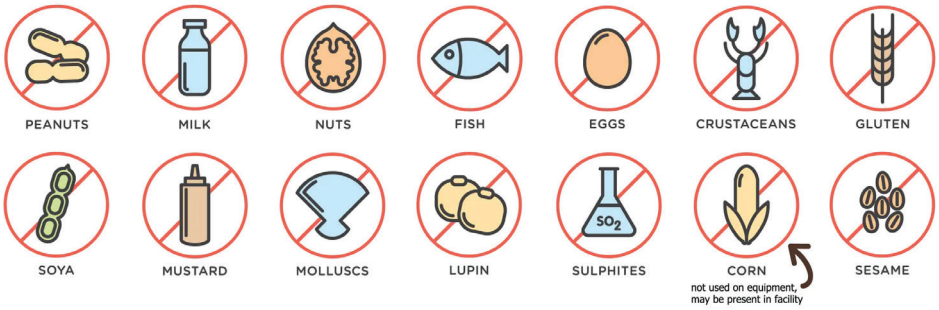


Fig. 2.5.4: Allergens

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

What Are the Most Common Food Allergens?

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

What Are the Signs & Symptoms of a Food Allergy?

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

Handling of Allergenic Foods:

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

2.5.3 Contamination, Cross Contamination and Prevention

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

The most common types of contaminant include:

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

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

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

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

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

Prevention of Contamination:

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

Exercise

1. Identify the correct focus area of GMP from the list given below. Mark the correct option.

GMP	Area of Focus	
a. All processes of production like raw material procurement, execution, storage, packaging, and logistics follow strict organisational parameters.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
b. The equipment used for processing foods is protected against contamination from lubricants, metal fragments, fuel, and contaminated water.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
c. Your processing unit has enough facilities for toilets and wash stations.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
d. The entire work area follows high standards of cleaning and sanitisation.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
e. The entire processing unit is well ventilated and has adequate lighting.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
f. The organisation follows a cleaning and sanitising drill as per daily, weekly, and monthly schedules.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
g. You are provided training on Good Manufacturing Practices (GMP).	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐
h. You are in sound health condition during working hours.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation	☐ ☐ ☐ ☐

2. Match the column.

Hazard Analysis	HACCP Principle
a. Plan preventive measures at that critical point to control the risk	i. Follow record-keeping procedures
b. State the boundary line between safe and unsafe processes	ii. State verification procedures
c. Specify the corrective actions that should be followed when critical limits are crossed	iii. Establish critical limits
d. Test the HACCP plan and ensure compliance on a regular basis	iv. Establish a monitoring system
e. Maintain a log of situations when critical limits were exceeded	v. Conduct a hazard analysis
f. Evaluate the production process and identify the points where hazards may be introduced	vi. Identify critical control points
g. State the process of monitoring critical points and critical limits	vii. Establish corrective measures

Notes

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

https://www.youtube.com/watch?v=RS4A-uczS6E&t=489s

GMP,GHP & FSMS

https://www.youtube.com/watch?v=CD0XLUutibk&t=40s

Cleaning facilities

https://www.youtube.com/watch?v=iq8jOuZ5k6k&t=22s

Pest Control Program

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RE IMAGINE FUTURE

3. Prepare and Maintain Work Area and Process Machineries for Production of Ice Cream

FICSI
Food Industry Capacity and Skill Initiative

FIC/N2013

Key Learning Outcomes

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

1. List the machineries used in a dairy processing plant
2. Explain the functions to be carried out before starting production
3. Explain the maintenance procedure to be followed for dairy processing machineries before starting production
4. Explain the lubrication system followed in the dairy industry
5. State the different types of maintenance procedures
6. State the materials and equipment used in the cleaning and maintenance of the work area
7. State the common detergents and sanitisers used in cleaning work area and machineries
8. State the properties of cleaning agents used
9. State the methods of cleaning and sanitisation
10. Describe the CIP method of cleaning
11. Describe the SIP method of cleaning
12. Explain the method of managing and disposing waste material

UNIT 3.1: Usage and Maintenance of Equipment in Dairy Processing Plant

Unit Objectives

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

1. List the machineries used in a dairy processing plant
2. Explain the functions to be carried out before starting production
3. Explain the maintenance procedure to be followed for dairy processing machineries before starting production
4. Explain the lubrication system followed in the dairy industry
5. State the different types of maintenance procedures

3.1.1 Equipment Used in Dairy Processing

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

1. Raw Milk Reception Dock

Milk is delivered to the dairy plant either in cans or in tankers (road/rail). The place in the dairy plant where milk first arrives and is received after grading for acceptance is known as milk reception dock or platform or Raw Milk Receiving Dock (RMRD).

Since further processing of milk mainly depends upon its quality, the decision of whether to accept or reject the milk must be done immediately after arrival and after thorough investigation.

Reception includes unloading, grading, conveying, sampling, testing, weighing or measuring, recording, dumping, and pumping.

2. Storage Tanks

Storage tanks are containers that hold hot or cold liquids used for short or long-term storage. In the dairy industry, storage tanks are classified based on structure and heat preservation capacity. Storage tanks are available in many shapes viz:

- Vertical and horizontal cylindrical
- Open top and closed top
- Flat bottom and cone bottom
- Slope bottom and dish bottom

The vertical cylindrical large tanks have rounded corners to withstand the pressure of the contained liquid. These storage tanks are designed to handle varying degrees of liquid pressure during transportation.

Fig. 3.1.1. Horizontal insulated milk storage tank

Fig. 3.1.2. Vertical insulated milk storage tank

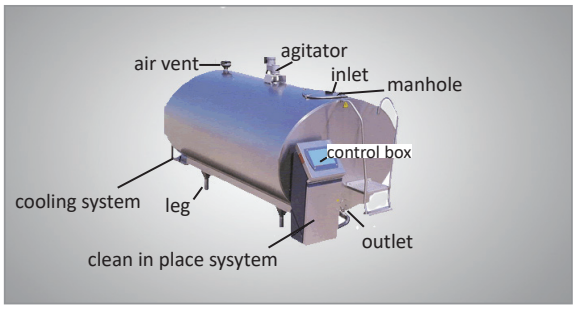

Fig. 3.1.3. Ghee boiler

Fig. 3.1.4. Bulk milk cooler

3. Milk Chiller

Chilling of milk is the rapid cooling of raw milk to sufficiently low temperature to check for the growth of microorganisms present. In the chilling process, the temperature of milk should be reduced to less than 10°C, preferably 3 - 4°C.

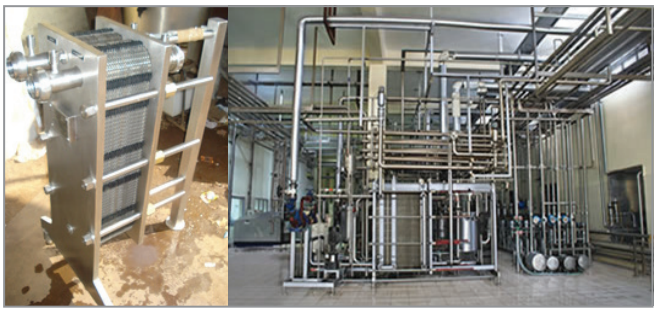

Fig. 3.1.5. Milk chiller

Fig. 3.1.6. Milk separator

4. Milk Separator

A separator is a device that separates milk into cream and skimmed milk.

5. Homogeniser

Homogenisation is the process used to make a uniform mixture of two mutually non-soluble liquids. This is achieved by turning one of the liquids into a state consisting of extremely small particles distributed uniformly throughout the other liquid. A typical example is the homogenisation of milk where the fat components in the milk are reduced in size and dispersed uniformly through the rest of the milk.

Fig. 3.1.7. Homogeniser

6. Pasteuriser

Pasteurisation of milk is the process of heating milk to a specific temperature for a specific period in order to kill microorganisms that could cause spoilage, disease or undesired fermentation of food.

During pasteurisation, milk is heated at 63°C for 30 minutes or 72°C for 15 seconds in an approved and full functional equipment. After pasteurization, milk is immediately cooled to 5°C or below.

Pasteurisation is required:

- to increase milk safety for the consumer by destroying disease causing microorganisms (pathogens) that may be present in milk
- to enhance the quality of milk products by destroying microorganisms and enzymes that contribute to the reduced quality and shelf life of milk

Fig. 3.1.8. Pasteurisation unit

Fig. 3.1.9. Milk packaging machine

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

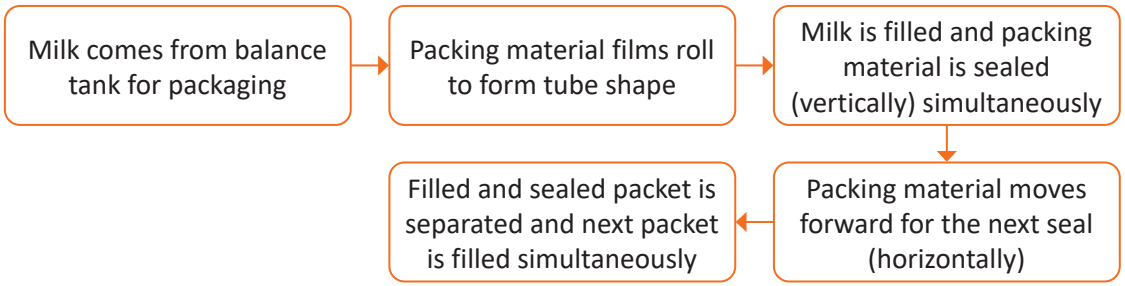

Fig. 3.1.10. Form Fill Seal (FSS) process

Equipment Used in Ice Cream Processing

Following is a list of the different equipment used in typical ice-cream mix room:

Pasteuriser – I	Catta – I
Pasteuriser – II	Catta – II
Pasteuriser – III	Catta PWS – Cone
Homogeniser – I	Cerpaco – III PWS cup
Homogeniser – II	Walzer
Homogeniser – III	Hoyer – II Comet cone
Double jacket blender	WCB New
Tank in mix room	Extrusion line
Cream separator	Vector line
Crepaco – I (double barrel freezer)	Hardening tunnel – I
WCB old freezer	Hardening tunnel – II
Hoyer freezer	Crate conveyor – I
Pasteuriser-I	Crate conveyor – II

Table 3.1.1: Equipment Used in Ice Cream Processing

3.1.2 Preparation of Machineries for Production

Before beginning with the actual production process, an ice cream processing technician must prepare and maintain the process machineries and tools. Following is a step-by-step guide to preparing machineries for production:

1. Plan, schedule, and organise machineries
2. Ensure proper installation
3. Ensure periodic inspection
4. Ensure adequate lubrication of machineries
5. Adjust machineries and instruments, if required
6. Replace worn and damaged parts

Apart from this, a dairy products processor must also:

- Record and report observations, adjustments, repairs, and replacements
- Periodically review records on inspection, lubrication, repairs, and performance of equipment
- Keep an adequate supply of spare parts
- Determine maintenance costs
- Ensure regular cleanliness and painting of equipment
- Inspect and maintain all emergency, personnel, and plant protective equipment
- Ensure maintenance of full serviceability of all utilities

3.1.3 Maintenance and check of Basic Equipments in Dairy Processing Plant

1. **Milk cans**
   - Milk cans must be handled with great care.
   - Ensure that there are no dents on the milk cans
   - They must not be in a damaged condition.
2. **Milk cooling equipment**
   - Always ensure that manufacturer's instructions on servicing and scheduled repairs are followed
   - Special attention should be paid to lubrication of compressors and detection and timely repair of refrigerant gas leakages
3. **Milk separator**
   - The gears must be well lubricated.
   - The level of the lubricant must be kept constant. (Observe the oil level through the sight glass.)
   - The bowl must be carefully balanced.
   - The bowl should be cleaned thoroughly and immediately after use to ensure proper functioning of the separator.
4. **Butter churn**
   - The churn and butter-making equipment should be washed as soon as possible, preferably while the wood is still damp in the case of wooden churns.
   - Wash the inside of the churn thoroughly with hot water. Invert the churn with the lid on in order to clean the ventilator.
   - The ventilator should be dismantled occasionally for complete cleansing.
5. **Milk pumps**
   - Follow manufacturer's instructions and lubrication procedures

6. **Plate heat exchanger**
    - Follow manufacturer's instructions and preventive maintenance programme
    - Pay particular attention to possibilities of under-pasteurisation, recontamination of pasteurized milk due to air leakages into the system, and milk leakages
    - Ensure the manual on product temperature is at an appropriate place in addition to automatic monitors
    - Ensure that the flow diversion valve is functioning properly
7. **Packaging machine**
    - Check the amount of oil, water, and air in the machine before starting it.
    - Sanitise the machine with hot water
    - Before starting the machine, switch on the UV-tube.
    - During packaging, check the amount of milk in the packet and the code.
    - Check if there is any leakage in the packet
    - Check the teflon tape. If it is in a bad condition, replace it.
    - After packaging is complete, clean the machine and dry it with air.

Lubrication System

Lack of lubrication is one of the principal causes of equipment breakdown in the dairy industry. Hence, it is important to follow the following:

- A regular lubrication schedule
- A lubrication chart for each machine
- A pre-defined frequency of lubrication
- A list of places to be lubricated

Modern equipment calls for certain types of lubricants for certain types of bearings e.g. light, high speed bearing will require a light oil, whereas a heavy duty, low speed bearing will require a heavier oil.

3.1.4 Maintenance and Check

In food manufacturing, maintenance supports various key objectives, many of which are unique to food production. Maintenance plays the following roles in food manufacturing:

1. It keeps the production running smoothly.
2. It helps to prevent any contamination and ensure food safety.
3. It reduces product losses.
4. It maintains regulatory compliance.

An effective maintenance routine ensures that operations are continued, repair costs are minimized, and downtime is reduced.

Following are the types of maintenance that are carried out in a food processing unit:

1. **Reactive Maintenance** is a method where machines run until they fail. It's a hands-off approach, and the significant benefit is that it keeps routine maintenance costs low.
2. **Predictive Maintenance** uses advanced technology such as infrared and ultrasound equipment during the routine inspection of machines. This process can stop unpredicted breakdowns, and using advanced technology and the industrial unit can reduce the amount of time needed to inspect equipment piece by piece. This type of maintenance is expensive, but this method accurately stays a step in front of faults.

3. **Proactive Maintenance** is a systemic issue-focused maintenance program. Rather than examining equipment, this approach considers how to control the problems that lead to machine wear and tear instead of the deterioration itself.
4. **Preventative Maintenance** is the checking of machines and equipment on a planned, regular basis. The purpose is to prevent costly downtime and minimize the probability of faults. It requires more planning and effort than other techniques. However, it has long and short-term benefits in cost-reduction and efficiency of machine performance. Preventative checks are done before a machine breakdowns and while it is still in running condition. Generally, the strategy leads to good food hygiene and prevents foreign materials from entering food produce.

