



**RQF LEVEL 5**



**FOPIC503**

**FOOD PROCESSING**

# Ice Cream Production

**TRAINEE'S MANUAL**

October, 2024



# ICE CREAM PRODUCTION



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## ACRONYMS

**%:** Percentage

**°C:** Degree Celsius

**°F:** Degree Fahrenheit

**ATP:** Adenosine Triphosphate

**CBT/A:** Competency-Based Training/Assessment

**CIP:** Cleaning In Place

**COP:** Cleaning Out of Place

**CSR:** Corporate Social Responsibility

**EFSA:** European Food Safety Authority

**EU:** European Union

**FDA:** Food and Drug Administration

**FIFO:** First In First Out

**FOP:** Food Processing

**GMP:** Good Manufacturing Practices

**HACCP:** Hazard Analysis and Critical Control Point

**HDPE:** High-density polyethylene

**hrs:** Hours

**HTST:** High Temperature Short Time

**IPA:** Isopropyl Alcohol

**ISO:** International Standardizations Organization

**KOICA:** Korean International Cooperation Agency

**LTLT:** Low Temperature Long Time

**MSNF:** Milk Solids Non-Fat

**PE:** Polyethylene

**PET:** Polyester

**pH:** Potential of Hydrogen

**PLA:** Polylactic acid

**PP:** Polypropylene

**PPE:** Personal Protective Equipment

**RPM:** Revolution Per Minute

**RQF:** Rwanda Qualification Framework

**RTB:** Rwanda TVET Board

**TQUM:** TVET Quality Management Project

**TVET:** Technical and Vocational Education and Training

**UHT:** Ultra-High Temperature

**USDA:** United States Department of Agriculture

## INTRODUCTION

This trainee's manual includes all the knowledge and skills required in food processing specifically for the module of "**Ice Cream Production.**" Trainees enrolled in this module will engage in practical activities designed to develop and enhance their competencies. The development of this training manual followed the Competency-Based Training/Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainee's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainee, you will start by addressing questions related to the activities, which are designed to foster critical thinking and guide you towards practical applications in the labor market. The manual also provides essential information, including learning hours, required materials, and key tasks to complete throughout the learning process.

All activities included in this training manual are designed to facilitate both individual and group work. After completing the activities, you will conduct a formative assessment, referred to as the end learning outcome assessment. Ensure that you thoroughly review the key readings and the 'Points to Remember' section.

## **MODULE CODE AND TITLE: FOPIC503 ICE CREAM PRODUCTION**

**Learning Outcome 1: Prepare tools, materials, equipment and work place**

**Learning Outcome 2: Prepare cream mixture**

**Learning Outcome 3: Preserve ice cream**

## Learning Outcome 1: Prepare Tools, Materials, Equipment and Work place



### Indicative contents

**1.1 Selecting tools and equipment used in ice cream production**

**1.2 Selecting materials used in ice cream production**

**1.3 Cleaning tools, equipment, and workplace**

**1.4 Arranging workplace in ice cream production**

**1.5 Preparing ingredients used in ice cream production**

**1.6 Standardizing Cream**

**1.7 Identifying the types of ice cream**

### Key Competencies for Learning Outcome 1: Prepare Tools, Materials, Equipment and workplace

| Knowledge                                                                                                                                                                                                                                                                                                                                                                                                                                               | Skills                                                                                                                                                                                                                                                                                                                                                                                                                          | Attitudes                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Description of tools and equipment used in ice cream production</li><li>• Description of cleaning products used in ice cream production</li><li>• Description of ingredients used in ice cream production</li><li>• Description of types of packaging materials used in ice cream production</li><li>• Calculation of ratios for cream standardization</li><li>• Identification of types of ice cream</li></ul> | <ul style="list-style-type: none"><li>• Selecting tools and equipment used in ice cream production</li><li>• Adjusting tools and equipment used in ice cream production</li><li>• Selecting materials used in ice cream production</li><li>• Cleaning the workplace</li><li>• Arranging workplace for ice cream production</li><li>• Preparing ingredients used in ice cream production</li><li>• Standardizing Cream</li></ul> | <ul style="list-style-type: none"><li>• Being careful while selecting and handling tools, materials and equipment as some of them can be harmful</li><li>• Paying attention while cleaning and arranging workplace to minimize accidents that may occur</li><li>• Being accurate while measuring ingredients and standardizing cream</li></ul> |



**Duration: 20 hrs**

**Learning outcome 1 objectives:**



By the end of the learning outcome, the trainees will be able to:

1. Describe properly tools and equipment used in ice cream production
2. Describe appropriately materials used in ice cream production
3. Select properly materials, tools and equipment used in ice cream production
4. Adjust correctly tools and equipment used in ice cream production
5. Clean effectively the workplace for ice cream production
6. Arrange correctly the workplace for ice cream production
7. Prepare accurately ingredients used in ice cream production
8. Calculate correctly ratios for cream standardization
9. Identify appropriately the types of ice cream according to ice cream specification
10. Standardize properly the cream based on ice cream specification



**Resources**

| Equipment                                                                                                                                                                                                      | Tools                                                                                                                                                                                                                                                                                                    | Materials                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Pasteurizer</li><li>• Ice cream hardening machine</li><li>• Freezer</li><li>• Fridge</li><li>• Homogenizer</li><li>• Cream separator</li><li>• Working table</li></ul> | <ul style="list-style-type: none"><li>• Whisks</li><li>• Lactometer</li><li>• Measuring cylinder</li><li>• Alcohol gun</li><li>• Sieve</li><li>• Spade spoons</li><li>• Jags</li><li>• pH meter</li><li>• Thermometer</li><li>• Mops</li><li>• Brushes</li><li>• Milk cans</li><li>• Squeegees</li></ul> | <ul style="list-style-type: none"><li>• Fresh milk</li><li>• Cream</li><li>• Stabilizers</li><li>• Butter</li><li>• Sweeteners</li><li>• Colours</li><li>• Flavours</li><li>• Packaging materials</li><li>• Labels</li><li>• Cooking stove</li><li>• Cleaning products</li><li>• Alcohol.</li></ul> |



## Indicative content 1.1: Selecting tools and equipment used in ice cream production



Duration: 3 hrs



### Theoretical Activity 1.1.1: Description of tools and equipment used in ice cream production



#### Tasks:

1: Answer the following questions related to the description of tools and equipment used in ice cream production:

- i. Based on your understanding, identify tools and equipment used in ice cream production
- ii. What are the safety precautions of tools and equipment used in ice cream production?

2: Write your answers on paper, flip chart.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.1.1



### Key readings 1.1.1.: Description of tools and equipment used in ice cream

#### Production

- List and uses of tools and equipment used in ice cream production

| S/N | Name of tool/equipment | Image                                                                               | Use                                                                                                                    |
|-----|------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1   | Ice cream maker        |  | This machine churns and freezes the ice cream mixture simultaneously, incorporating air and creating a smooth texture. |

|   |               |                                                                                     |                                                                                                                         |
|---|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 2 | Batch freezer |    | A specialized machine for freezing large quantities of ice cream. It allows for controlled temperature and consistency. |
| 3 | Mixing tank   |    | Used for combining ingredients like milk, cream, sugar, and flavorings before the ice cream mixture is processed.       |
| 4 | Pasteurizer   |   | Heats the mixture to kill harmful bacteria and ensure safety, while also improving the texture of the ice cream.        |
| 5 | Homogenizer   |  | Breaks down fat molecules in the mixture to create a uniform texture and prevent separation.                            |
| 6 | Refrigerator  |  | Stores the ice cream at low temperatures to maintain its quality and prevent melting before packaging.                  |

|    |                          |                                                                                     |                                                                                                                                            |
|----|--------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 7  | Ice cream mixer          |    | For adding flavors, fruits, nuts, and other mix-ins to the ice cream base.                                                                 |
| 8  | Packaging machine        |    | Automates the process of filling, sealing, and labeling containers for retail sale.                                                        |
| 9  | Scoop and spade tools    |    | Used for serving and portioning ice cream. Scoops are typically used for softer ice creams, while spades can work through firmer textures. |
| 10 | Thermometer              |  | Ensures that mixtures are heated or cooled to the appropriate temperatures during production.                                              |
| 11 | pH-meter                 |  | Measures the acidity of the ice cream mixture, which can affect flavor and texture.                                                        |
| 12 | Ice cream tubs and cones |  | For serving and storing the final product. Tubs are used for bulk sales, while cones are popular for individual servings.                  |

|    |                           |                                                                                   |                                                                                                                     |
|----|---------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 13 | Carts or display freezers |  | For showcasing ice cream products in retail settings, keeping them frozen while making them accessible to customers |
| 14 | Cream separator           |  | machine used for separating and removing cream from whole milk                                                      |

- **Safety precautions of using tools and equipment**

When making ice cream, safety precautions must be taken to ensure the safety of both workers and the quality of the product.

Here are some safety guidelines for common tools and equipment used in ice cream making:

| SN | Tool/equipment name                 | Safety precautions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Ice Cream Makers and batch freezers | <ul style="list-style-type: none"> <li>✓ Ensure operators are trained to use the machine correctly and understand its functions.</li> <li>✓ Never open the machine lid while it is in operation to avoid contact with moving parts.</li> <li>✓ Follow the manufacturer's guidelines for filling capacity to prevent spills or damage to the machine.</li> <li>✓ Make sure the machine is grounded properly and free from water or wet surfaces to prevent electric shock.</li> <li>✓ Ensure the machine is turned off and unplugged before cleaning to avoid injuries from moving parts or electric shock.</li> </ul> |
| 2  | Blenders and mixers                 | <ul style="list-style-type: none"> <li>✓ Ensure that all blades are properly secured and covered with safety guards if necessary. Avoid contact with the blades while the machine is in operation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                         |

|   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                     | <ul style="list-style-type: none"> <li>✓ Always use lids on blenders to prevent splashes of hot or cold ingredients, which could cause burns or frostbite.</li> <li>✓ Turn off and unplug the equipment before removing the blades or making adjustments to prevent accidental injury.</li> </ul>                                                                                                                         |
| 3 | Pasteurizers        | <ul style="list-style-type: none"> <li>✓ Handle hot equipment and ingredients carefully to avoid burns. Use appropriate protective gear like gloves when handling hot surfaces.</li> <li>✓ Monitor pressure gauges and ensure pressure relief valves are functioning properly to prevent dangerous pressure buildup.</li> <li>✓ Regularly check and maintain the pasteurizer to ensure it is operating safely.</li> </ul> |
| 4 | Freezers            | <ul style="list-style-type: none"> <li>✓ Do not touch any freezing surfaces with bare hands to avoid frostbite or cold burns.</li> <li>✓ Ensure good ventilation when using deep freezers or cold storage areas to prevent oxygen displacement (especially with liquid nitrogen).</li> </ul>                                                                                                                              |
| 5 | Scoops and utensils | <ul style="list-style-type: none"> <li>✓ Ensure all scoops and utensils are properly sanitized between uses to prevent contamination.</li> <li>✓ Be cautious when using utensils that have sharp edges or tips, especially when scraping containers or scooping hardened ice cream.</li> </ul>                                                                                                                            |
| 6 | Packaging equipment | <ul style="list-style-type: none"> <li>✓ If using automated packaging systems, ensure safety sensors and stop mechanisms are functioning properly to avoid accidents.</li> <li>✓ Handle cutting and sealing tools with care to avoid cuts. Always use tools with protective covers or guards</li> <li>✓ Use gloves when handling hot or cold packaging materials to prevent burns or frostbite</li> </ul>                 |



### Practical Activity 1.1.2: Selecting and adjusting tools and equipment used in ice cream production



#### Task:

Referring to the previous theoretical activity 1.1.1, go to the ice cream production workshop and perform the following task:

- 1: Select and adjust the tools and equipment used in producing ice cream.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/ the workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.1.2
- 5: Perform the task provided in the application of learning 1.1.



#### Key readings 1.1.2: Selecting and adjusting tools and equipment used in ice cream production

- **Selection criteria tools and equipment used in ice cream production**

Below are the key selection criteria to consider when choosing tools and equipment for ice cream production:

- ✓ **Capacity and production volume**
- ✚ **Batch Size:** Consider the production capacity required (small-scale vs. large-scale).
- ✓ **Consistency and quality**
- ✚ **Product consistency:** Ensure that the equipment can produce ice cream with a consistent texture, overrun (amount of air in the product), and quality.
- ✚ **Mixing and homogenization:** Select mixers and blenders that can thoroughly mix ingredients for a smooth and uniform final product.
- ✓ **Hygiene and cleanability**
- ✚ **Sanitation standards:** Choose equipment that meets local and international food safety standards (e.g., FDA, USDA, or EU food safety regulations).
- ✚ **Ease of cleaning:** Look for equipment with easily removable parts, automatic cleaning systems (CIP—clean-in-place), or smooth surfaces to prevent contamination and bacteria build-up.

- ✚ **Material:** Ensure tools are made from food-grade materials like stainless steel, which resists corrosion, does not react with food, and is easy to clean.
- ✓ **Energy Efficiency**
- ✚ **Power Consumption:** Choose energy-efficient equipment to reduce operational costs, especially for high-energy machines like freezers and pasteurizers.
- ✚ **Refrigeration Efficiency:** Select freezers and refrigeration units with efficient compressors and energy-saving modes to minimize energy usage during operation.
- ✓ **Automation and control**
- ✚ **Automation Level:** Depending on the production scale, you may opt for equipment that automates certain tasks (e.g., ingredient mixing, filling, and packaging), improving efficiency and reducing labor costs.
- ✚ **Temperature and Process Control:** Equipment with advanced control systems for monitoring and adjusting temperature, speed, and processing times can ensure consistent results and reduce manual intervention.
- ✓ **Cost and budget**
- ✚ **Maintenance Costs:** Choose equipment that requires minimal maintenance and has a reliable warranty to avoid high long-term operational costs.
- ✓ **Durability and reliability**
- ✚ **Build Quality:** Opt for robust, high-quality equipment designed for continuous use, especially in large-scale production environments.
- ✚ **Brand Reputation:** Choose equipment from reputable manufacturers known for producing reliable, durable machinery with good customer support and readily available spare parts.
- ✓ **Customization and Flexibility**
- ✚ **Product Variety:** If producing multiple types of ice cream (e.g., dairy-free, gelato, frozen yogurt), choose equipment that can handle different recipes and ingredient compositions.
- ✚ **Customizable Features:** Some equipment offers adjustable settings, such as freezing speed, mixing intensity, or packaging sizes, which allow for product flexibility.
- ✓ **Safety Features**
- ✚ **Safety Guards and Sensors:** Ensure all equipment has appropriate safety features, such as guards on moving parts, emergency stop buttons, and temperature/pressure sensors.

- ✚ **Operator Ergonomics:** Equipment should be designed to minimize physical strain on operators, with user-friendly controls and easy access for routine maintenance and adjustments.
- ✓ **Space requirements**
- ✚ **Footprint Size:** Assess the available space in your facility and ensure the equipment fits without overcrowding the workspace.
- ✓ **Compliance and Certification**
- ✚ **Regulatory Compliance:** Ensure the equipment complies with local health and safety regulations, including certifications like CE, UL, or ISO.
- ✚ **Food Safety Certification:** Equipment should meet HACCP (Hazard Analysis and Critical Control Points) standards to ensure the production process is safe from contamination.
- ✓ **Environmental impact**
- ✚ **Eco-Friendly Options:** Look for equipment that uses eco-friendly refrigerants and minimizes water and energy usage to align with sustainability goals.
- **Adjustment of tools and equipment for ice cream production**  
The following procedure is for adjusting tools and equipment for ice cream production:
  - ✓ Ensure the equipment is turned off and unplugged.
  - ✓ Wear appropriate personal protective equipment (PPE).
  - ✓ Clear the work area of obstructions.
  - ✓ Understand the Equipment: Familiarize yourself with the equipment's components and functions, identify the adjustment points, refer to the operator's manual for specific instructions.
  - ✓ Prepare for Adjustment: Gather necessary tools and equipment, have replacement parts on hand if needed, take measurements or notes of the original settings.
  - ✓ Make adjustments: Follow the manufacturer's recommended procedure, make small adjustments at a time and test the equipment after each change, use appropriate tools and techniques to avoid damaging the equipment.
  - ✓ Test and verify: Operate the equipment under normal conditions to verify the adjustment, check for any unintended consequences, re-adjust if necessary.
  - ✓ Record changes: Document the adjustments made for future reference and update maintenance records.
  - ✓ Clean up: Return tools and equipment to their proper storage location and clean up the work area.
- **Functionality of tools and equipment used in ice cream production**

In general, the functionality of ice cream production tools and equipment revolves around **blending, freezing, aerating, mixing in ingredients, packaging, and maintaining low temperatures** to ensure product safety, consistency, and quality from start to finish.