It is essential to have a schedule for preventative maintenance of each piece of machinery and equipment used in the production. This consists of:

- Time schedule stating when and how frequently maintenance should be done
- Maintenance activities list for each item

These schedules provide simple guidelines for all types of equipment, covering the duties to be undertaken in the following areas:

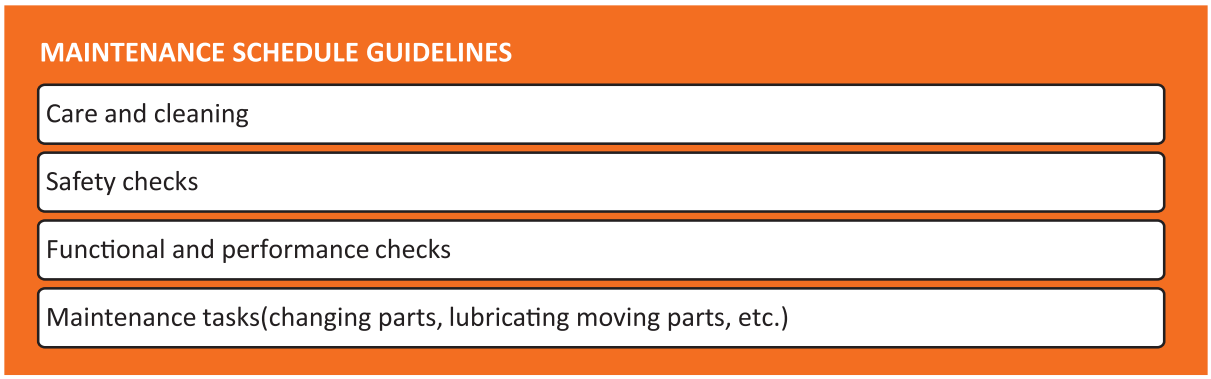

Fig. 3.1.10. Maintenance Schedule Guidelines

Checklist for Planning Maintenance

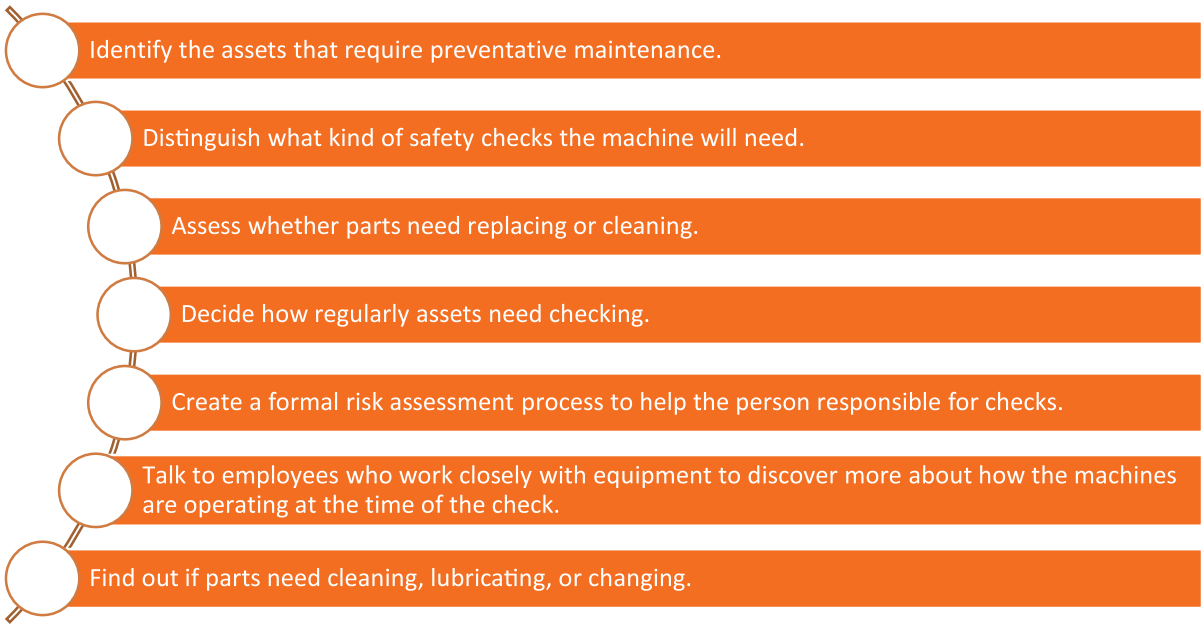

Fig. 3.1.11. Maintenance Checklist

After completing any maintenance, the technician must keep a log for maintenance. This log entry should include a description of the work carried out, who carried it out, and the date and time it happened

Document Maintenance Procedures: Every piece of equipment and machinery should have detailed descriptions, drawings, and photographs of how and when each machinery should be maintained or serviced. It includes:

- Maintenance procedures
- Lubrication procedures
- Tool reconciliation procedures
- Procedures for temporary repairs
- Procedures for emergency repairs
- Spare parts inventory program
- Training procedures
- Handover procedures Audit Procedures

UNIT 3.2: Sanitisation of the Work Area

Unit Objectives

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

1. State the materials and equipment used in the cleaning and maintenance of the work area
2. State the common detergents and sanitisers used in cleaning work area and machineries
3. State the properties of cleaning agents used
4. State the methods of cleaning and sanitisation

3.2.1 Cleaning & Sanitizing Work Area, Machinery, Tools, and Equipment

The cleaning and sanitizing process are one of the most essential programs in the food processing industry. It has always been a critical element for ensuring food safety and quality. Food processing industries need to be kept spotlessly clean to ensure compliance with standard regulations and prevent contamination. Everything from random debris to flakes of rust and paint needs to be kept clear from foodstuff to make sure the product is entirely safe for consumption, so frequent cleaning is vital to food processing operations.

Though the entire process is quite tricky because of the complexity of the machinery and equipment used in the industry, it can also introduce additional difficulty by creating a wet environment. Equipment must be designed and built to withstand these environments, like using only food-grade stainless steel, but the complexity doesn't end there. High-pressure washers used to clean equipment can also strip the coatings on machines and cause injuries to employees, and the wet environment itself often poses a slip-and-fall hazard as well as food contamination.

Cleaning and sanitizing (disinfecting) are usually two separate processes. Effective cleaning must be carried out before sanitizing the work area and machinery, as sanitizers may not work as well if the work area or machinery has not had all visible contamination removed. Cleaning is often done using correct proportion of detergent and water. Detergents are chemicals that eliminate dirt and grease. However, it does not kill bacteria and other microorganisms. Microorganisms may be removed during the cleaning process but it can't be destroyed properly. Hence, sanitizing is required for this purpose.

The primary reasons for cleaning and sanitizing the work area and machinery are:

Fig. 3.2.1 Reasons for Cleaning and Sanitizing

The food processing industry follows standard procedures for cleaning the work area to ensure no bacterial growth due to the presence of leftover food particles. For cleaning purposes, the work area is divided into two categories:

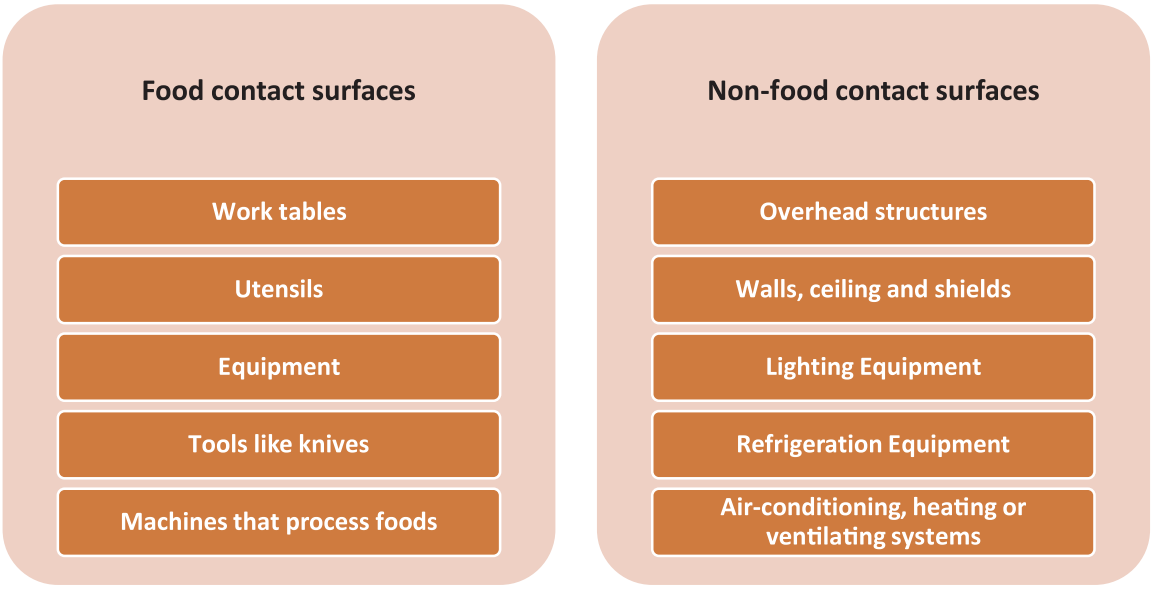

Fig. 3.2.2 Cleaning Work Area Categories

Proper and regular cleaning of the work areas protects food from any contamination. The cleanliness of the ambient air should also be controlled in the workplace, where contamination of any infectious material will be dangerous. The surfaces used for producing and storing foods with low moisture content should always be dry and hygienic during use. When wet cleaning is required, these surfaces must be sanitized and thoroughly dried to use. The entire work area in wet applications must be cleaned and sanitized absolutely before use or at the risk of contamination. Equipment and tools when not in usage should be stored properly to avoid any contamination risk.

3.2.2 Cleaning Agents and Sanitizers Used for Cleaning

There are several common cleaning and sanitizing agents that can be used to clean the food-contact and non-food contact surfaces. The nature and complexity of the detergent employed depend on the variation of soils, water hardness, and temperature of the method, plant surfaces, and safety. Detergent suppliers normally have a range of detergents to be employed in varying and specific circumstances. The range of products will include:

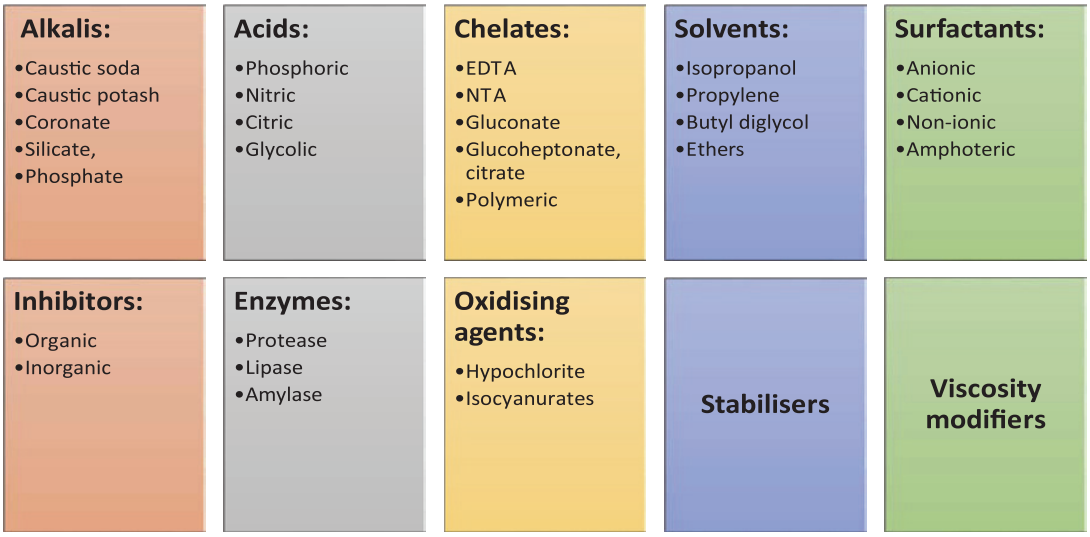

Fig. 3.2.3 Various Ranges of Detergents

The industry must use approved cleaning and sanitation chemical agents and the same must be prepared before use as per the instructions described on the product label. It is essential to identify the correct detergent for cleaning operation correctly. This will save money in the long term as cleaning will be more effective. The failure of a product to work is usually not due to a poor quality product but rather choosing the wrong one. Application and use are also important factors, and a good supplier will usually provide training in the correct use of the product. A 'detergent' is designed to remove soils. Another term used is 'sanitizer' and is often used to describe similar products. A 'disinfectant' is a product that kills microbes without employing a soil removal action. The table below lists the typical cleaning agents and their appropriate usage, risks, and safety measures that should be taken while using these agents.

Cleaning agents	Used for	Risk	Safety measures
Hypochlorite 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 Microor ganisms	Has a strong odor	Use in well-ventilated and open spaces

Cleaning agents	Used for	Risk	Safety measures
Ozone	Cleaning food- contact and on-food-contact surfaces like Equipment, w alls, doors, Drains, c onveyors, tanks, and Other contai ners; Killing Microbes	No risk involved since it leaves no residue	Safe to use

Table 3.2.1 Different types of cleaning agents, related risk factors, and safety measures

Cleaning and sanitization take time and cost money. However, well-designed and organized food processing businesses can reduce the time needed for thorough cleaning with proper planning.

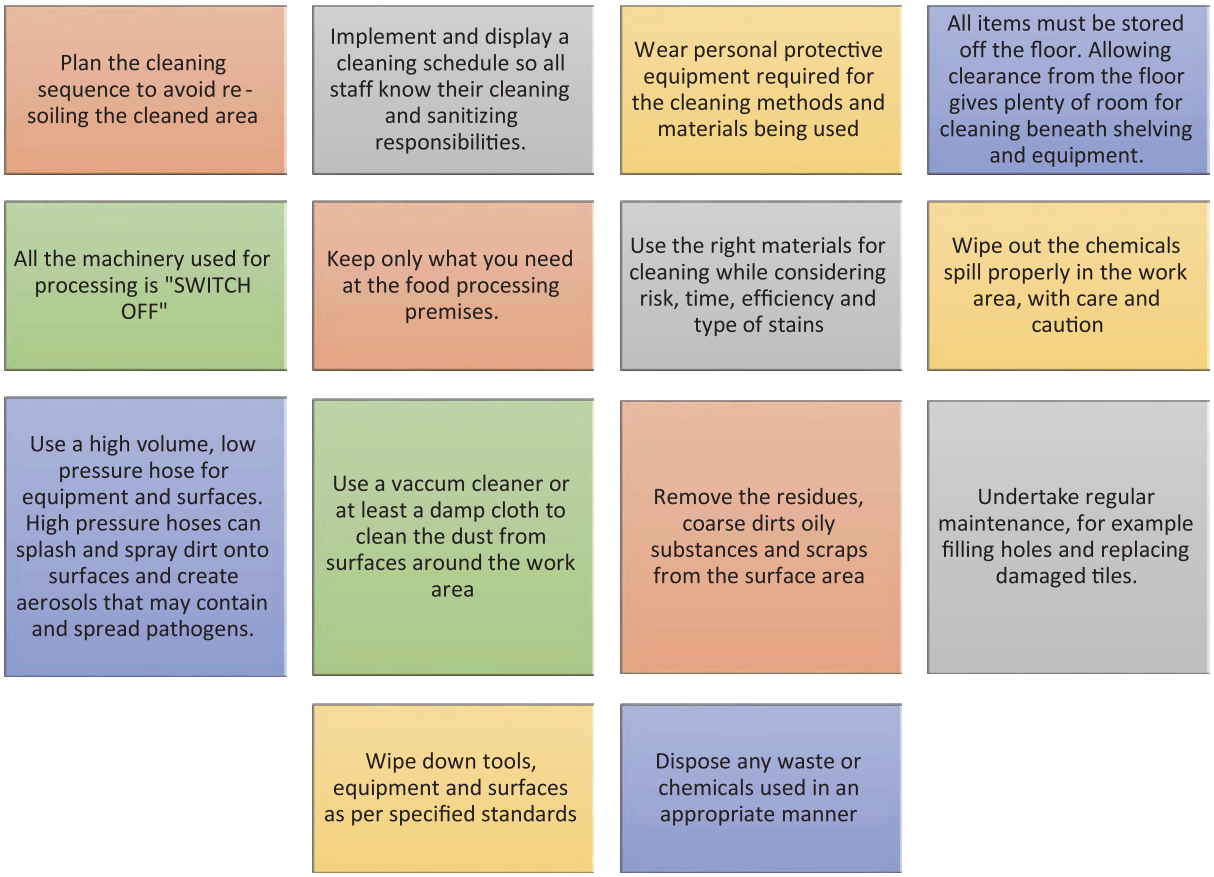

Fig. 3.2.4 Standard Practices for Cleaning the work area and equipment

The term sanitary refers to the state of a food contact surface or machinery where it does not contain microorganisms at a level that would permit the transmission of infectious disease or compromise food safety. Sanitizers are substances capable of destroying microorganisms, including those bacteria that cause food poisoning and other diseases. With appropriate use, they can reduce surface contamination by bacteria to a safe level. Therefore, it is essential to read and follow the directions on sanitizers carefully. Sanitizing is usually done using heat and water, or chemicals, or a combination of both methods.