This is a general overview of the functionality of key tools and equipment:

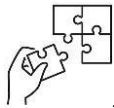
- ✓ **Mixing and blending equipment:** Blends raw ingredients (milk, cream, sugar, stabilizers, flavors) into a uniform mixture. Ensures that all components are evenly distributed for consistent flavor and texture throughout the ice cream.
- ✓ **Pasteurizers:** Heats the ice cream mix to a specific temperature to kill harmful bacteria and pathogens. Ensures product safety and extends shelf life by reducing the risk of contamination.
- ✓ **Homogenizers:** Breaks down fat globules in the ice cream mix to ensure smooth texture and even distribution of fat. Improves the creaminess and stability of the final product.
- ✓ **Batch freezers:** Freezes the ice cream mixture while simultaneously churning it to incorporate air (overrun). This process controls the texture and volume of the ice cream, producing a smooth, consistent product.
- ✓ **Continuous freezers:** Used in large-scale production, these machines freeze and aerate the ice cream mix in a continuous process, allowing for high-capacity production with consistent results.
- ✓ **Filling machines:** Automatically dispenses ice cream into containers (such as tubs, cones, or cups) with precise portion control. Ensures uniformity and efficiency in packaging.
- ✓ **Hardening tunnels:** Rapidly freezes the filled ice cream containers to stabilize their structure and maintain the desired texture. Reduces the formation of large ice crystals and preserves product quality.
- ✓ **Storage freezers:** Keep the ice cream at a low, consistent temperature for long-term storage and distribution. Maintains product integrity and prevents melting or softening before sale or consumption.
- ✓ **Mix-in machines:** Incorporates solid ingredients such as fruits, nuts, candies, or cookie pieces into the ice cream without damaging their structure. Ensures even distribution of mix-ins throughout the product.
- ✓ **Packaging equipment:** Seals the containers, applies labels, and prepares the ice cream for retail distribution. Ensures product safety, prevents contamination, and provides consumers with essential product information.
- ✓ **Conveyor systems:** Transports ice cream products between various stages of production (e.g., from the filling machine to the hardening tunnel). Enhances workflow efficiency by automating the movement of products.

- ✓ Refrigeration systems: Provide necessary cooling throughout various stages of production, from mixing and freezing to storage. Maintains the temperature required for optimal product consistency and quality.



### Points to Remember

- Always sanitize and clean all tools and equipment before use to prevent contamination
- Regularly check and maintain your ice cream maker and other equipment to ensure they are functioning correctly
- Sharp tools should be handled with care the same as electrical equipment (follow safety guidelines for operating pasteurizer, ice cream maker, and cream separators).
- While adjusting tools and equipment for ice cream production first understand the tool or equipment i.e. familiarize yourself with the tool's functions and limitations, and the specific needs of the recipe, and know how to adjust settings (e.g., speed, temperature, time), always follow manufacturer's guidelines and be familiar with regular cleaning to prevent equipment malfunction and proper maintenance to ensure optimal performance.
- Don't be afraid to experiment with different settings and keep a record of adjustments and their outcomes.



### Application of learning 1.1.

You are requested to go to the ice cream production workshop to select and adjust tools and equipment used in ice cream production.



## Indicative content 1.2: Selecting materials used in ice cream production



Duration: 3 hrs



### Theoretical Activity 1.2.1: Description of cleaning products used in ice cream production



#### Tasks:

1: Answer the following questions related to the description of cleaning products used in ice cream production:

- i. What could be the types of cleaning products used in cleaning workplaces for ice cream production?
- ii. What could be the health precautions for using cleaning agents?
- iii. Identify the directional use of cleaning products for cleaning ice cream production workplace

2: Write your answers on paper, flip chart.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.2.1



#### Key readings 1.2.1.: Description of cleaning products used in ice cream production

- **Types of cleaning products used in cleaning workplace for ice cream production**

Below are the types of cleaning products commonly used in cleaning an ice cream production workplace:

- ✓ **Detergents**

- ✚ **Alkaline Detergents:** Effective at removing fat, oils, and proteins found in dairy products. Commonly used for cleaning utensils, work surfaces, and equipment.

- ✚ **Neutral Detergents:** Milder and used for less aggressive cleaning, such as surfaces that are cleaned regularly without heavy soiling.

**Examples:** Chlorinated alkaline detergents, mild dishwashing liquids.

- ✓ **Sanitizers/Disinfectants**

- ✚ **Quaternary Ammonium Compounds (Quats):** Commonly used for sanitizing food contact surfaces. Safe and effective for use on stainless steel and other surfaces.
- ✚ **Chlorine-Based Sanitizers:** Widely used for disinfecting equipment and surfaces. Effective against a wide range of bacteria, viruses, and fungi.
- ✚ **Hydrogen Peroxide and Peracetic Acid:** Effective for sanitizing in areas where biofilms and other contaminants may form.

**Examples:** Quat-based surface sanitizers, bleach (chlorine-based), hydrogen peroxide.

#### ✓ **Degreasers**

- ✚ **Solvent-Based Degreasers:** Effective for cleaning greasy residues on equipment and machinery.
- ✚ **Water-Based Degreasers:** Less aggressive but effective at cutting through grease in food processing areas.

**Examples:** Citrus-based degreasers, alkaline degreasers.

#### ✓ **Acid Cleaners**

- ✚ **Phosphoric Acid Cleaners:** Effective for descaling stainless steel equipment.
- ✚ **Nitric Acid Cleaners:** Used for heavy-duty descaling of equipment where hard water is a problem.

**Examples:** Phosphoric acid-based descalers, and nitric acid descalers.

#### ✓ **Foam cleaners**

- ✚ **Alkaline Foam Cleaners:** Ideal for cleaning fats, oils, and protein residues.
- ✚ **Chlorinated Foam Cleaners:** Effective for both cleaning and sanitizing surfaces.

**Examples:** Chlorinated foam cleaners, and alkaline foam detergents.

#### ✓ **Enzymatic Cleaners**

- ✚ **Protease-Based Cleaners:** Effective at breaking down protein-based soils.
- ✚ **Lipase-Based Cleaners:** Target fat and oil residues.

**Examples:** Multi-enzyme cleaning solutions.

#### ✓ **Alcohol-Based Sanitizers**

- ✚ **Isopropyl Alcohol (IPA):** Commonly used for disinfecting small tools, surfaces, and hands.

- ✚ **Ethyl Alcohol-Based Sanitizers:** Used for sanitizing hands and surfaces in food production areas.

**Examples:** Hand sanitizers, and surface wipes.

- ✓ **Floor Cleaners**

- ✚ **Heavy-duty degreasing Floor Cleaners:** Remove fats and oils from floors.
- ✚ **Disinfectant Floor Cleaners:** Used to sanitize floors and remove bacteria and other pathogens.

**Examples:** Industrial floor degreasers, and disinfectant floor cleaners.

- ✓ **Cleaning in Place (CIP) Solutions**

- ✚ **Alkaline CIP Cleaners:** Used for removing organic material like fats and proteins.
- ✚ **Acid CIP Cleaners:** Used to remove mineral scales and deposits.

**Examples:** Caustic soda solutions, and acid-based CIP detergents.

- **Safety and health precautions of using cleaning agents**

- ✓ **Read product labels** for each cleaning agent.
- ✓ **Wear appropriate PPE** to protect skin, eyes, and respiratory systems.
- ✓ Ensure **proper ventilation** to avoid inhaling fumes.
- ✓ **Do not mix chemicals** unless instructed.
- ✓ Follow **manufacturer instructions** for dilution and use.
- ✓ Ensure proper **handling, storage, and disposal** of chemicals.
- ✓ **Train employees** on safe use and emergency procedures.
- ✓ Clean up spills immediately and ensure **proper labeling**.
- ✓ **Rinse surfaces** thoroughly after cleaning, especially food-contact surfaces.

- **Direction for using the cleaning products used in ice cream production**

- ✓ Prepare for Cleaning
- ✓ Dilute the Cleaning Agent (if applicable)
- ✓ Apply the Cleaning Agent
- ✓ Allow the Recommended Contact Time
- ✓ Scrub or Agitate (if needed)
- ✓ Rinse the Surface Thoroughly
- ✓ Dry the Surface or Equipment
- ✓ Apply Sanitizer (if required)

- ✓ Dispose of Used Cleaning Solution Properly
- ✓ Store Cleaning Agents Safely
- ✓ Clean Tools and Equipment

**Example steps for using a chlorine-based surface sanitizer:**

1. **Dilution:** Mix 1 tablespoon of chlorine-based sanitizer with 1 gallon of water.
2. **Application:** Spray or wipe the solution on cleaned surfaces.
3. **Contact Time:** Allow it to sit for 2 minutes.
4. **Rinse (if required):** Rinse with clean water if specified on the label.
5. **Drying:** Let the surface air dry or wipe it with a clean towel.