Effective Practices for Sanitization

For effective and safe use of a sanitizer, follow the manufacturer's instructions provided on the label.

- Some sanitizers are toxic to people, and the residue must be rinsed off, while other sanitizers are food-safe and do not require rinsing. So, the manufacturer's instructions shall always be followed for the sanitizer to ensure safe use.
- Sanitizers work best at the correct dilution. If they are too weak, they do not work effectively, and money is being wasted if they are too strong.
- Sanitizers need time to work. The contact time varies and may be seconds to minutes depending on the job.
- Check the dilution, contact time, safety precautions, shelf life, and storage of all chemicals before use.

In some cases, cleaning and disinfection may be combined into one operation using a sanitizer which has the action of both a detergent and a disinfectant. However, it is believed that the two-stage approach is more consistent and effective than the single-stage sanitizer approach. It is important that non-scented chemicals are used in food operations due to the risk of taint.

UNIT 3.3: Cleaning Processes

Unit Objectives

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

1. Describe the CIP method of cleaning
2. Describe the SIP method of cleaning

3.3.1 Clean-In-Place (CIP)

CIP is a method used for internal cleaning of machineries. It is done without dismantling pipes, vessels, process equipment, filters or fittings. In this process, a sanitising 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.

Tips to conduct an effective CIP process:

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

3.3.2 Cleaning Sequence

The 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 sanitiser

Advantages of CIP

The major advantages of implementing CIP are:

- Guaranteed and repeatable quality assurance
- Provision of full data logging for quality assurance requirements
- 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

CIP STEPS	PASTEURIZER	SILO/TANKS	TRANSFER LINES	RECEPTION LINES	MILK TANKERS
Rinsing with Water	10min at ambient temp.	5min at Ambient temp	5min at Ambient temp	5min at ambient temp	1-3min at Ambient temp
Lye Circulation	45min at 80°C	20min at 80°C	5min at 80°C	15 min at 80°C	5min at 75°C
Fresh Water Circulation	6 min at Ambient temp	7min at Ambient temp	5min at Ambient temp	7min at Ambient temp	5min at Ambient temp
Acid Circulation	40min at 60°C	15min at 60°C	5min at 60°C	20min at 60°C	-
Fresh Water Circulation	10min at Ambient temp	7min at Ambient temp	5min at Ambient temp	10min at ambient temp.	-

Fig. 3.3.1: CIP Steps of different equipments

3.3.3 Clean-Out-Of-Place (COP)

COP is conducted at a cleaning station. This method involves dismantling of the equipment. In this process, equipment and units are scrubbed with soap in COP tanks. After this, the tanks are rinsed again to remove residual detergent or chemicals. Equipment and units are reassembled and sanitised once more with heat treatment or sanitising agent.

Tips to conduct an effective COP process:

- Follow the order of tasks
- Use cleaning tanks as much as possible
- Ensure tools used in COP do not lead to contamination

Food processing equipment and units that undergo the COP process are:

- Fittings
- Gaskets
- Valves
- Tank vents
- Grinders
- Pumps
- Knives
- Nozzles

3.3.4 Sterilising-In-Place (SIP)

SIP is the process by which food processing equipment is sanitised after the CIP process. It helps to eliminate any residual microbiological contamination.

SIP is a combination of three processes viz. sterilisation, disinfestation, and sanitisation.

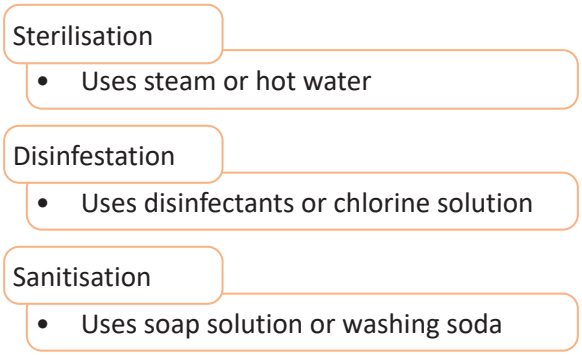

Fig. 3.3.2. Sterilising-In-Place (SIP)

3.3.5 Process of Cleaning the Work Area

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.

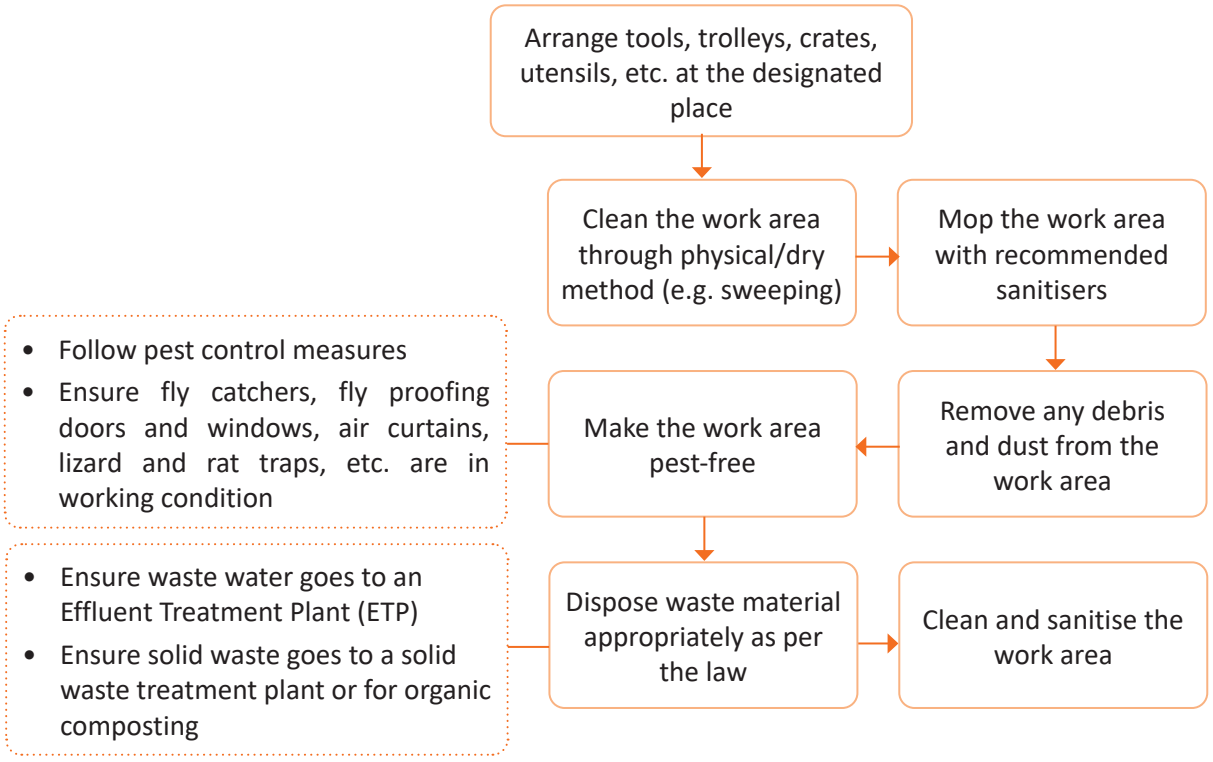

Fig. 3.3.3: cleaning of work area

3.3.6 Process of Cleaning Machineries, Tools and Equipment

The chart explains cleaning of machineries, tools, and equipment used in the ice cream processing industry. The dotted chart states the techniques used for mechanical cleaning of equipment.

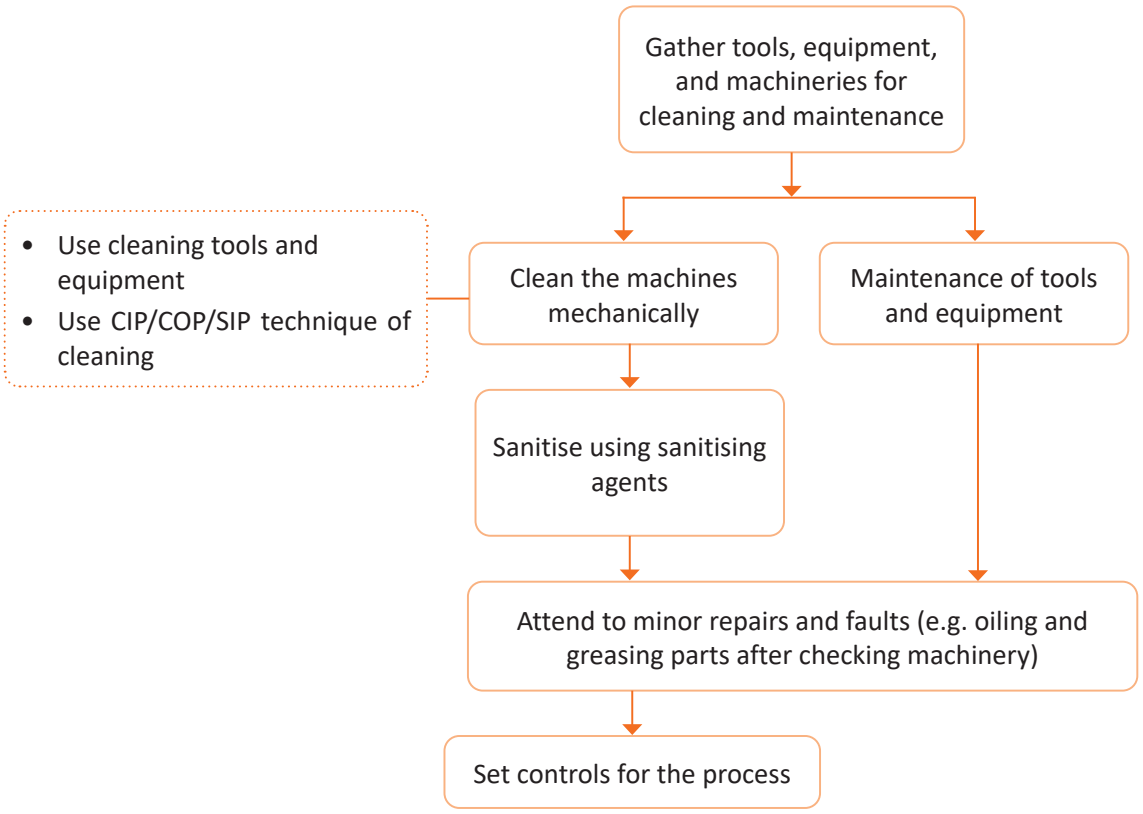

Fig. 3.3.4: Flow chart process- cleaning of machinery

UNIT 3.4: Waste Management in Dairy Industry

Unit Objectives

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

1. Explain the method of managing and disposing waste material

3.4.1 Waste Management in Dairy Industry

Waste management is the collection, transportation, processing, recycling or disposal, and monitoring of waste materials. Waste materials are classified as:

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

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.

Exercise

1. Match the columns.

Name of cleaning process	Method of cleaning
a. Disinfestation	i. Internal cleaning of machineries
b. Detergent	ii. Process of sterilisation, disinfection, and sanitation
c. SIP	iii. Using chlorine solution
d. CIP	iv. Water softener

2. Fill in the blanks with the correct option.

a. The types of sanitisers used are _____ and _____ in a dairy processing unit.

i. thermal, biological
ii. biological, chemical
iii. thermal, chemical
iv. biological, microbial

b. Sanitisation implies to _____ of all pathogenic and almost all non-pathogenic organisms.

i. addition
ii. destruction
iii. deposition
iv. concentration

c. Process which is helpful in eliminating any microbiological contamination is _____.

i. SIP
ii. COP
iii. CIP
iv. SAP

d. The full form of SIP is _____.

i. Sanitisation-in-place
ii. Sanitisation-inward-place
iii. Sanitisation-in-pipes
iv. Side-in-place

e. RMRD is short form of _____.

i. Random Milk Reception Dock
ii. Regular Milk Reception Dock
iii. Raw Milk Reception Dock
iv. Ripened Milk Reception Dock

3. Match the columns.

Equipment in Dairy Processing Plant	Usage
a. Raw Milk Reception Dock	i. Rapid cooling of milk
b. Milk Chiller	ii. Uniform mixture of two mutually non-soluble liquids
c. Milk Separator	iii. Short or long term storage
d. Homogeniser	iv. Process of heating milk to a specific temperature
e. Storage Tanks	v. Arrival and receiving milk after grading for acceptance
f. Pasteuriser	vi. Separates milk into cream and skimmed milk

Notes

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

https://www.youtube.com/watch?v=doOhWost2io

Facilities and Utilities

https://www.youtube.com/watch?v=ftogJKHQAX4

Equipments used in Ice-cream processing industry

NCVET
कौशल गुणवत्ता प्रगति

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

FICSI
Food Industry Capacity and Skill Initiative

4. Prepare for Production of Ice Cream

Unit 4.1 - Ingredients for Production

Unit 4.2 - Factors Affecting Efficiency During Production

Unit 4.3 - Plan Production Sequence

Unit 4.4 - Raw Material and Manpower Estimation

FIC/N2014

Key Learning Outcomes

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

1. Explain the standard operating procedures followed in the dairy industry
2. List the ingredients required for production
3. State the factors affecting operation efficiency during production
4. Describe the process of planning production sequence to maximize capacity utilisation of resources
5. Demonstrate the process of production planning

UNIT 4.1: Ingredients for Production

Unit Objectives

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

1. List the ingredients required for production

4.1.1 Ingredients Required for Producing Ice Cream

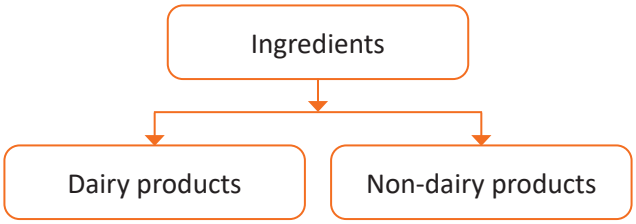

Fig. 4.1.1. Ingredients required for producing ice cream

Dairy Products

- Sweet cream
- Unsalted butter
- Palm kernel oil
- Whole milk
- Skim milk
- Skim milk powder

Non-Dairy Products

Non-dairy product	Function
Sweetening agents like sucrose	• Sweetens ice cream • Improves taste • Smoothens body and texture • Gives ice cream faster melting quality
Emulsifiers	• Improves whipping quality of ice-cream mix • Reduces whipping time • Helps produce drier ice cream with smoother body and texture • Helps decreases melting rate of ice cream • Improves fat dispersion
Stabilisers	• Helps preserve emulsion • Helps reduce growth of ice crystals during storage • Provides uniformity to ice cream mix • Helps delay melting
Added flavours	• Improves appearance, texture, and taste
Added colours	• Improves appearance of ice cream
Fruits and nuts	• Enhances flavour of ice cream

UNIT 4.2: Factors Affecting Efficiency During Production

Unit Objectives

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

1. State the factors affecting operation efficiency during production

4.2.1 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 optimising the use of available resources and facilities. Some of the factors that affect the plant operation efficiency are:

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	Employ 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

Table 4.2.1: Corrective measures

UNIT 4.3: Plan Production Sequence

Unit Objectives

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

1. Describe the process of planning production sequence to maximise capacity utilisation of resources
2. Demonstrate the process of production planning

4.3.1 Production Sequence

Every organisation in the food processing industry follows the method of preparing a production sequence before beginning production. This helps to ensure the following:

Ingredients used in the baking industry are divided into groups as per their roles. The following table explains this classification.