**Theoretical Activity 1.2.2: Description of ingredients used in ice cream production**



**Tasks:**

- 1: Answer the following questions related to the description of ingredients used in ice cream production:  
What do you think are the ingredients used in ice cream production?
- 2: Write your answers on paper, flip chart.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the key readings 1.2.2



**Key readings 1.2.2.: Description of ingredients used in ice cream production**

- **Milk ingredients used in ice cream production**

In ice cream production, milk and its derivatives are key ingredients that provide texture, creaminess, and flavor.

Common milk ingredients include:

- ✓ **Whole milk:** Provides fat and water content essential for ice cream's smooth texture.

- ✓ **Cream:** Adds richness and increases fat content, which is critical for a creamy mouthfeel.
- ✓ **Skim milk:** Used to adjust the fat content without adding extra fat.
- ✓ **Condensed milk:** Adds sweetness and a rich, concentrated milk flavor.
- ✓ **Milk powder (Non-fat dry milk):** Helps improve texture, add solids, and provide a smoother consistency by reducing the ice crystals formed during freezing.
- ✓ **Whey:** A byproduct of cheese making, it is sometimes used to balance the protein content and enhance texture.

- **Non-milk ingredients used in ice cream production**

In addition to milk ingredients, a variety of non-milk ingredients are used in ice cream production to enhance flavour, texture, and stability. These include:

- ✓ **Sweeteners:**
  - ✚ **Sugar** (sucrose, glucose, fructose): Provides sweetness and lowers the freezing point to create a softer texture.
  - ✚ **Corn syrup:** Used as a sweetener and for improving texture by controlling ice crystal size.
  - ✚ **Honey:** Natural sweetener used in some specialty ice creams.
- ✓ **Stabilizers:**
  - ✚ **Guar gum, locust bean gum:** Help to prevent ice crystal formation and improve texture.
  - ✚ **Carrageenan:** A natural thickener derived from seaweed, used to stabilize the cream mixture.
  - ✚ **Gelatin:** Occasionally used as a natural stabilizer and thickener.
- ✓ **Emulsifiers:**
  - ✚ **Lecithin** (from egg yolk or soy): Helps to bind fat and water, ensuring a smooth and creamy texture.
  - ✚ **Monoglycerides & Diglycerides:** Synthetic emulsifiers that help with texture and prevent the mixture from separating.
- ✓ **Flavorings:**
  - ✚ **Vanilla** (extract, pods, or synthetic vanillin): A popular flavoring for basic ice cream varieties.
  - ✚ **Chocolate** (cocoa powder or melted chocolate): Used in various chocolate-based ice cream flavors.
  - ✚ **Fruit purees and concentrates:** Natural or artificial flavorings used to make fruit-based ice creams.

- ✚ **Nuts, cookies, candy:** Mix-ins to add texture and additional flavors.
- ✓ **Colorants:**
  - ✚ **Natural colorants:** Such as beet juice for red, turmeric for yellow, and spirulina for green.
  - ✚ **Artificial colorants:** Synthetic colors are used in some commercial varieties to make vibrant colors.
- ✓ **Air (Overrun):**
  - ✚ Air is incorporated into the ice cream mixture during churning, improving texture and reducing density. More air results in lighter ice cream, while less air leads to a denser product.
- ✓ **Salt (In the freezing process):**
  - ✚ While not directly in the ice cream itself, salt is used in the freezing process to lower the temperature of ice and create the right environment for churning ice cream.



### **Theoretical Activity 1.2.3: Identification of packaging materials used in ice cream production**



#### **Tasks:**

1: Answer the following questions related to the identification of packaging materials used in ice cream production:

What could be the types of packaging materials used in packaging ice cream?

2: Write your answers on paper, flip chart.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.2.3



### **Key readings 1.2.3.: Identification of packaging materials used in ice cream production**

- **Types of packaging materials used in ice cream production**

Ice cream packaging materials are selected to preserve freshness, prevent melting, and maintain the product's quality during storage and transport.

Common packaging materials include:

✓ **Paperboard:**

+ **Laminated Paperboard Cartons:** Widely used for ice cream tubs and cartons, these are made from paperboard coated with a layer of plastic or wax to make them moisture-resistant and durable.

+ **Paper Cups:** Often used for individual servings of ice cream or frozen desserts, with a plastic or wax coating to prevent leakage.

✓ **Plastic:**

+ **Polyethylene (PE) or Polypropylene (PP) Tubs:** Durable, moisture-resistant, and lightweight, commonly used for large containers of ice cream.

+ **Plastic Lids:** Often used in combination with paperboard tubs to provide a secure seal.

+ **Polyethylene (PE) Films:** Used for wrapping individual servings like ice cream bars or sandwiches, providing protection against moisture and air. Foil/Paper Laminates:

+ **Foil-Wrapped Ice Cream Bars:** A thin layer of aluminum foil laminated to paper or plastic, providing excellent moisture and oxygen barriers, often used for ice cream sandwiches and bars.

+ **Foil Linings for Cartons:** Some paperboard cartons are lined with a thin layer of aluminum foil to offer extra insulation and a better moisture barrier.

✓ **Polystyrene (EPS) Foam:**

+ **Foam Containers:** These offer excellent insulation and are often used for take-home ice cream packaging or at ice cream parlors for scooped servings.

✓ **Glass:**

+ **Reusable Glass Jars:** Some premium or artisanal brands use glass jars for their ice cream packaging, providing a high-end look and a sustainable, reusable option.

✓ **Flexible Pouches:**

+ **Stand-up Pouches:** Used for some novelty or soft-serve ice cream products, flexible pouches with resealable tops provide portability and protection.

✓ **Bio-based or Compostable Packaging:**

+ **Biodegradable Paperboard:** Made from renewable resources like corn starch-based or plant-based plastics, used as an eco-friendly option in some premium brands.

- ✚ **Compostable Plastics:** Derived from plant-based materials like PLA (polylactic acid), these are used for more environmentally conscious packaging.
- ✓ **Metal:**
- ✚ **Metal Cans:** Occasionally used for specialty ice cream or frozen dessert packaging, providing superior protection and an airtight seal.



#### Practical Activity 1.2.4: Selecting materials used in ice cream production



##### Task:

Referring to the previous theoretical activities 1.2.1, 1.2.2, and 1.2.3, go to the ice cream production workshop and perform the following task:

- 1: Select materials used in producing ice cream.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.2.4
- 5: Perform the task provided in the application of learning 1.2.



#### Key readings 1.2.4 Selecting Materials Used in Ice Cream Production

- **Selection criteria for cleaning products**  
The selection of cleaning products used in ice cream production is critical to maintaining hygiene, ensuring product safety, and meeting regulatory standards. The following are the key criteria to consider:
  - ✓ **Effectiveness:** The cleaning product must effectively remove a wide range of contaminants, including fats, proteins, sugars, and mineral deposits left by milk and other ingredients used in ice cream production. It should effectively eliminate microorganisms like bacteria, yeast, and mold, which thrive in dairy environments.
  - ✓ **Food Safety Compliance:** Food-Grade Certification, Non-Toxic and Non-Tainting
  - ✓ **Material Compatibility:** Corrosion Resistance and Non-Abrasive:
  - ✓ **Ease of Rinsing:** The cleaning solution should be easy to rinse off completely to prevent chemical residues from contaminating the ice cream.
  - ✓ **Environmental Impact:** Biodegradability and Non-Polluting
  - ✓ **Temperature and Time Efficiency:** The cleaning product should work effectively at various temperatures, as ice cream production involves both cold and warm

processes. Products that can clean and disinfect quickly are beneficial for minimizing downtime during production.