- Optimum utilisation of resources
- Optimum utilisation of manpower
- Optimum utilisation of machineries
- Better control over inventory
- Better quality control

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

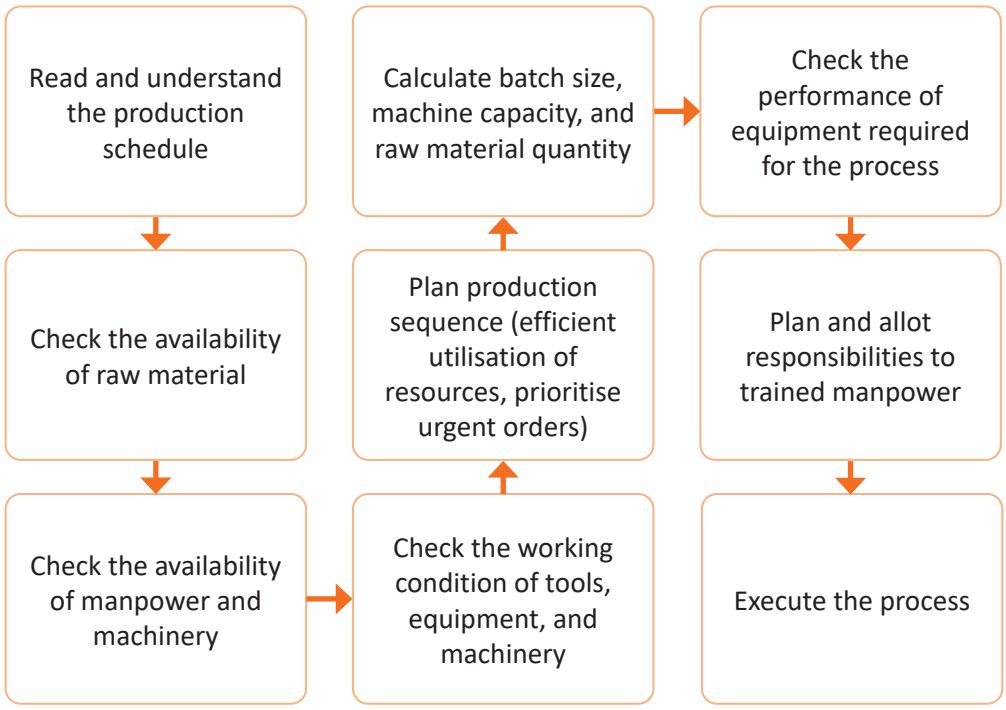

Fig. 4.3.1. Production planning process

UNIT 4.4: Raw Material and Manpower Estimation

Unit Objectives

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

1. Discuss the capacity utilisation of machinery with respect to the processing time, production time, production order and batch size for each product

4.4.1 Capacity Utilization

Capacity utilization is a relationship between the actual and potential production output, using its capacity of machinery and available resources. The capacity utilization percentage provides an insight into a food processing industry's operational efficiency and can vary based on consumer and market demand.

1. Following are the steps to calculate the capacity utilization of production:

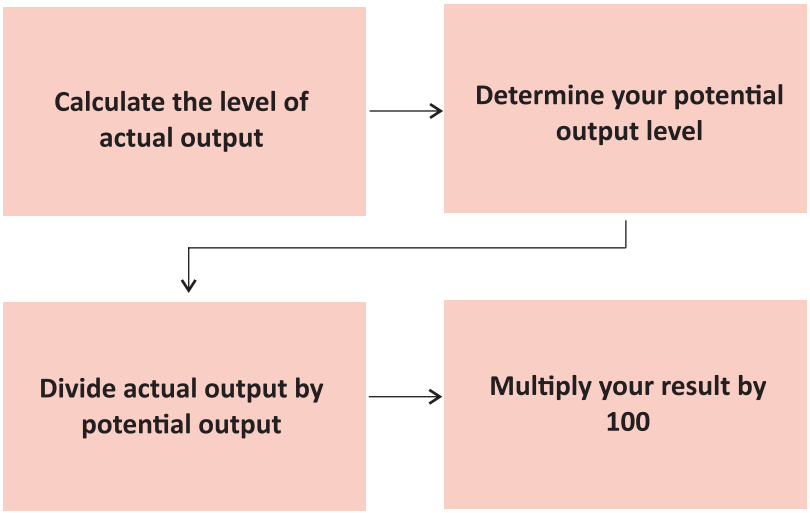

Fig. 4.4.1: Steps to calculate Capacity utilization

The capacity utilization formula gives you the capacity utilization rate:

Capacity utilization = (actual output level / potential output) x 100

In the above formula, the actual output level represents the number of units a manufacturing unit produces within a specific period. The potential output means the maximum capacity that companies and economies can operate at when they use all resources without incurring additional operational expenses.

2. Each machine in the production line operates at a particular cycle time. Therefore, the efficiencies of a production operation in a manufacturing system can be measured based on the utilization of production resources such as machines in a particular cycle.

Machine capacity = operating hours x operating rate x the number of machines

3. We can calculate the capacity of a process with respect to the batch size, using the following formula:

Capacity = (batch size) / (set-up time + batch size * time per unit)

4.4.2 Process Loss

Process loss is the loss that occurs while converting raw material into finished product. Such loss may occur due to:

- The nature of raw material
- Mishandling of raw material/machinery

Exercise

1. Arrange the production sequence in the right order.

Procedure/Steps	Order the steps (as 1, 2, 3, 4, 5, 6, 7, 8 and 9)
a. Execute the process of making dairy products	
b. Check the availability of raw material	
c. Plan and allot responsibilities to trained manpower	
d. Plan production sequence (efficient utilisation of resources, prioritise urgent orders)	
e. Calculate batch size, machine capacity, and raw material quantity	
f. Check the working condition of tools, equipment, and machinery	
g. Check the performance of equipment required for the process	
h. Check the availability of manpower and machinery	
i. Read and understand the production schedule	

2. Match the columns.

Factors affecting efficiency	Measures
a. Utilities	i. Using floor space efficiently
b. Efficient labour	ii. Proper scheduling of raw material
c. Work schedule	iii. Quality checks for milk used for production
d. Quality of raw material	iv. No wastage of working hours
e. Processing units	v. Easy availability of water, electricity, refrigeration and steam
f. Supply of raw material	vi. Employ skilled labour

Notes

5. Produce Ice Cream

Key Learning Outcomes

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

1. Describe milk
2. State the composition of milk
3. List the different types of milk products
4. State the composition and nutritive value of the milk products
5. Explain the process of testing milk for accepted quality standards
6. Demonstrate the test for checking the quality of milk
7. Describe the procedure for organoleptic test of milk
8. Describe the procedure for COB test of milk
9. State the production process of pasteurization
10. Explain the process of separation and bactofugation
11. State the method of standardisation of milk
12. State the method of homogenisation of milk
13. State the method of heat exchange during pasteurisation
14. State the method of standardisation of milk
15. Explain the process of HTST pasteurisation
16. Demonstrate the process of HTST pasteurisation
17. State the composition of ice-cream
18. List the different types of ice-cream
19. Explain the process of producing ice-cream
20. Demonstrate the process of producing plain ice-cream
21. Demonstrate the process of producing frozen desserts
22. Demonstrate the process of producing premium ice-cream
23. Demonstrate the process of producing kulfi
24. List the composition of different types of ice-cream
25. Demonstrate the process of making the mix
26. State the method of pre-heating ice-cream mix
27. State the method of blending
28. State the process of filtration
29. State the method of homogenisation of ice-cream mix
30. State the method of pasteurisation of ice-cream mix
31. State the method of cooling the ice-cream mix
32. State the method of ageing the ice-cream mix
33. State the method of freezing the ice-cream mix
34. State the method of estimating overrun in ice-cream
35. Arrange for proper cleaning of production area, equipment, and tools used
36. Organise periodic maintenance of all production machineries

UNIT 5.1: Introduction to Milk

Unit Objectives

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

1. Describe milk
2. State the composition of milk
3. List the different types of milk products
4. State the composition and nutritive value of the milk products

5.1.1 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. It should have the prescribed percentage of milk fat and SNF (Solid Not Fat)."

Milk of different classes and of different designations must conform to the standards laid down by FSSAI. Mixed milk means a combination of the milk from cow, buffalo, sheep, goat or any other milch animal. The combination also should conform to the standards laid by the FSSAI. The following table explains the composition of milk:

Nutritional Factor	Description	Energy Value
Protein	Milk contains protein casein, which is high quality protein. Milk contains all essential amino acids in an appropriate proportion.	4.1 KC/g
Minerals	Milk contains calcium and phosphorus.	
Vitamins	Milk is a good source of vitamins A, D, thiamine, and riboflavin.	
Fat	Milk fat plays a very important role in the flavour and physical properties of milk and its products. The fat content in milk is generally from 3.5 to 4.5 %	9.3 KC/g
Lactose	Lactose is the sugar component of milk. The principal function of lactose is to supply energy.	4.1 KC/g

Table 5.1.1: Composition of milk

UNIT 5.2: Quality Control in Milk Processing Plant

Unit Objectives

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

1. Explain the process of testing milk for accepted quality standards
2. Demonstrate the test for checking the quality of milk
3. Describe the procedure for organoleptic test of milk
4. Describe the procedure for COB test of milk

5.2.1 Milk Testing and Quality Control

Milk testing and quality control are essential components of any milk processing industry. Milk has a high risk of losing its purity at the hands of middlemen who are not careful or farm workers. The water content in milk and its high nutritive value makes it an ideal medium for rapid multiplication of bacteria particularly under unhygienic production and storage.

Fig. 5.2.1. Milk testing and quality control

Milk Sampling

Milk in cans and bulk tanks should be thoroughly mixed to disperse the milk fat before a milk sample is taken for any chemical control tests. Representative samples of packed products must be taken for any investigation on quality.

Organoleptic Tests

The organoleptic test permits rapid segregation of poor quality milk at the milk receiving platform. No equipment is required for this test. The milk grader must have a good sense of sight, smell, and taste. The result of the test is obtained instantly and the cost of the test is also low. Milk that cannot be adequately judged organoleptically must be subjected to other more sensitive and objective tests.

Procedure:

1. Open a can of milk.
2. Immediately smell the milk.
3. Observe the appearance of the milk.

4. If the grader is still unable to make a clear judgement, taste the milk. (Do not swallow it. Spit the milk sample into a bucket provided for that purpose or into a drain basin and flush it with water.)
5. Look at the can lid and the milk can to check for cleanliness.

Result:

Abnormal smell and taste may be caused by:

- Atmospheric taint (e.g. barny/cowy odour)
- Physiological taints (hormonal imbalance, cows in late lactation leading to spontaneous rancidity)
- Bacterial taints
- Chemical taints or discolouring
- Advanced acidification (pH < 6.4)

Clot On Boiling (COB) Test

This test is quick and simple. It is one of the oldest tests to check for highly acidic milk (pH < 5.8) or abnormal milk (e.g. colostrum or mastitis milk). If a milk sample fails in the test, the milk must contain many acid or rennet-producing microorganisms or the milk has an abnormal high percentage of proteins like colostrum. Such milk cannot withstand heat treatment and should be rejected.

Procedure:

1. Boil a small amount of milk in a spoon, test tube or other suitable container.
2. If there is a visible abnormality, the milk has failed the test. Heavy contamination in freshly drawn milk cannot be detected when the acidity level is between 0.20-0.26 % lactic acid.

UNIT 5.3: Processing Milk

Unit Objectives

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

1. State the production process of pasteurisation
2. Explain the process of separation and bactofugation
3. State the method of standardisation of milk
4. State the method of homogenisation of milk
5. State the method of heat exchange during pasteurisation
6. State the method of standardisation of milk
7. Explain the process of HTST pasteurisation
8. Demonstrate the process of HTST pasteurisation

5.3.1 Pasteurisation of Milk

Pasteurisation refers to the process of heating milk to at least 63°C (145°F) for 30 minutes or 72°C (161°F) for 15 seconds (or to any temperature-time combination which is equally efficient) in an approved and fully functional equipment. After pasteurisation, milk is immediately cooled to 5°C (41°F) or below.

Pasteurization is important for the following:

- Complete destruction of harmful microorganisms to make it safe for consumption
- Improvement of keeping quality i.e. destruction of almost all spoilage organisms (85-99%)

Pasteurisation Requirements

Particulars	30 minutes	15 seconds
Kill TB germs	138°F/58.9°C	158°F/70°C
Inactive phosphatase	142°F/61.1°C	160°F/71.1°C
Pasteurisation requirements	143°F/61.7°C	161°F/71.7°C
Cream line reduction	144°F/62.2°C	162°F/72.3°C

Types of Pasteurisation

Pasteurisation of milk is done by two methods:

- Batch method known as Low Temperature Long Time (LTST)
- Continuous method known as High Temperature Short Time (HTST)

The following table explains the two processes in detail:

Low Temperature Long Time (LTST)	High Temperature Short Time (HTST)
• Milk is heated to 63°C/145°F for 30 minute and then cooled to 5°C or below • Heat moves through a metal wall into the product for heating and out of the product for cooling • Mostly used for cream and ice-cream pasteurisation	• Milk is heated to 72°C (161°F) for 15 seconds and then cooled to 50C or below • Heating and cooling are automated procedures • Mostly used for processing large volumes of milk

Pasteuriser

A pasteuriser is plate-type equipment that helps exchange heat. In this, a number of stainless steel plates separated by rubber jackets are held together in a screw press to form a series of narrow cavities through which liquid can flow. Each plate has parts to direct the milk and the heating or the cooling medium.

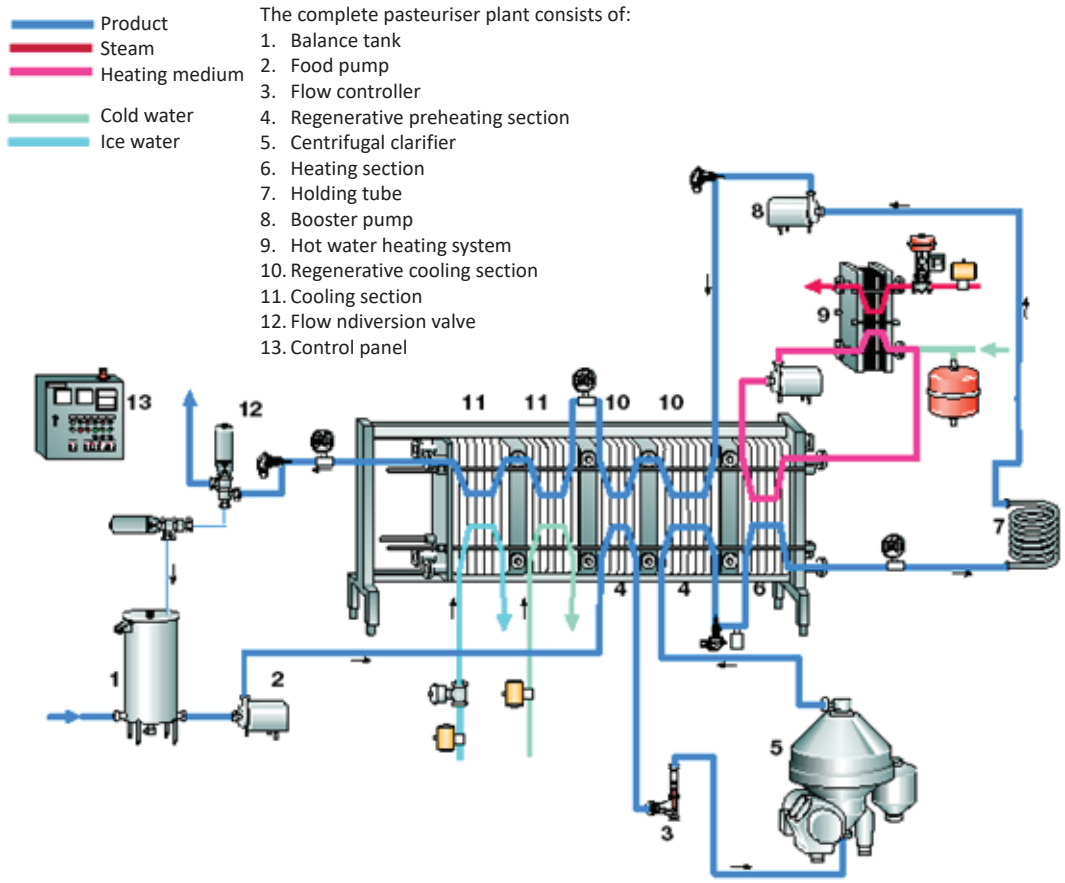

Fig. 5.3.1. The complete pasteuriser plant

Following operations take place during pasteurisation:

- Filtration and clarification
- Separation of milk (separators)
- Bactofugation
- Standardisation of milk
- Homogenisation of milk
- Heat exchange
- HTST pasteurisation

Filtration and Clarification

Some of the operations that are part of the filtration and clarification process are:

Pre-heating

This term refers to heating of milk before actually processing it.Milk is pre-heated to about 35-40°C using plate or tubular heater for efficient filtration/clarification.

Straining

Straining helps to remove some of the large particles of foreign material such as straw, hair, insects, grass, dirt, flies, etc. to ensure visible sediment in milk is reduced.

Filtration

Filtration of milk is carried out to remove visible sediment (foreign matter) from milk to improve its quality. This may be removed by either filtration or centrifugal clarification. While filtration removes suspended foreign particles by straining process, clarification removes the same by centrifugal force.

Clarification

Clarification is more efficient than filtration for removal of dirt and foreign matter from milk. Clarification removes leucocytes, udder tissues, other large cells, and fine dirt. The objective of clarification is to improve the appearance and marketability of milk.

5.3.2 Separation of Milk and Bactofugation

Separation of Milk (Separators)

In the dairy industry, the process of separating milk into cream and skim milk is known as separation. Milk fat can be removed in the form of cream and the remaining portion is serum referred to as skim milk. Skim milk contains predominantly SNF and has very little fat.

Principles of Cream Separation

Separation of cream can be done by either gravity (malai) or by applying centrifugal force. Separation of milk is possible because of difference in density between fat (0.93) and skim milk (1.036). When milk fat in the form of globules rises to the surface of the milk, the globules maintain their identity at the temperature below their melting point forming fat concentrate known as malai.

Bactofugation

Bactofugation is the process of removal of microorganisms from milk using centrifugal force. It is a special form of separation of microorganisms mainly spore formers (bacilliclostridia) to enable milk to be sterilised at lower temperature-time combinations.

Most of the microorganisms are inactivated by pasteurisation. However, the highly heat resistant spores survive pasteurisation. They can lead to significant quality defects in hard cheese, semi-hard cheese or long-life products due to proteolysis, lipolysis and gas formation. Therefore, bactofugation is mainly used in the manufacturing of these products. The objectives of bactofugation are as follows:

- To improve hygienic quality of milk
- To avoid heat resistant bacteria without resorting to excessive heating
- To ensure exceptionally high degree of bacteriological purity in milk

5.3.3 Standardisation of Milk

Standardisation

It is defined as the adjustment of one or more constituents of milk to a nominated level. In the dairy industry, this normally involves reducing the butterfat content by adding skim milk or by removal of cream.

Objectives of standardisation:

- To comply with the legal requirements for particular milk/dairy products
- To provide the consumer with a uniform product
- To ensure that production is cost-effective

Standardisation of milk is done by the following method:

- Addition of skim milk (which helps to increases the volume of milk available for sale)
- Removal of cream (which allows the production of other value-added dairy products like table cream, butter or other high fat products)

Methods of Calculation

For standardisation of milk or cream for manufacturing a product, one must estimate the proportion of various ingredients that should be mixed. This can be done by two methods viz. Pearson's Square Method and algebraic equations.

Pearson's Square Method: The steps to follow are:

1. Draw a square
2. Place the desired fat percentage in the centre.
3. Place the fat percentage of the materials to be mixed at the left hand corners of the square.
4. Subtract the number in the centre from the larger number at the left hand side of the square.
5. Place the remainder at the diagonally opposite right hand corner.

The number on the right hand side now represents the number of parts of each of the original materials to be blended to have the desired fat content in the final mix.

The number at the upper right corner refers to the parts of material whose fat test was placed at the upper left corner and the number at the lower right corner refers to the parts of material whose fat test was placed at the lower left corner.

If the numbers on the right are added, the sum obtained will represent the parts of the finished product.

Example:

In this example 2/3 of the final volume of the 4% milk must be added to 1/3 of the 1% milk to get 3% milk. So if you wanted 1000 L of 3% milk, then you would need 666 L of 4% milk and add that to 333 L of 1% milk.

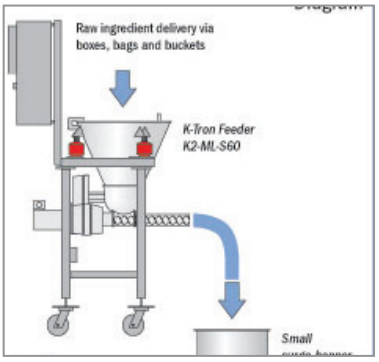

Fig. 5.3.2. Pearson's square method

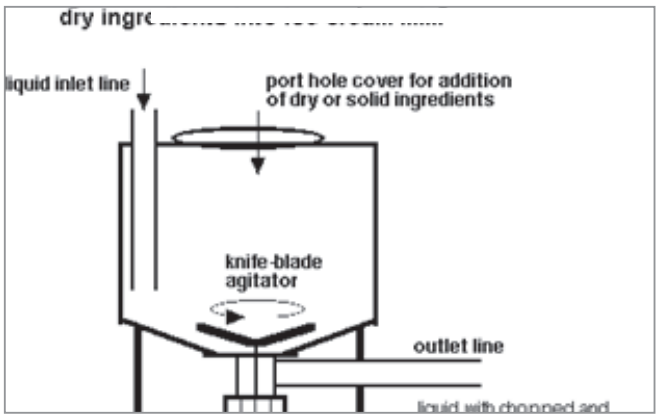

Fig. 5.3.3. Standardisation of milk

5.3.4 Homogenisation of Milk

Homogenisation of Milk

Homogenisation implies mechanical treatment to break fat globules into smaller size of 2µm or less and uniformly disperse them in milk. Homogenisation in the dairy industry is used principally to prevent or delay formation of a cream layer in full cream milk by reducing the diameter of the fat globules. After homogenisation, size of fat globules becomes less than 2µm. The average size of milk fat globule in milk is 2-12µm. The number of fat globules is 3-4 billion in a millilitre of milk.

Heat Exchange

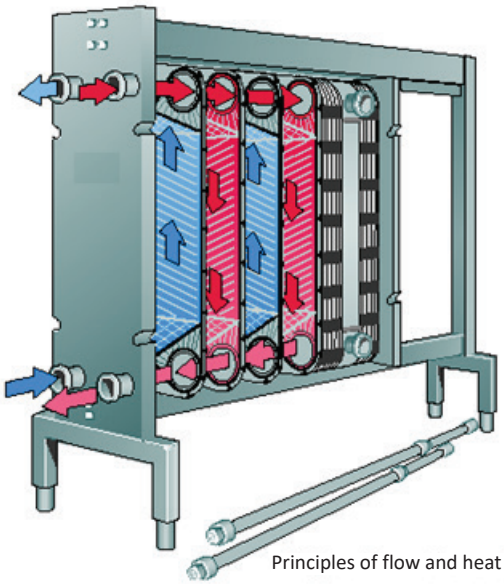

Fig. 5.3.4. Plate heat exchanger

The plate heat exchanger equipment is widely used for heat exchange purpose. It consists of a series of plates, terminals between the plates, and a head terminal on to which the plates are pressed with the end terminal. For installation, cleaning, and changing of plate rubbers, the plates and intermediate terminals can be easily moved backwards and forwards on carrying bars in a frame. Liquids can be passed in and out of the plant via the intermediate, head, and end terminals. The liquid can flow alternately with a colder or warmer medium through the plates in such a manner that one plate occurs in zones close to walls because of low rates of flow.

5.3.5 HTST Pasteurisation

Process of HTST Pasteurisation

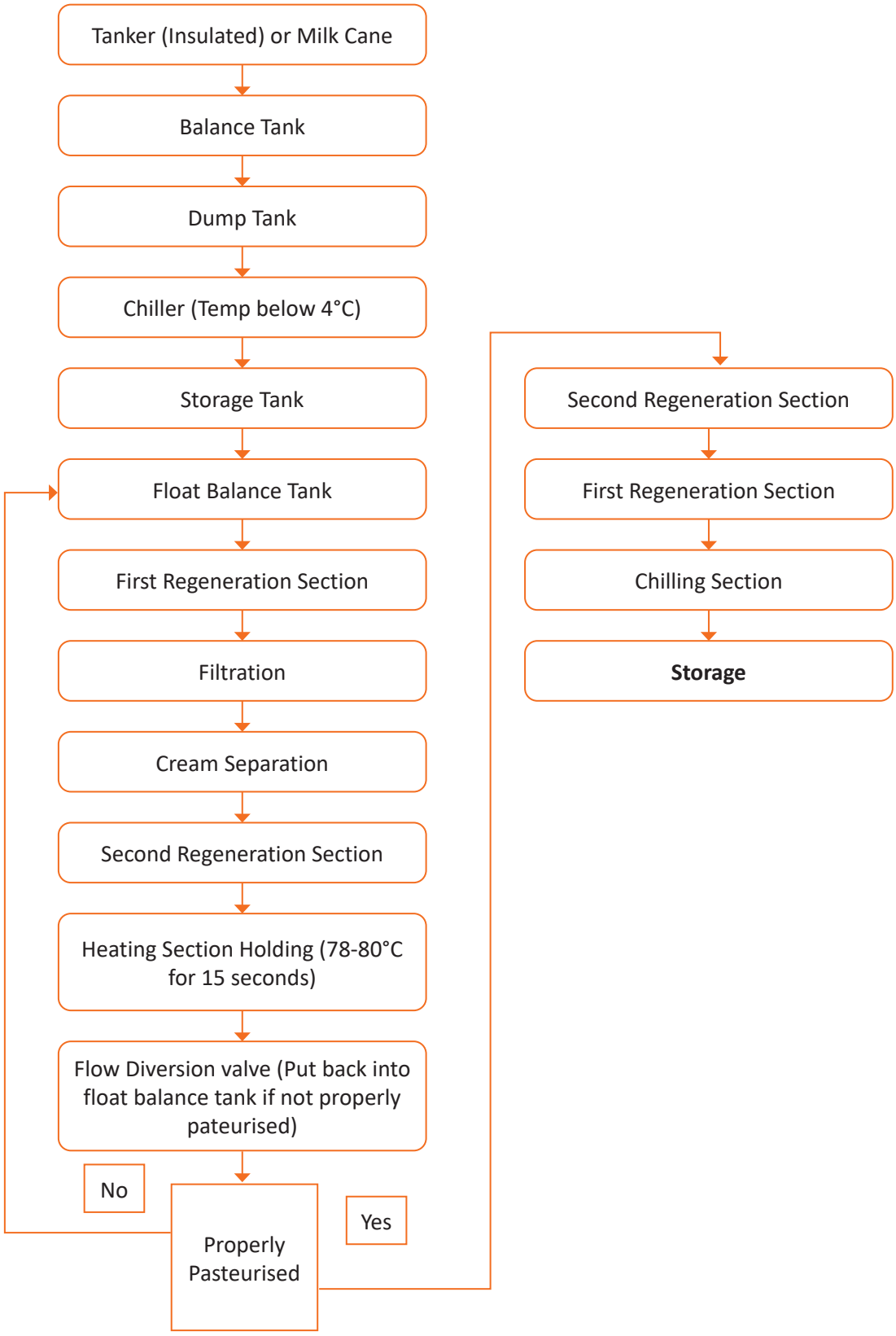

Fig. 5.3.5. Process of HTST pasteurisation

5.3.6 LTLT Pasteurisation

In this method, milk and other liquid ingredients are heated in a large tank for at least 30 minutes. It is used for preparing milk for making starter cultures in the processing of cheese, yogurt, buttermilk, and for pasteurising ice cream mixes in some certain dairies.

General standards for pasteurising ice cream mix for batch method is heating the mix at 68.50°C and holding the temperature for not less than 30 minutes with the help of hot water circulation in jacket.

First, ice cream mix gets pumped into the vat and by the help of an agitator motor, the mix gets agitated continuously. In this method of pasteurisation, the mix gets heated in a double jacketed vat and the abovementioned temperature gets maintained for 30 minutes. After this, the ice cream mix is cooled at a temperature below 40°C by circulation of chilled water.