- ✓ **Cost-Effectiveness: Economical Use and**
- ✓ **Worker Safety:** Non-Hazardous., Low Odor or odourless, and ease of Handling
- ✓ **Regulatory and Certification Standards:** Compliance with GMP (Good Manufacturing Practices), ISO, and HACCP Certification.
- ✓ **Allergen Control:** Cleaning products should be free from allergens that could cross-contaminate production lines or equipment, especially if multiple flavors or varieties are produced in the same facility.
- **Selection criteria for ingredients used in ice cream production**
- ✓ **Quality and Freshness:**
  - ✚ **High-Quality Raw Materials:** Ingredients like milk, cream, and eggs should be of premium quality to ensure a rich, smooth, and consistent flavor.
  - ✚ **Freshness:** Ingredients must be fresh, especially dairy products, to maintain a clean flavor profile and minimize the risk of spoilage or contamination.
  - ✚ **Sensory Attributes:** The appearance, taste, and smell of ingredients should meet the desired sensory qualities, especially for flavorings like vanilla, chocolate, or fruits.
- ✓ **Food Safety and Compliance:**
  - ✚ **Food-Grade Certification:** Ingredients should be certified for food use and comply with local and international food safety standards (e.g., FDA, EFSA).
  - ✚ **Microbiological Safety:** Ingredients must be free of harmful pathogens (e.g., Salmonella, E. coli, Listeria) that can thrive in dairy-based environments.
  - ✚ **Allergen Management:** Ensure that ingredients comply with allergen labeling regulations and are handled properly to avoid cross-contamination in production.
- ✓ **Consistency and Functionality:**
  - ✚ **Consistent Supply:** Choose ingredients that are readily available from reliable suppliers to ensure consistency in production batches.
  - ✚ **Functional Properties:** Ingredients must meet functional requirements such as emulsification, stabilization, or sweetness, which are essential for the final product's texture and stability. For example:
    - **Milk and Cream:** Provide fat and protein necessary for texture and richness.
    - **Stabilizers:** Control ice crystal formation and improve shelf life.
    - **Emulsifiers:** Help mix fat and water for a smooth, consistent texture.
- ✓ **Nutritional Content:**
  - ✚ **Nutritional Balance:** Ingredients should contribute to a balanced nutritional profile, with controlled levels of fat, sugar, and calories based on the type of ice cream being produced (e.g., low-fat or premium varieties).
  - ✚ **Healthy Alternatives:** If developing specialty or health-focused products, consider

using alternative ingredients such as plant-based milk, natural sweeteners (e.g., stevia, monk fruit), or low-fat substitutes.

✓ **Flavor Profile:**

✚ **Authenticity:** Select ingredients that deliver natural, rich flavors. For example, real vanilla beans or pure chocolate provide a more authentic taste than artificial flavorings.

✚ **Complementary Flavors:** Ingredients should blend well with others to create a balanced and harmonious flavor, whether it's a simple vanilla or complex layered flavor.

✚ **Flavor Stability:** Choose ingredients that maintain their flavor during processing, freezing, and storage.

✓ **Texture and Mouthfeel:**

✚ **Creaminess and Smoothness:** Ingredients like cream, milk, and fats are essential for achieving the creamy, smooth mouthfeel of ice cream.

✚ **Air Incorporation (Overrun):** Ingredients should contribute to the ice cream's ability to hold air, creating a light and fluffy texture. Stabilizers and emulsifiers play a key role in this.

✚ **Crystal Control:** Ingredients should prevent the formation of large ice crystals to avoid graininess and ensure a smooth texture. Stabilizers like guar gum or carrageenan help control this.

✓ **Cost-Effectiveness:**

✚ **Affordability:** Ingredients must be cost-effective to ensure profitability, especially in large-scale production.

✚ **Yield Efficiency:** Ingredients that offer better yield or require less processing time can lead to cost savings in the production process.

✓ **Shelf Stability:**

✚ **Shelf Life:** Ingredients with longer shelf lives reduce waste and ensure they remain fresh for extended production schedules. Stabilizers and preservatives may be necessary to extend the shelf life of the final product.

✚ **Stability During Storage:** Ingredients should retain their quality during storage and not degrade in freezing or mixing conditions.

✓ **Sustainability and Ethics:**

✚ **Sustainable Sourcing:** Preference should be given to ingredients sourced sustainably, such as fair trade vanilla or cocoa, or dairy from farms that follow ethical animal practices.

✚ **Organic or Natural:** Some markets demand organic or minimally processed ingredients, so consider sourcing natural ingredients with minimal additives or preservatives.

✓ **Specialty and Dietary Requirements:**

✚ **Dietary Considerations:** Ingredients should meet the dietary needs of the target

market, such as being vegan, gluten-free, lactose-free, or kosher-certified.

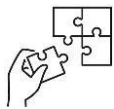
- ✚ **Low-Allergen Options:** Choose ingredients that can cater to those with food allergies or sensitivities, such as non-dairy milk alternatives (e.g., almond milk, oat milk) or egg-free emulsifiers.
- ✓ **Supplier Reliability:**
- ✚ **Reputation of Supplier:** Partner with reputable suppliers who meet food safety standards, offer traceability, and provide a consistent supply of high-quality ingredients.
- ✚ **Certification and Audits:** Ensure suppliers follow good manufacturing practices (GMP), undergo regular audits, and provide ingredient certifications for quality assurance.
- **Selection criteria for packaging materials used in ice cream production**
- ✓ **Barrier Properties:**
  - ✚ Moisture Resistance
  - ✚ Oxygen Barrier
  - ✚ Light Protection
- ✓ **Insulation and Temperature Stability:**
  - ✚ Thermal Insulation
  - ✚ Durability in Freezing Conditions
- ✓ **Material Strength and Durability:** The packaging should be strong enough to resist crushing during handling, transport, and stacking in freezers and must provide a tight seal to prevent leakage, contamination, and freezer burn. The sealing mechanism should be durable enough to withstand freezing and thawing cycles.
- ✓ **Food Safety and Regulatory Compliance:**
  - ✚ Food-Grade Certification
  - ✚ Chemical Safety
  - ✚ Tamper Evident confidence.
- ✓ **Environmental Impact:**
  - ✚ Recyclability
  - ✚ Biodegradable and Compostable Options
  - ✚ Reduced Carbon Footprint
- ✓ **Cost-Effectiveness:**
  - ✚ Affordability
  - ✚ Economies of Scale
- ✓ **Product Protection and Shelf Life:**
  - ✚ Preservation of Texture and Flavor
  - ✚ Extending Shelf Life
- ✓ **Convenience for Consumers:**
  - ✚ Ease of Opening and Resealing
  - ✚ Portability

-  Portion Control
- ✓ **Branding and Aesthetics:**
-  Printability
-  Custom Shapes and Sizes
-  Labeling Requirements
- ✓ **Sustainability and Sourcing:**
-  Ethical Sourcing
-  Corporate Social Responsibility (CSR)



### Points to Remember

- Always read and respect the manufacturer's instructions on the label before using cleaning products.
- Always use fresh dairy products, fruits, and flavourings as fresh ingredients contribute to better flavour and texture.
- Don't use expired or stale ingredients because they can affect both the taste and safety of the ice cream.
- Use packaging materials that are approved for food contact and are free from harmful chemicals. Materials should comply with food safety regulations.
- Don't Use packaging materials that can transfer odours to the ice cream or absorb flavours, which can negatively impact the taste.
- Follow the instructions on the label of each cleaning product carefully.
- Do not mix cleaning agents together especially bleach and ammonia, as this can create dangerous fumes.
- Be sure to rinse all surfaces thoroughly after cleaning them with a disinfectant.
- While selecting packaging materials, prioritize product protection, consider ice cream type, evaluate shelf-life goals, choose packaging that aligns with environmental goals (explore recyclable, biodegradable, or compostable options), and balance the cost of packaging with its benefits to the product and brand image.



### Application of learning 1.2.

You are requested to go to the ice cream production workshop to select materials used for ice cream production.



## Indicative content 1.3: Cleaning Tools, Equipment and Workplace for Ice Cream Production



Duration: 3hrs



### Practical Activity 1.3.1: Cleaning tools, equipment and workplace for ice cream production



#### Task:

You are requested to go to the ice cream production workshop and perform the following task:

- 1: Clean tools, equipment, and workplace for ice cream production.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.3.1
- 5: Perform the task provided in the application of learning 1.3.