While operating a batch pasteuriser:

- Check the proper functioning of thermometer
- Do not pass the heating medium (hot water) into the jacket (refer figure below).
- While pumping the mix into vat, start the agitator simultaneously
- Mind the airspace

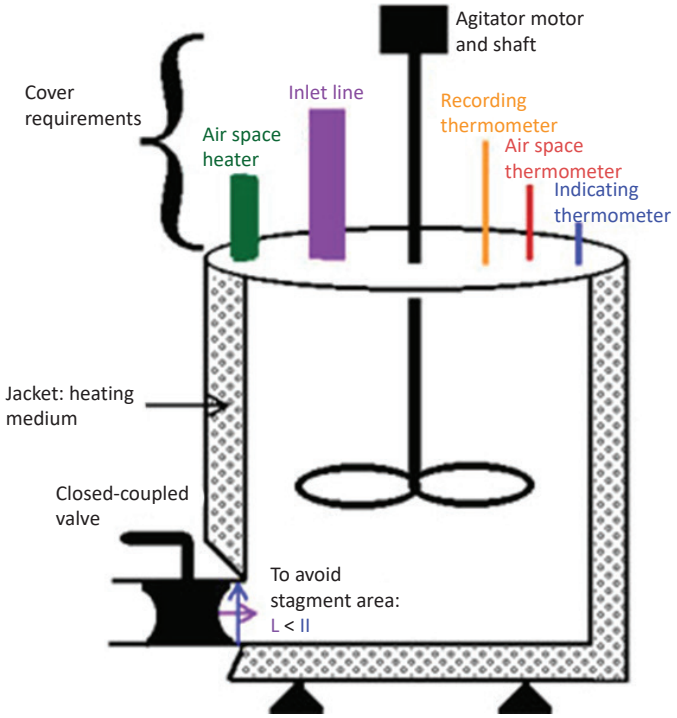

Fig. 5.3.6. LTLT pasteurisation

UNIT 5.4: Introduction to Ice Cream

Unit Objectives

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

1. State the composition of ice cream
2. List the different types of ice cream
3. Explain the process of producing ice cream

5.4.1 Production of Ice Cream

Ice Cream

As per FSSAI, ice-cream and its different types are products obtained by freezing a pasteurised mix prepared from milk and/or other products derived from milk. It may or may not contain sweetening agents, fruit and fruit products, eggs and egg products, coffee, cocoa, chocolate, condiments, spices, ginger, nuts, etc. It may also contain bakery products such as cake or cookies as a separate layer and/or coating.

Requirement	Ice Cream	Medium Fat Ice Cream	Low Fat Ice Cream
Total solid	Not less than 36.0%	Not less than 30.0%	Not less than 26.0%
Wt/Vol (gms/l)	Not less than 525	Not less than 475	Not less than 475
Milk fat	Not less than 10.0%	More than 2.5 % but less than 10.0%	Not more than 2.5%
Milk protein	Not less than 3.5%	Not less than 3.5%	Not less than 3.0%

Table 5.4.1: Production of Ice Cream

Varieties of Ice Cream in a Typical Dairy Processing Plant

Following are some types of ice creams produced in a dairy processing plant:

- Plain ice cream
- Nut ice cream
- Kulfi
- Sundae
- Sundae swirl
- Stick varieties of ice cream
- Cone
- Candy
- Probiotic ice cream

- Dolly

Composition of Ice Cream

The following table explains the composition of ice cream:

Particulars	Composition
Milk fat	13-14%
Milk protein	3.7-4.25%
Stabiliser/emulsifier	0.35%
Total solids	35.00 – 42.5%
Sugar	16.00%
Minimum weight (gram/litre)	540
SPC	1,00,000 CFU/ml
Coliform (microorganisms)	NMT 10 CFU/ml (Nil in export ice-cream)

Table 5.4.2: Composition of Ice Cream

Overview of the Process of Ice Cream Manufacturing

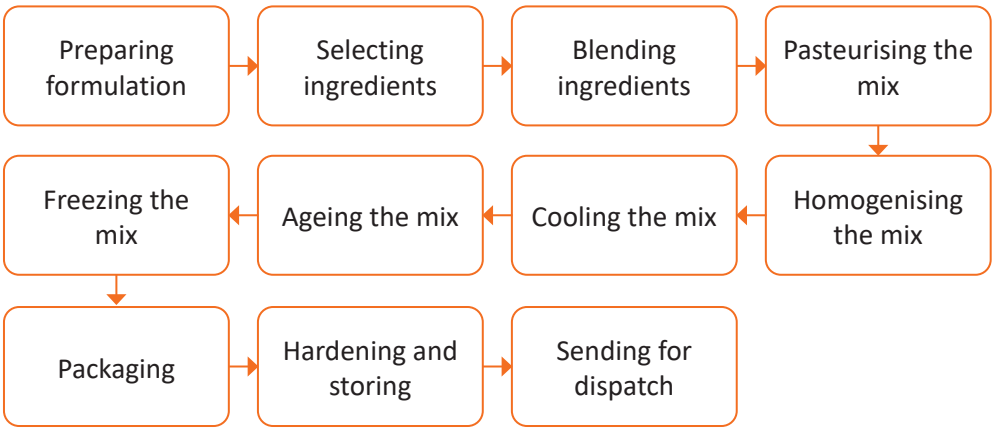

Fig. 5.4.1. Overview of the process of ice cream manufacturing

UNIT 5.5: Production Process of Ice Cream and Syrup

Unit Objectives

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

1. Demonstrate the process of producing plain ice cream
2. Demonstrate the process of producing frozen desserts
3. Demonstrate the process of producing premium ice cream
4. Demonstrate the process of producing kulfi

5.5.1 Production for Plain Ice Cream

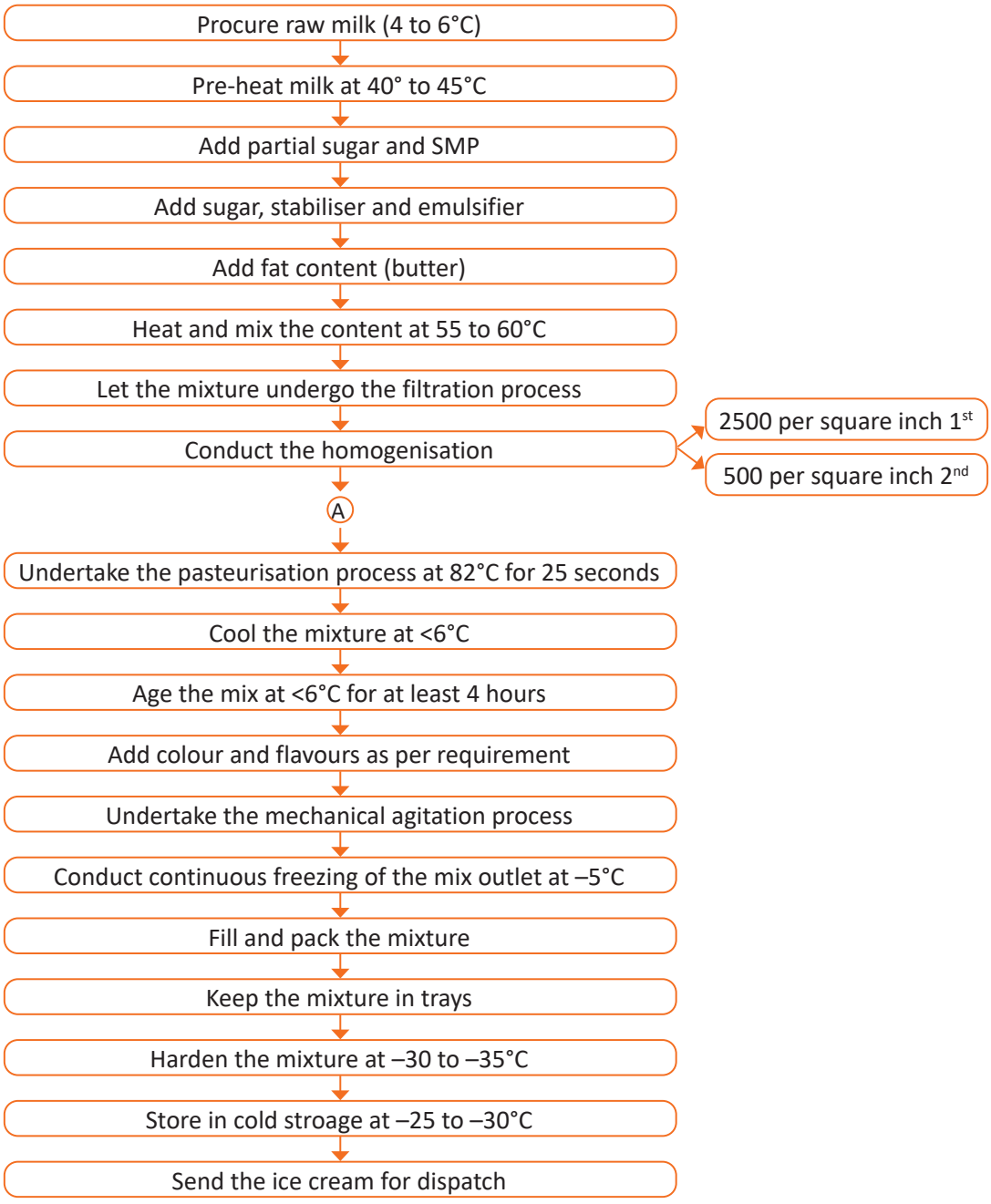

Fig. 5.5.1. Production process of plain ice cream

5.5.2 Production of Frozen Desserts

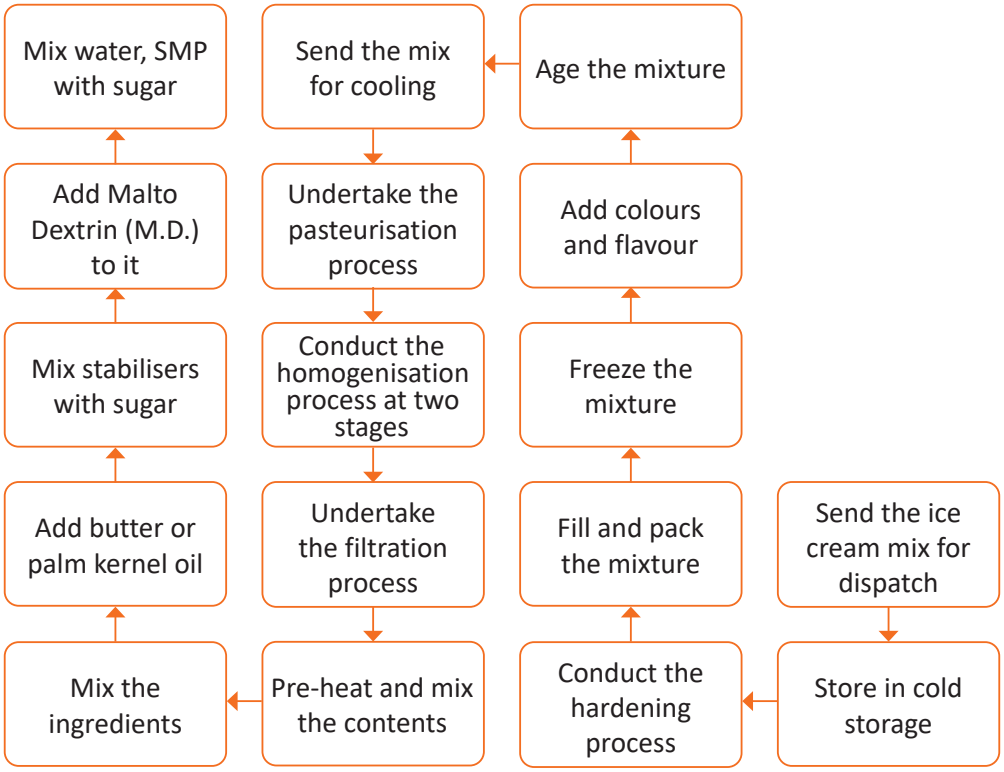

Fig. 5.5.2. Production process of frozen desserts

5.5.3 Production of Premium Ice Cream

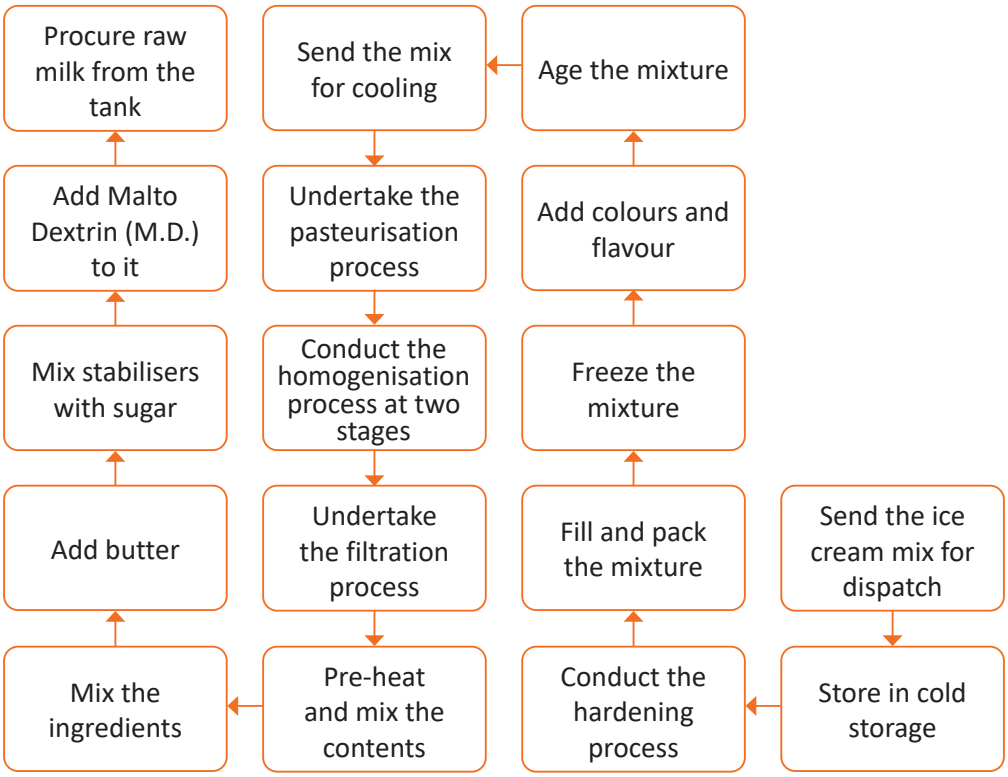

Fig. 5.5.3. Production process of premium ice cream

5.5.4 Production of Kulfi

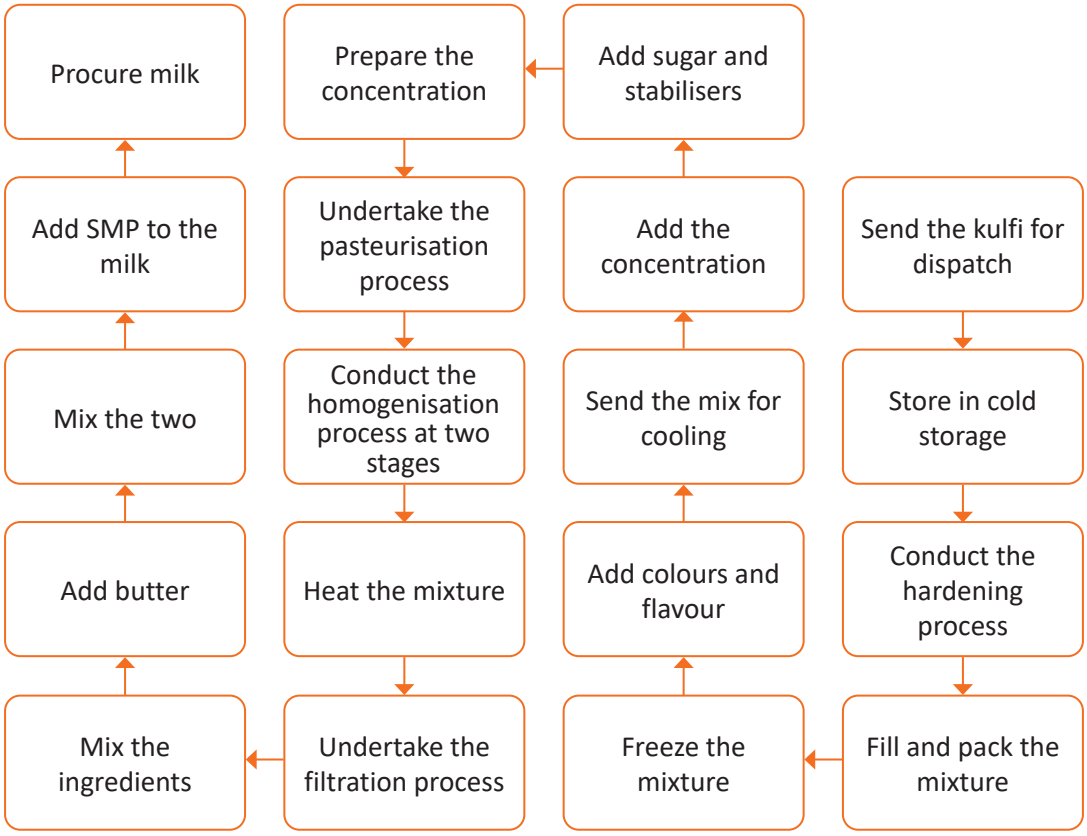

Fig. 5.5.4. Production process of kulfi

5.5.5 Production of Syrup

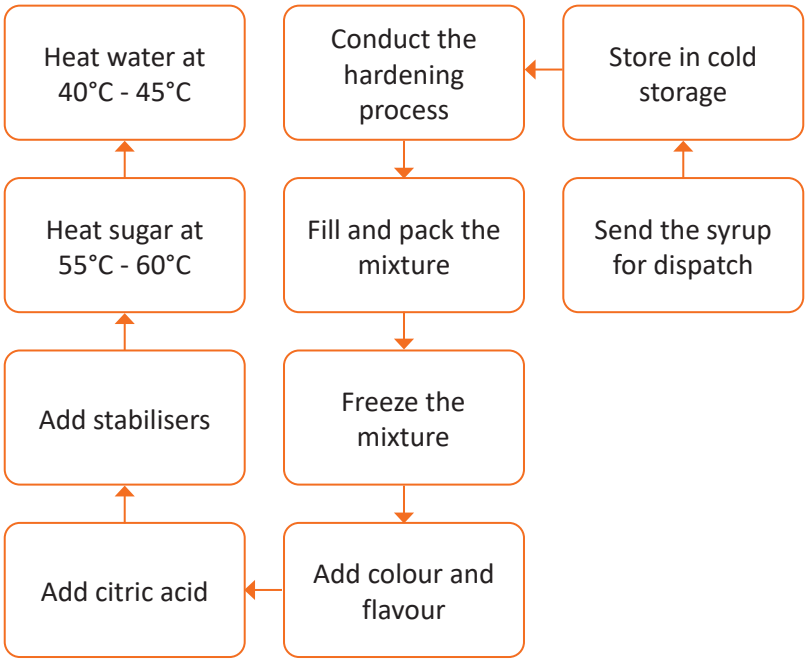

Fig. 5.5.5. Production process of syrup

UNIT 5.6: Producing Ice Cream

Unit Objectives

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

1. List the composition of different types of ice cream
2. Demonstrate the process of making the mix
3. State the method of pre-heating ice cream mix
4. State the method of blending
5. State the process of filtration
6. State the method of homogenisation of ice cream mix
7. State the method of pasteurisation of ice cream mix
8. State the method of cooling the ice cream mix
9. State the method of ageing the ice cream mix
10. State the method of freezing the ice cream mix
11. State the method of estimating overrun in ice cream

5.6.1 Figuring the Mix

Figuring the mix is the most important process while producing ice-cream. This is because while figuring the mix, an ice cream processing technician has to:

- Consider the composition of the mix
- Decide on the amount of ice-cream to be made
- Decide the composition of ingredients to be used

The following tables show the composition of different types of ice creams:

Ingredients for Frozen Dessert Mix	Quantity, per 100 kg mix
Skim milk	65 kg (8.5 % SNF)
Palm kernel oil	9.0 kg
Sugar	16.5 kg
Malto dextrin	2.0 kg
Sampoorna (stab.)	0.35 kg
Water	1.71 kg

Ingredients for Plain Ice Cream Mix	Quantity per 100 kg mix
Milk (fat 6 %, SNF 8.5 %)	66.50 kg
Butter (80 % fat)	9.26 kg
SMP	5.31 kg
M.D.	1.00 kg
Sugar	16.5 kg
Sampoorna (stab.)	0.35 kg
Water	1.08 kg

Ingredients for Premium Ice Cream Mix	Quantity, per 100 kg mix
Milk (fat 6 %, SNF 8.5 %)	65.00 kg
Butter	11.38 kg
SMP	6.48 kg
Sugar	16.5 kg
Stab. (SE-40)	0.10 kg
Stab.(102C)	0.25 kg

Table 5.6.1: Figuring the Mix

Making the Mix

In the blender, ingredients are heated to help dissolving and blending. The mixing process incudes a small batch operation where each ingredient is weighed into the blender.

The fundamental requirement of mix formulation is to obtain a well-balanced mix, which also satisfies the legal standards. The other important consideration is a correct total solid to water ratio. If the ratio is too high, it results in sandiness and rough texture of the ice cream. If the ratio is too low, it results in the ice-cream having glassy or icy texture along with weak body.

Usually, total solid of 36.0 % to 40.0 % results into organoleptically acceptable ice-cream. There is inverse relation between fat and SNF in ice-cream mix. For instance, super premium ice-cream (high fat) will have lower SNF than average (moderate fat) ice-cream. Thus, 16 % fat ice-cream should ideally have 17 % sugar as against 15 % sugar for ice-creams with 10 % fat.

The methods used to calculate the correct proportion of ingredients are:

- Pearson square method
- Serum point method
- Formula tables graphics method
- Algebraic method

5.6.2 Pre-Heating

The objective of pre-heating the mix is to increase the temperature of the mix for appropriate mixing of all ingredients. It helps to avoid lumpiness of dry ingredients. It also increases the efficiency of pasteurisation and homogenisation of the mix. Usually, pre-heating is conducted at a temperature between 20 to 25°C.

5.6.3 Blending

Blending is the initial step for operation of the ice cream manufacturing process. In this step, all the ingredients are added to milk at different temperatures as per the process. After this, small batch operations are carried out for different ingredients.

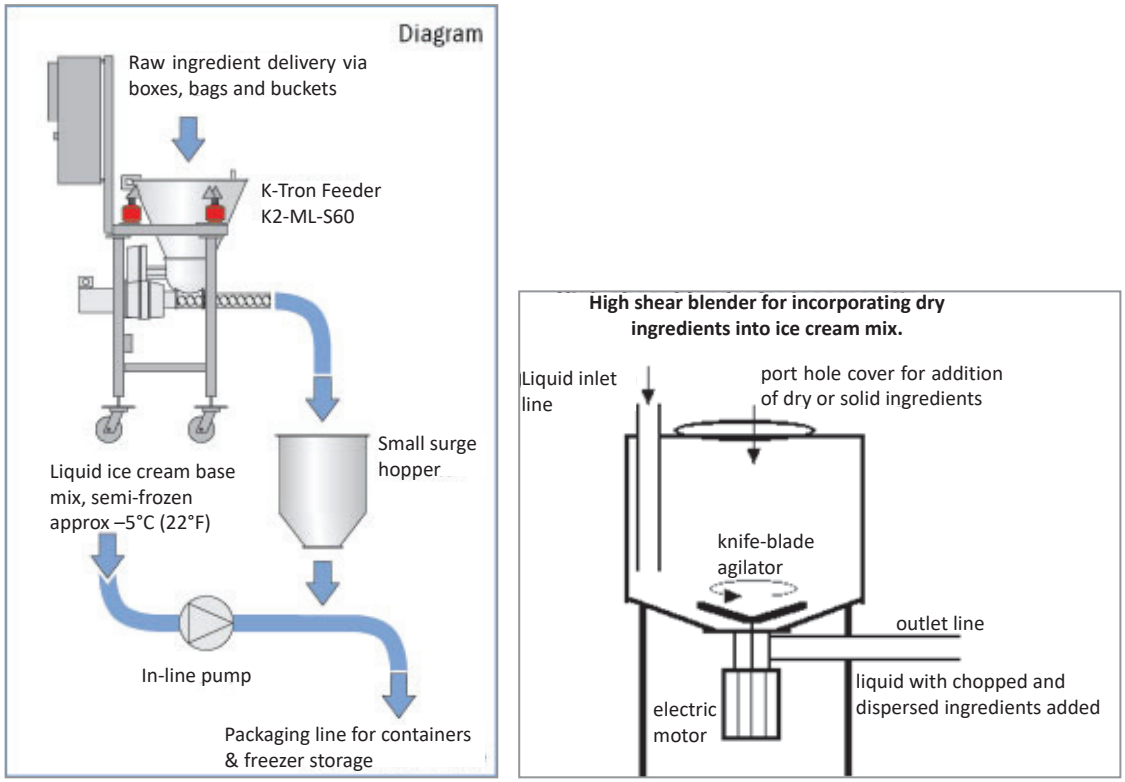

Fig. 5.6.1. Blending

5.6.4 Filtration

The objective of filtration in the mixing section is to remove extraneous material from the mix. A duplex filter of 80-mesh screen is generally used for this. Filtration is carried out at about 45-460C after discharging the mix from the regeneration section. The main aim of using regeneration section is to increase the temperature of the mix as well as to increase the efficiency of pasteuriser.

5.6.5 Homogenisation of the Ice Cream Mix

It is the most essential process of ice-cream making. The main purpose of homogenisation is to make a permanent and uniform suspension of fat. This is done by reducing the size of the fat globule to a very small diameter preferably not more than 2 microns.

The benefits of the homogenisation are:

- Prevents fat separation during ageing
- Produces more uniform ice cream with a smoother texture
- Improves whipping ability
- Shortens ageing period
- Decreases the risk of churning occurring in the freezer
- Helps in the process of stabilisation

There is special arrangement for homogenisation of mix, which is carried out at 63–770°C. At lower temperature, homogenisation increases the formation of fat globules.

Homogenisation pressure

At the 1st stage: 2500 psi

At the 2nd stage: 500 psi

Pasteurisation of the Ice Cream Mix

An ice cream mix may contain various types of microorganisms, especially pathogens. Hence, it is important to pasteurise the ice cream mix. The advantages of pasteurisation are:

- Renders the mix completely free of pathogenic bacteria, without disturbing the nutritive and acceptable quality of the mix
- Dissolves and helps to blend the ingredients of the mix
- Improves the flavour of the mix
- Improves the ice cream's keeping quality
- Helps to maintain uniformity in production

Proper pasteurisation consists of:

- Rapidly heating the mix to a definite temperature
- Holding it at that temperature for a definite minimum period of time
- Rapidly cooling it to below 5°C

The general standards for pasteurising the ice cream mix are:

- LTLT method – 68.5°C for not less than 30 minutes
- HTST method – 80°C for not less than 25 seconds

For processing ice cream, continuous type pasteurisation method is employed most of the times. The mix is pasteurised at 82 to 86°C for 25 seconds.

5.6.6 Cooling and Ageing of the Ice-Cream Mix

Cooling

After heating/pasteurizing, the mix is sent to the cooling section. In this section, temperature is reduced from 82°C/84°C to 6°C. This is done to facilitate the process of ageing the ice-cream mix.

Ageing

Ageing refers to the process of holding the mix at a low temperature for a definite time before freezing. The ageing temperature has to be maintained at 5°C. The ageing time under average commercial conditions may be 3-4 hours. Ageing is used to:

- Improve body and texture of ice-cream
- Improve whipping capacity of mix
- Increase maximum overrun
- Increase resistance to melting

5.6.7 Freezing the Ice Cream Mix

Freezing the Mix

After ageing, the mix is ready for freezing. Freezing is important as it helps to ensure the quality, palatability, and satisfactory overrun in the finished product.

When the ice-cream is partially frozen to a certain consistency, it is put into packages and quickly transferred to cold storage rooms. This is where freezing and hardening process gets completed without the process of agitation. The freezing time for continuous ice-cream freezers is 24 seconds for temperatures between -6 to -5°C.

Freezing Process

The function of the freezing process is to freeze a portion of the water of the mix and to incorporate air into the mix. This is done by:

- Lowering the temperature of the mix from ageing temperature to the freezing point
- Freezing a portion of the water in the mix
- Incorporating air into the mix
- Cooling ice-cream from the temperature at which it is drawn from the freezer
- Hardening the ice-cream till room temperature while sensible heat is being removed and before any ice crystal formed

This process takes less than 2 minutes.

5.6.8 Overrun in Ice Cream

Overrun in Ice Cream

Overrun is the volume of ice cream obtained in excess of the volume of the mix. It is expressed in percentage. This increased volume is due to the air incorporated during the freezing into the ice cream. It mainly depends upon:

- The composition of the mix
- The method of processing

Overrun gives the body of ice cream mix proper texture and palatability necessary to a good quality product. Too much of overrun produces snowy, fluffy, unpalatable ice-cream. Too little overrun produces soggy, heavy products.

Determination of Overrun in Ice Cream

Overrun in ice cream depends upon the weigh or volume.

Depending upon the weight:

% overrun = {(weight of unit volume of mix – weight of unit volume of ice cream) × 100} ÷ weight of unit volume of ice cream

Depending upon the volume:

% overrun = {(volume of ice cream – volume of mix) ×100} ÷ volume of mix

UNIT 5.7: Packaging, Hardening and Storage of Ice Cream

Unit Objectives

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

1. List the factors to consider during the packing of ice- ream
2. List the materials used for packaging ice cream
3. State the method of hardening and storage in ice cream

5.7.1 Packaging

After drawing the ice cream from the freezer, it is usually collected in containers to give it desired shape or size for convenient handling during the hardening and marketing processes. The chief requirements for packaging of ice cream are:

- Protection against contamination
- Attractive appearance
- Ease of opening and re-closure
- Ease of disposal
- Protection against moisture loss
- Ability to withstand temperature fluctuation

The packaging materials generally used are:

- Wax coated fibre board cartons
- Polythene wax blends for protection against moisture and oxygen
- Plastic cylinder containers
- Polycups
- Sticks
- Bars

Fig. 5.7.1: Packaging Material

5.7.2 Hardening and Storage of Ice Cream

For hardening, ice cream is put into trays and placed in hardening tunnels. At this point, ice cream has a semi-fluid consistency and is not stiff enough to hold its shape. During the process of hardening, ice cream is brought to a temperature between -25 to -35°C or below. In the freezer, quick hardening is desirable since slow hardening favours large ice crystals and coarseness. The factors affecting hardening time are:

- Size and shape of the ice cream package
- Speed of air circulation
- Temperature of cooling air
- Sections of hardening room
- Temperature of ice cream drawn from the freezer
- Composition of mix
- % overrun in the ice cream being hardened

UNIT 5.8: Post Production Cleaning and Maintenance

Unit Objectives

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

1. Arrange for proper cleaning of production area, equipment, and tools used
2. Organize periodic maintenance of all production machineries

5.8.1 Post Production Cleaning Method

This explains the method of cleaning the work area after production.