#### Key readings 1.3.1 Cleaning tools, equipment, and workplace for ice cream production

- **The purpose of cleaning tools, equipment, and workplace for ice cream production**
- ✓ **Maintain Hygiene and Health:** Regular cleaning helps eliminate bacteria, viruses, and allergens, which can lead to illness if left unchecked. A clean workplace reduces the risk of infections and promotes employee well-being.
- ✓ **Enhance Appearance:** A tidy, well-maintained workplace looks professional and creates a positive impression for clients, customers, and employees.
- ✓ **Improve Productivity:** A clean and organized workspace minimizes distractions and improves the efficiency of work processes. Clutter-free areas help employees focus better and find tools or documents faster.
- ✓ **Ensure Safety:** Regular cleaning helps identify and remove hazards such as spills, clutter, or sharp objects that can cause accidents or injuries.
- ✓ **Prolong Equipment Life:** Cleaning machinery and equipment prevents the build-up of dirt and dust, which can cause mechanical issues or premature wear and tear.
- ✓ **Comply with Regulations:** Many industries are subject to health, safety, and sanitation regulations. Maintaining a clean workplace helps comply with these

legal requirements, avoiding fines or shutdowns.

- **Application of cleaning methods**

- ✓ **Wet Cleaning**

-  **Definition:**

Wet cleaning involves the use of water, detergents, and other liquid-based solutions to clean surfaces, equipment, or areas. It is the most commonly used cleaning method for removing dirt, debris, and organic materials.

-  **How it works:**

- Surfaces are scrubbed or rinsed with water and detergent to remove dirt, organic matter, grease, and residues.
- Cleaning solutions may contain sanitizers or disinfectants to kill harmful bacteria, viruses, and other microorganisms.
- Rinsing with clean water is often required after applying cleaning agents to prevent residue build-up.
- Wet cleaning may involve soaking, scrubbing, high-pressure washing, or using steam.

- ✓ **Dry Cleaning**

-  **Definition:**

Dry cleaning refers to cleaning methods that do not involve the use of water or liquid solutions. Instead, it relies on mechanical action (brushing, vacuuming, compressed air) or absorbent materials to remove dirt, debris, and dust.

-  **How It Works:**

- Mechanical cleaning tools such as **brushes, brooms, vacuum cleaners, or air blowers** are used to remove dust, debris, and particles from surfaces.
- In some cases, absorbent materials like **microfiber cloths or powders** may be used to pick up grease or oil.
- Compressed air is sometimes employed to blow away dust and particles from surfaces and equipment.
- Dry steam cleaning, using minimal moisture, can also be used to sanitize certain surfaces.

- **Application of cleaning techniques**

- Clean-in-Place (CIP)**

-  **Definition:**

CIP is a cleaning method where the equipment is cleaned without disassembling it. It is used to clean the internal surfaces of pipes, vessels, equipment, and other processing machinery while they remain in place.

-  **How it works:**

- A series of cleaning solutions (detergents, disinfectants, and sanitizers) are circulated through the equipment.

- The cleaning cycle often involves several stages: pre-rinse, detergent wash, post-rinse, and sanitization.
- The system is automated and does not require the manual intervention of workers, which minimizes exposure to cleaning chemicals.

### **Clean-out-of-Place (COP)**



#### **Definition:**

COP is a cleaning method where equipment is disassembled, and parts are removed from their original location for cleaning. This method is used for components that cannot be cleaned effectively in place.



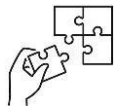
#### **How it works:**

- Equipment is taken apart, and removable parts are transported to a dedicated cleaning station or COP tank.
- The components are immersed in cleaning solutions (soaking) or manually scrubbed.
- They may be rinsed and sanitized manually or using automated cleaning tanks.
- After cleaning, the parts are reassembled and sanitized before being placed back into operation
- **Check cleanliness of tools, equipment and workplace**
  - ✓ **Visual Inspection:** is the most basic and immediate method of assessing cleanliness by visually checking surfaces, equipment, and tools for any signs of dirt, debris, food residue, or contamination.
  - ✓ **ATP Testing (Adenosine Triphosphate Testing):** is a rapid method for detecting the presence of organic material and microorganisms on surfaces. ATP is a molecule found in all living cells, so its presence on equipment or tools indicates that biological material remains after cleaning.
  - ✓ **SWAB Test:** it involves using a sterile swab to collect a sample from a surface, which is then analyzed for microbial contamination, such as bacteria, yeasts, and molds.
  - ✓ **Acidity Test (pH Test):** it measures the pH level of a surface to determine whether it is neutral, acidic, or alkaline. It is often used in industries where residue from cleaning chemicals can impact product quality or safety.



### **Points to Remember**

- Follow the instructions on the label of each cleaning product carefully.
- Do not mix cleaning agents together especially bleach and ammonia, as this can create dangerous fumes.
- Be sure to rinse all surfaces thoroughly after cleaning them with a disinfectant.



### **Application of learning 1.3.**

You are requested to go to the ice cream production workshop to clean the workplace, tools, and equipment for ice cream production and check cleanliness.



## Indicative content 1.4: Arranging Workplace for Ice Cream Production



Duration: 3hrs



### Practical Activity 1.4.1: Arrangement of the workplace for ice cream production



#### Task:

You are requested to go to the ice cream production workshop and perform the following task:

- 1: Arrange the workplace for ice cream production.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.4.1
- 5: Perform the task provided in the application of learning 1.4.



#### Key readings 1.4.1 Arrangement of the Workplace for ice cream production

- **The purpose of arranging the workplace for ice cream production**

The purpose of arranging the workplace for ice cream production is to create an environment that supports food safety, enhances efficiency, ensures consistent product quality, and promotes worker safety. A well-organized production space optimizes the use of resources, minimizes the risk of contamination, and enables a smoother, more productive workflow.

The purposes of arranging the workplace for ice cream production include:

- ✓ Ensuring Food Safety and Hygiene
- ✓ Maximizing Efficiency and Productivity
- ✓ Maintaining Quality Control
- ✓ Improving Safety
- ✓ Maintaining Temperature Control
- ✓ Facilitating Cleaning and Sanitation
- ✓ Enhancing Inventory Management
- ✓ Facilitating Staff Training and Supervision
- ✓ Improving Workflow and Communication
- ✓ Enhancing Flexibility

- **Arrangement criteria for workplace**

- ✓ **Ice cream processing line**

The **processing line for ice cream production** involves a series of carefully controlled steps and equipment designed to transform raw ingredients into the finished product. Each stage plays a crucial role in ensuring the quality, consistency, and safety of the ice cream.

Below is an overview of the main steps involved in a typical ice cream production line.

-  **Ingredient Preparation**

This is the first stage where all the raw ingredients required for making ice cream are prepared and combined.

-  **Pasteurization**

The ice cream mix undergoes pasteurization to eliminate harmful bacteria and pathogens, ensuring the product is safe for consumption. It consists of heating the ice cream mix to a specific temperature (usually between 80°C to 85°C or 175°F to 185°F) for a set period, then rapidly cools it down. This kills bacteria and ensures a longer shelf life. **High-Temperature Short Time (HTST)** pasteurization or batch pasteurization are commonly used.

-  **Homogenization**

After pasteurization, the mix is homogenized to break down fat molecules and ensure a smooth and consistent texture in the finished ice cream.

-  **Aging**

The homogenized mix is stored in aging tanks for a few hours (typically 4 to 24 hours) to allow the fats to crystallize and the proteins to hydrate. This process improves the stability and texture of the ice cream.

-  **Flavoring and Mixing**

After aging, flavorings such as vanilla, chocolate, fruit, or other custom flavors are added to the base mix. Inclusions like chocolate chips, cookie pieces, or nuts may also be introduced at this stage.

-  **Freezing**

The mix is then partially frozen in a continuous freezer, where air is incorporated to create the desired texture. This process is known as "overrun," and it determines the density and creaminess of the ice cream.

-  **Inclusion and Variegation (Optional)**

If additional inclusions such as cookie pieces, caramel swirls, or chocolate chunks are required, they are added after the freezing process.

-  **Filling and Packaging**

Once the ice cream is partially frozen and all inclusions are added, it is transferred to the packaging section, where it is filled into various containers.

### **Hardening**

After the ice cream is filled, it undergoes hardening to achieve the final frozen state. Hardening rapidly freezes the ice cream to temperatures as low as -30°C to -40°C (-22°F to -40°F).

### **Storage and Distribution**

Once hardened, the ice cream is stored in cold storage before it is distributed to retailers or consumers.

### **Quality Control**

Throughout the production process, various quality control measures are implemented to ensure that the ice cream meets safety and quality standards. It includes laboratory testing and sensory evaluation.