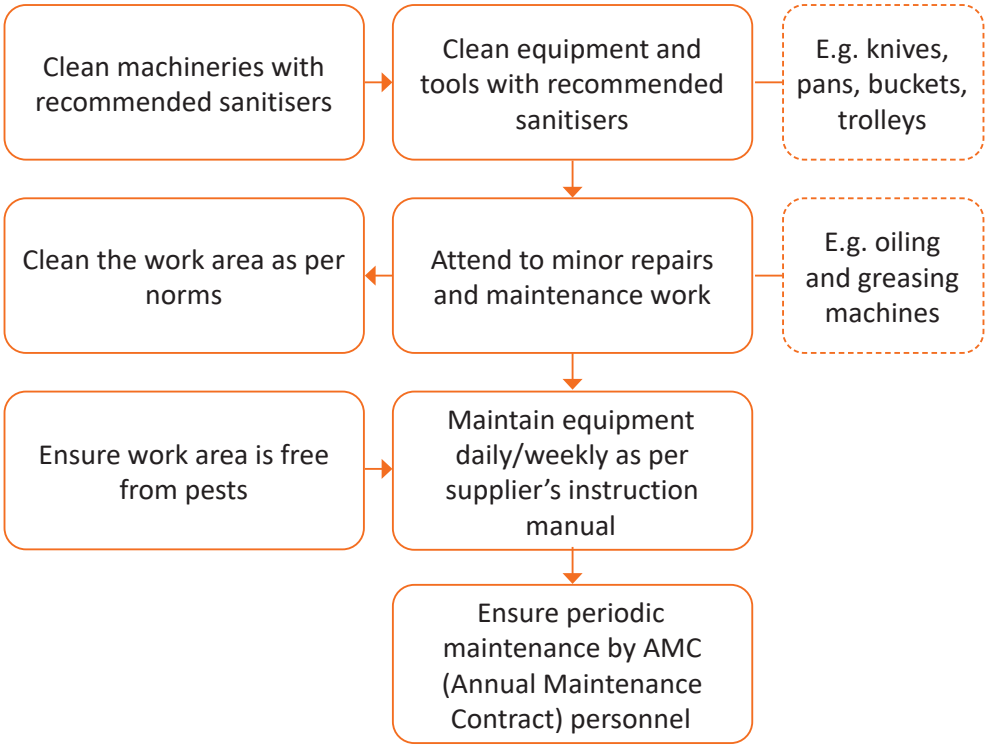

Fig. 5.8.1. Post production cleaning method

Practical

Objective

1. Execute the process of pasteurization and aging of ice cream mix

Materials Required (symbol)

- Ice Cream Mix
- Homogeniser
- Pasteurizer
- PPE
- Toolbox
- Standard Operating System (SOP)
- Safety Manual

Method:

1. Take the well-blended ice cream mix into pasteurizer for pasteurization of the ice cream mix
2. Keep the temperature and time combination for pasteurization as per BIS:
    - For Batch Method-68.5◦C for not less than 30 minutes
    - HTST method -80◦C for not less than 25 seconds
    - Vacreation-90◦C for not less than 1-3 seconds
    - UHT Pasteurization 98.8-128.3◦C for not less than 0-40 seconds
- Homogenise the mix in the homogeniser
- Keep the homogeniser temperature ranging from 63 to 77◦C and a pressure of 2000 to 2500 psi (135 to 170 kg/cm2) with one valve or 2500 to 3000 psi (170 to 200 kg/cm2) on the first stage of homogenisation and 500 psi (35kg/cm2) on the second stage of homogenisation
- Rapidly cool the mix to a temperature below 4◦C using a plate heat exchanger
- Leave the cooled mix to age preferably for a period of 24 hours at 4◦C temperature

Precautions:

1. Wear PPE while operating machines
2. Safely handle all electrical systems
3. Ensure that the machines are turned off after the operation
4. Ensure that the rapid heating and holding of the mix at definite temperature and rapid cooling below 5◦C is maintained for proper pasteurization

Observation:

Sr. No.	Name of Equipment	Activities Completed
1		
2		
3		
4		
5		

Conclusion:

Sr. No.	Conclusion			
1				
2				
3				
4				
5				

Practical

Objective

1. Execute the process of freezing, packing, and storing of ice cream mix.

Materials Required (symbol)

- Milk
- Sweetening Agents
- Fruit and fruit products
- Egg and egg products
- Coffee, cocoa
- Chocolate
- Condiments
- Spices
- Ginger
- Nuts
- Cake or Cookies
- PPE

- Toolbox
- Standard Operating System (SOP)
- Safety Manual

Method:

1. Freeze the cool mix by either of the two methods given below:
   - Mix the proper amount of colour and flavouring agents, put it into the freezer for quick freezing while being agitated to incorporate air to control crystal formation
   - When ice cream is partially frozen to the proper consistency take it from the freezer into packages and quickly transfer it to cold storage rooms and complete the process of the freezing and hardening (-25 to -35◦C or below) without agitation
2. Pack the hardened ice cream properly using the packing machine as per SOP
3. Send the packed ice creams to be stored in chill room for storage and dispatch

Precautions:

1. Wear PPE while operating machines
2. Safely handle all electrical systems
3. Ensure that machines are turned off after the operation
4. Keep in mind that small ice crystals are necessary to give smoothness, texture, palatability, and satisfactory overrun in the finished ice cream

Observation:

Sr. No.	Name of process	Activity Performed
1		
2		
3		
4		
5		

Conclusion:

Sr. No.	Conclusion			
1				
2				
3				
4				
5				

Exercise

1. Fill in the blanks with the correct option.

a. Pasteurisation involves _____ destruction of harmful microorganisms.

i. complete ii. partial iii. incomplete iv. slow

b. Organoleptic test is all about testing the milk through _____.

i. sense of sight, smell and taste ii. by machineries
iii. by advance equipment iv. microbiologically

c. The full form of C.O.B. test is _____.

i. Clot over boiled ii. Clot on boiler
iii. Clot on boiling iv. Concentration on boiling

d. The freezing time and drawing temperature for continuous ice-cream freezers are 24 seconds for _____.

i. –36 to –35°C ii. 36 to 35°C
iii. –6 to –5°C iv. 6 to 5°C

e. LTLT method is used for _____ cream and ice-cream.

i. pasteurising ii. heating
iii. cooling iv. rinsing

f. Pre-heating of ice-cream mix is done to _____ lumpiness of the dry ingredients.

i. avoid ii. increase
iii. decrease iv. assist

g. _____ helps to remove extraneous material from the ice-cream mix.

i. Blending ii. Filtration
iii. Processing iv. Cleaning

h. Ageing is the process of _____ the mix at a low temperature before freezing.

i. ageing ii. cooling
iii. holding iv. drying

i. Before hardening, ice-cream has a _____ consistency.

i. liquid ii. hard
iii. solid iv. semi-solid

j. Overrun is the volume of ice-cream obtained in _____ of the volume of the mix.

i. less ii. excess
iii. lower iv. minimum

2. Arrange the following in the right sequence.

Procedure/Steps	Order the steps (as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10)
a. Ageing the mix	
b. Sending for dispatch	
c. Pasteurising the mix	
d. Preparing the formulation	
e. Freezing the mix	
f. Hardening and storing	
g. Homogenising the mix	
h. Cooling the mix	
i. Blending ingredients	
j. Selecting ingredients	

Notes

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

https://www.youtube.com/watch?v=R7kpys-iiRU

Manufacturing Process of Ice-cream

https://www.youtube.com/watch?v=uf7wGAXg4b8

Demonstration video on Ice-cream processing

https://www.youtube.com/watch?v=TarvglQ3cPg&t=4s

Details on setting an Ice-cream Industry

https://www.youtube.com/watch?v=aOsebi8cAzA

Storage Facility

https://www.youtube.com/watch?v=kAO6VRXH7jg

Packaging and Storage of Ice-cream

https://www.youtube.com/watch?v=vFbDzfCpy54

Packaging technology for Ice-cream

6. Complete Documentation and Record Keeping Related to Production of Ice Cream

Unit 6.1 - Documentation and Record Keeping

FIC/N2016

Key Learning Outcomes

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

1. State the need for documenting and maintaining records of raw materials, process, and finished products;
2. State the method of documenting and recording the details of raw material to final finished product;
3. State ERP system and maintaining documentation via ERP

UNIT 6.1: Documentation and Record Keeping

Unit Objectives

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

1. State the need for documenting and maintaining records of raw materials, process, and finished products;
2. State the method of documenting and recording the details of raw material to final finished product.

6.1.1 Need for Documentation

Every organisation 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:

- It gives detailed knowledge about running of the business
- It helps to control product quality
- It helps to keep track of the money invested in the business
- It helps to identify the separate costs of raw material or product ingredients
- It helps to identify the production cost of a particular process
- It helps to ensure that quality assurance procedures are followed
- It helps to ensure that the production unit is running smoothly/effectively
- It works as an evidence for legal procedures
- It helps to set an appropriate product price
- It helps to take corrective measures at the right time

6.1.2 How to Keep Records?

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

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

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 log books (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.

Example of a stock control book:

• Product Name			• Batch Number	
• Raw material*	• Supplier	• Results of inspection for:		
		A	B	C

6.1.3 Introduction to ERP Solutions

ERP System

ERP stands for Enterprise Resource Planning. ERP is an enterprise-wide information system that facilitates the flow of information and coordinates all resources and activities within the business organisation.

ERP Functions

Functions typically supported by the system include:

- manufacturing
- logistics
- accounting
- inventory
- distribution
- shipping
- invoicing

A wide variety of business activities including sales, marketing, billing, production, inventory management, human resource management, and quality control are supported by these systems.

At present, many companies in food processing sector are using ERP systems of different ERP system providers. Some of the top ERP systems used by the organisations are:

- Batchmaster Manufacturing
- Sage
- SAP
- Plex
- Process Pro
- Sys Pro
- Microsoft Dynamics
- Deacom
- Netsuite

Exercise

1. Tick the correct options

a. What is the need for documentation?

i. It gives detailed knowledge about the running of a business. ☐

ii. It helps to control product quality. ☐

iii. It helps to keep track of the money invested in the business. ☐

iv. It helps to identify the separate costs of raw material or product ingredients. ☐

v. It helps to identify the production cost of a particular process. ☐

vi. It helps in raw material storage. ☐

vii. It helps to ensure that quality assurance procedures are followed. ☐

viii. It helps to ensure that the production unit is running smoothly/effectively. ☐

ix. It works as an evidence for legal procedures. ☐

x. It helps to clean the food handling equipment and machineries. ☐

xi. It helps in sending the produce to the market. ☐

xii. It helps to set an appropriate product price. ☐

xiii. It helps to take corrective measures at the right time. ☐

b. Production records keep a log of _____ .

i. the quantity and type of raw materials. ☐

ii. the amount of finished products stored. ☐

iii. the quantity and type of ingredients used. ☐

iv. the processing conditions in which production took place (e.g. the temperature set or the air pressure applied). ☐

v. the product quality. ☐

2. Match the columns

Column A	Column B
a. Every production process completed is given a number	i. Stock control books
b. The details of raw material procurement is noted	ii. Batch number
c. The details of production process is noted	iii. Quality procedures are followed
d. The details of product sales is recorded	iv. Legal evidence
e. Records serve as	v. Processing log books
f. Properly maintained records help to identify whether	vi. Sales and distribution log

3. Complete the process of documentation and maintaining records of production and finished products. Fill in the blanks with the correct options given below.

a. Document and maintain the records of _____.

b. Document the finished products details _____.

c. Maintain the record of _____ related to finished products.

d. Verify the documents and _____ in case of quality concerns and for quality management system audit.

e. Document process details such as type of raw material used, process parameters (temperature, time, etc. as applicable) for entire process handled _____ for all products produced.

Options:

1. in process chart or production log
2. as per company standards
3. finished products
4. track from finished product to raw materials
5. observations or deviations (if any)

Notes

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7. Employability Skills

DGT/VSQ/N0101

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

https://eskillindia.org/NewEmployability

Employability Skills

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8. Annexure

Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
1. Introduction	UNIT 1.2: Introduction to the Food Processing Industry	1.2.1 Food Processing	11	https://www.youtube.com/watch?v=J-2EiMVNtp-M&t=23s	Overview of Food Processing Industry
	UNIT 1.3: Introduction to the Dairy Industry in India	1.3.2 Dairy Industry in India	11	https://www.youtube.com/watch?v=4XuvGYvKGnE	Overview of Dairy Industry
		1.3.1 Need for Processing Milk	11	https://www.youtube.com/watch?v=jTcvrizLEP4	Orientation video
	UNIT 1.4: Attributes of an Ice Cream Processing Technician	1.4.1 Roles and Responsibili-ties	11	https://www.youtube.com/watch?v=-2CmMaIbDjE	Introduction to Ice-cream processing
		1.4.1 Roles and Responsibili-ties	11	https://www.youtube.com/watch?v=HUAtwVcVbgU	Roles and Responsibilities

Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
2. Food Safety, Hygiene and San-itation for Processing Food Products	UNIT 2.3: Good Manufactur-ing Practices (GMP)	2.3.1 Good Manufactur-ing Practices (GMP)	33	https://www.youtube.com/watch?v=R-S4A-uczS6E&t=489s	GMP,GHP & FSMS
	UNIT 2.1: Sanitation and Hy-giene	2.1.1 Personal Sanitation	33	https://www.youtube.com/watch?v=CD0XLUutibk&t=40s	Cleaning facilities
	UNIT 2.5: Introduction to Food Safety	2.5.2 Food Safety Hazard and Risk	33	https://www.youtube.com/watch?v=iq8jOuZ5k6k&t=22s	Pest Control Program
3. Prepare and Maintain Work Area and Process Machineries for Production of Ice Cream	UNIT 3.2: Sanitisation of the Work Area	3.2.1 Cleaning & Sanitizing Work Area, Machinery, Tools, and Equipment	55	https://www.youtube.com/watch?v=doOhWost2io	Facilities and Utilities
	UNIT 3.1: Usage and Maintenance of Equipment in Dairy Processing Plant	3.1.1 Equipment Used in Dairy Processing	55	https://www.youtube.com/watch?v=ftogJKHQAX4	Equipments used in Ice-cream processing industry
5. Produce Ice Cream	UNIT 5.4: Introduction to Ice Cream	5.4.1 Production of Ice Cream	97	https://www.youtube.com/watch?v=R7kpys-iiRU	Manufacturing Process of Ice-cream

Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
	UNIT 5.6: Producing Ice Cream	5.6.1 Figuring the Mix	97	https://www.youtube.com/watch?v=uf7wGAXg4b8	Demonstration video on Ice-cream processing
	UNIT 5.4: Introduction to Ice Cream	5.4.1 Production of Ice Cream	97	https://www.youtube.com/watch?v=TarvglQ3cPg&t=4s	Details on setting an Ice-cream Industry
	UNIT 5.7: Packaging, Harden-ing and Storage of Ice Cream	5.7.2 Harden-ing and Storage of Ice Cream	97	https://www.youtube.com/watch?v=aOsebi8cAzA	Storage Facility
		5.7.1 Packaging	97	https://www.youtube.com/watch?v=kAO6VRXH7jg	Packaging and Storage of Ice-cream
		5.7.1 Packaging	97	https://www.youtube.com/watch?v=vFbDzfCpy54	Packaging technology for Ice-cream
Employability Skills (30 Hrs)				https://eskillindia.org/NewEmployability	

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