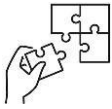
#### **Typical ice cream production line flowchart:**

- Step 1:** Raw ingredient preparation
- Step 2:** Mixing
- Step 3:** Pasteurization
- Step 4:** Homogenization
- Step 5:** Aging
- Step 6:** Flavor addition
- Step 7:** Freezing
- Step 8:** Inclusion and variegation
- Step 9:** Filling and packaging
- Step 10:** Hardening
- Step 11:** Cold storage
- Step 12:** Distribution



### **Points to Remember**

- While arranging the workplace, maintain cleanliness and hygiene; ensure a sterile environment by sanitizing all equipment and surfaces regularly.
- Create clear work zones for raw materials, mixing, freezing, and packaging to avoid cross-contamination
- Ensure proper ventilation to maintain a safe and cool environment, especially near production lines.
- Don't allow raw materials to come into contact with finished products. This could lead to contamination.



### **Application of learning 1.4.**

You are requested to go to ice cream production workshop to arrange the workplace basing on ice cream production.



## Indicative content 1.5: Preparing Ingredients Used in Ice Cream Production



Duration: 3hrs



### Practical Activity 1.5.1: Preparation of ingredients used in ice cream production



#### Task:

You are requested to go to the ice cream production workshop and perform the following task:

- 1: Prepare ingredients for ice cream production.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.5.1
- 5: Perform the task provided in the application of learning 1.5.



### Key readings 1.5.1 Preparation of ingredients used in ice cream production

- **The purpose of ingredients preparation**

Key purposes of ice cream ingredients preparation include:

- ✓ Ensuring consistency in the product
- ✓ Facilitating homogeneous mixing
- ✓ Improving texture and mouthfeel
- ✓ Enhancing flavor
- ✓ Ensuring food safety
- ✓ Facilitating efficient production
- ✓ Adapting to product variations
- ✓ Optimizing Freezing and Storage Properties

- **Calculation of ice cream ingredients ratio**

- ✓ **Basic ice cream mix components**

A typical ice cream formulation includes the following main components:

- + **Milk Fat** (from cream, milk, butter, etc.) – provides creaminess and richness.
- + **Milk Solids-Non-Fat (MSNF)** (from skim milk powder, condensed milk, etc.) – includes proteins and lactose that contribute to body and texture.
- + **Sugar** (sucrose, glucose syrup, etc.) – sweetens the ice cream and lowers the

freezing point.

- + **Stabilizers/Emulsifiers** (gelatin, guar gum, lecithin, etc.) – improve texture, prevent ice crystals, and enhance shelf life.
- + **Water** – comes from the milk and other liquid ingredients; it's the main component that freezes.
- + **Air** – incorporated during freezing to give ice cream its characteristic lightness (measured as "overrun").

✓ **Target ratios for ingredients**

A standard ice cream mix typically follows these general guidelines for ingredient ratios:

- + **Fat:** 8% to 16%
- + **Milk Solids Non-Fat (MSNF):** 9% to 12%
- + **Sugar:** 12% to 16%
- + **Stabilizers and Emulsifiers:** 0.3% to 0.5%
- + **Water:** Remainder (approximately 55% to 64%)

✓ **Example formula**

Let's say you are formulating an ice cream recipe for 1,000 grams of mix with the following target percentages:

- + **Fat:** 12%
- + **MSNF:** 10%
- + **Sugar:** 15%
- + **Stabilizers/Emulsifiers:** 0.3%
- + **Water:** Remainder

### **Step-by-Step Calculation of Ingredients**

#### **Step 1: Calculate the amount of fat**

Fat typically comes from cream, whole milk, or butter. Let's assume you are using 38% fat cream and 3.5% fat whole milk.

- + **Target fat content:** 12% of the total mix (1,000 g)
  - Fat required = 12% of 1,000 g = 120 g of fat.  
You can calculate how much cream and milk to use based on their fat percentages.
- + **Cream (38% fat):** Let the amount of cream be X.
  - $0.38X$  = amount of fat from cream.
- + **Whole Milk (3.5% fat):** Let the amount of whole milk be Y.
  - $0.035Y$  = amount of fat from milk.  
You can adjust the ratio of cream and milk to get 120 g of fat. For example:

✚ If you use 250 g of cream:

- Fat from cream =  $0.38 \times 250 = 95$  g.

✚ The remaining fat ( $120 \text{ g} - 95 \text{ g} = 25 \text{ g}$ ) must come from whole milk:

- $0.035Y = 25$  g
- $Y = 25 / 0.035 \approx 714$  g of whole milk.

### **Step 2: Calculate the Milk Solids Non-Fat (MSNF)**

MSNF typically comes from skim milk powder or condensed milk.

✚ **Target MSNF:** 10% of the total mix.

- MSNF required = 10% of 1,000 g = 100 g of MSNF.

Let's assume you are using **skim milk powder** (which is approximately 95% MSNF).

✚ Amount of skim milk powder required:

- MSNF =  $0.95 \times$  amount of skim milk powder.
- To get 100 g of MSNF, you need:
- $100 / 0.95 \approx 105$  g of skim milk powder.

### **Step 3: Calculate the amount of sugar**

✚ **Target sugar content:** 15% of the total mix.

- Sugar required = 15% of 1,000 g = 150 g of sugar.

You can use sucrose (table sugar) or a combination of sugars, such as glucose syrup or invert sugar, to adjust sweetness and freezing point.

### **Step 4: Calculate the stabilizers/emulsifiers**

Stabilizers and emulsifiers are usually used in small amounts.

✚ **Target stabilizer/emulsifier content:** 0.3% of the total mix.

- Stabilizers/emulsifiers required = 0.3% of 1,000 g = 3 g.

You can use a combination of stabilizers (like guar gum or carboxymethyl cellulose) and emulsifiers (like lecithin or mono- and diglycerides) to achieve the desired texture.

### **Step 5: Calculate the water content**

Water primarily comes from milk, cream, and any other liquid ingredients.

✚ The remaining weight in the formula will be water:

- Total weight = 1,000 g.
- Total other ingredients (fat, MSNF, sugar, stabilizers) =  $120 \text{ g} + 100 \text{ g} + 150 \text{ g} + 3 \text{ g} = 373 \text{ g}$ .

Thus, water required =  $1,000 \text{ g} - 373 \text{ g} = 627 \text{ g}$ .

### **✓ Example ingredient breakdown**

Based on these calculations, your ice cream recipe for 1,000 g of mix could look something like this:

- ✚ **Cream (38% fat):** 250 g (providing 95 g of fat).
- ✚ **Whole Milk (3.5% fat):** 714 g (providing 25 g of fat).
- ✚ **Skim Milk Powder:** 105 g (providing 100 g of MSNF).
- ✚ **Sugar:** 150 g.
- ✚ **Stabilizer/Emulsifier:** 3 g.
- ✚ **Water:** Remaining water comes from the milk and cream.

- **Weighing ice cream ingredients**

Weighing ice cream ingredients is a crucial step in the production process to ensure consistency, quality, and safety in the final product. Precise measurement of each component guarantees that the ice cream will have the desired texture, flavor, and physical properties.

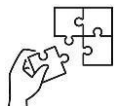
- ✓ **Steps for Weighing Ice Cream Ingredients**

- ✚ Step 1. Set up a clean and calibrated scale
- ✚ Step 2. Gather ingredients and containers
- ✚ Step 3. Tare the scale
- ✚ Step 4. Weigh each ingredient
- ✚ Step 5. Combine ingredients after weighing
- ✚ Step 6. Double-check measurements
- ✚ Step 7. Record ingredient weights



### Points to Remember

- Calculate ice cream ingredients correctly to meet the product requirements. Try to minimize errors as they can have a negative impact to the final product.
- While weighing ingredients for ice cream production, make sure you use measuring tools that are adjusted.



### Application of learning 1.5.

You are asked to go to the ice cream production workshop to prepare the ingredients for ice cream production.



## Indicative content 1.6: Standardizing Cream



Duration: 3hrs



### Practical Activity 1.6.1: Standardization of cream



#### Task:

You are requested to go to the ice cream production workshop and perform the following task:

- 1: Standardize cream for ice cream production.
- 2: Apply safety precautions.
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read the key readings 1.6.1
- 5: Perform the task provided in the application of learning 1.6.



### Key readings 1.6.1 Standardization of Cream

- **Cream separation methods**

In ice cream production and other dairy processes, **cream separation** is crucial for obtaining milk fat in varying concentrations to control the richness and texture of the final product. The two primary methods for separating cream from milk are **gravity separation** and **centrifugal separation**.

The overview of both methods:

- ✓ **Gravity Separation**

Gravity separation is the traditional and natural method of separating cream from milk, relying on the natural difference in density between the fat in milk (cream) and the water phase.

- ✚ **Principle:**

- Milk fat, being less dense than water, rises to the top when milk is left undisturbed for a certain period.
- The cream floats to the surface while the skimmed milk (the lower-fat portion) remains at the bottom.

#### **Process:**

- Fresh milk is allowed to stand in shallow pans or tanks for several hours (typically 12-24 hours).
- During this time, the cream slowly rises to the surface.
- Once the cream has formed a distinct layer at the top, it can be skimmed off manually or mechanically.

#### ✓ **Centrifugal Separation**

Centrifugal separation is the modern, more efficient method of separating cream from milk, using a centrifugal separator (or cream separator) to rapidly separate fat from the liquid phase.

#### **Principle:**

- Milk is fed into a rapidly rotating bowl (centrifuge), where the difference in densities between the fat and water components causes the cream (fat) to move toward the center, while the denser skim milk is forced to the outer edges.
- The machine continuously collects both the cream and skimmed milk in separate outlets.

#### **Process:**

- Milk is pumped into a **centrifugal separator**, where it is spun at high speeds (up to 6,000-10,000 RPM).
- The centrifugal force separates the milk into two streams: cream and skim milk.
- The separated cream can then be used in various dairy products like ice cream, butter, and other high-fat dairy products.

#### • **Ratios calculation while standardizing cream**

Standardizing cream involves adjusting the fat content of cream to meet specific requirements for a dairy product like ice cream. Two common methods for calculating the ratios of different milk or cream products (e.g., whole milk, skim milk, cream) to achieve a desired fat content are the **Pearson square method** and the **Algebraic method**.

#### ✓ **Pearson Square Method**

The Pearson Square Method (or Rectangle Method) is a straightforward technique used to blend two liquids with different concentrations of fat to achieve the desired concentration. This method is widely used in dairy processing to standardize cream or milk fat content.

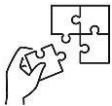
✓ **Algebraic Method**

The Algebraic method is another way to calculate the ratio of ingredients needed to standardize cream. It uses simple algebra to balance the fat content by solving for the unknown quantities of each component.



**Points to Remember**

- Cream standardization process must be handled with care to ensure product safety, consistency, and efficiency.
- Measure the fat content accurately using appropriate methods.
- Standardize cream at the correct temperature, usually between 4°C and 6°C, to prevent spoilage or butter formation.
- Use calibrated cream separators and homogenizers to ensure proper fat distribution
- Don't rely on guesswork to determine the fat percentage. Always test accurately before making adjustments.



**Application of learning 1.6.**

You are requested to go to the ice cream production workshop to standardize the cream for being used in ice cream production.



## Indicative content 1.7: Identifying the Types of Ice Cream



Duration: 2 hrs



### Theoretical Activity 1.7.1: Identification of types of ice cream



#### Tasks:

1: Answer the following questions related to identification of the types of ice cream. According to your knowledge, what could be the types of ice cream based on:

- a) Ingredients
- b) Fat content
- c) Texture

2: Write your answers on paper, flip chart.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.7.1



### Key readings 1.7.1.: Identification of types of ice cream

- **Types of ice cream based on ingredients**

Ice cream can also be classified based on the ingredients that define its flavor profile. The main categories in this classification are **plain ice cream**, **flavored ice cream**, and **fruit ice cream**.

- ✓ **Plain ice cream**

It refers to ice cream made from basic ingredients such as milk, cream, sugar, and stabilizers without any added flavoring beyond vanilla or other simple ingredients. It serves as a base for other types of ice creams but can be enjoyed on its own for its creamy, smooth texture and mild flavor.

- ✚ **Characteristics:**

- **Base flavor:** Often vanilla or sweet cream.
- **Ingredients:** Primarily milk, cream, sugar, and sometimes egg yolks (for custard-style ice cream).
- **Usage:** Frequently used as a foundation for sundaes, toppings, or to pair with desserts like pies and cakes.

✚ **Example varieties:** Vanilla ice cream and sweet cream ice cream

✓ **Flavored ice cream**

It is made by incorporating additional ingredients that impart distinct flavors. These flavors are often achieved through the use of natural extracts, spices, chocolate, nuts, or other ingredients that give the ice cream its specific taste.

✚ **Characteristics:**

- **Wide variety:** The flavor possibilities are nearly endless, ranging from traditional options to more exotic and creative combinations.
- **Added ingredients:** These include flavoring extracts (vanilla, chocolate), spices (cinnamon, cardamom), and even non-dairy flavoring options.

✚ **Common Types:**

- Chocolate ice cream
- Coffee ice cream
- Mint ice cream
- Cookies and cream
- Butterscotch ice cream

✓ **Fruit ice cream**

It is made by adding real fruits or fruit purees to the ice cream base. The fruits contribute both flavor and texture, creating a refreshing, naturally sweet dessert. Depending on the method of preparation, fruits can either be blended smoothly into the base or added as chunks or swirls.

✚ **Characteristics:**

- **Natural sweetness:** Fruits provide a natural sweetness and flavor, often reducing the need for additional sugar.
- **Freshness:** Fruit ice creams are often lighter and more refreshing than heavier, cream-based varieties.

✚ **Common Types:**

- Strawberry ice cream
- Mango ice cream
- Raspberry or Blueberry ice cream
- Banana ice cream

• **Types of ice cream based on texture**

Ice cream can be categorized based on its **texture**, which is influenced by the production process, freezing method, and air incorporation. The two main types based on texture are **soft ice cream** (also known as **soft serve**) and **hard ice cream**.

✓ **Soft ice cream (Soft Serve)**

**Soft ice cream** is characterized by its smooth and light texture. It is typically served at a slightly higher temperature than hard ice cream and contains more air, which gives it a softer consistency.

 **Characteristics:**

- **Air Incorporation:** Contains more air (called **overrun**) than hard ice cream, usually around 35%-45%, which makes it light and fluffy.
- **Serving Temperature:** Served at a temperature of around **-4°C to -6°C** (24°F to 21°F), making it softer and easier to dispense from machines.
- **Production Method:** Made using a continuous freezer that mixes and freezes the ice cream at the same time, resulting in a soft, creamy texture.
- **Fat Content:** Typically has a lower fat content (around 3%-6%) compared to hard ice cream.
- **Consumption:** Usually served fresh from a soft serve machine and is a common offering at fast-food outlets, ice cream parlors, and amusement parks.

 **Texture:**

- Light, airy, and smooth.
- Softer and more melt-in-the-mouth compared to hard ice cream.

✓ **Hard Ice Cream**

**Hard ice cream** is the more traditional type of ice cream, known for its dense and firm texture. It is frozen at lower temperatures, making it more solid and scoopable.

 **Characteristics:**

- **Air Incorporation:** Contains less air (about 20%-30% overrun), resulting in a denser, more substantial texture compared to soft ice cream.
- **Serving Temperature:** Stored and served at a temperature around **-12°C to -18°C** (10°F to 0°F), making it firmer and more solid.
- **Production Method:** Typically, churned and frozen in batch freezers, then stored at low temperatures to harden further before serving.
- **Fat Content:** Generally, has a higher fat content (around 10%-20%), which contributes to its rich, creamy texture.
- **Consumption:** Sold in scoops, cups, or cones, and available in a wide variety of flavors and forms (e.g., sundaes, ice cream cakes).

 **Texture:**

- Dense, firm, and rich.
- Scoops hold their shape well, and the ice cream takes longer to melt compared to soft serve.

- **Types of ice cream based on fat content**

Ice cream can be categorized based on its **fat content**, which significantly influences its texture, flavor, and mouthfeel. Fat gives ice cream its creamy

richness, and different types of ice cream are formulated to meet specific dietary preferences or regulatory standards.

✓ **Ultra Low-Fat Ice Cream**

**Ultra-low-fat ice cream** contains the least amount of fat and is designed for those who are looking for a very light option with minimal calories from fat.

+ **Fat Content:**

- Less than **1%** milk fat.

+ **Characteristics:**

- **Texture:** Light and often less creamy compared to higher-fat varieties.
- **Flavor:** May lack the rich, full flavor of traditional ice cream due to the lower fat content.
- **Common Ingredients:** Often relies on stabilizers and thickeners (e.g., guar gum, xanthan gum) to achieve a smoother texture in the absence of fat.

+ **Common Varieties:**

- Some types of **frozen desserts** marketed as low-calorie alternatives.
- Ice creams labeled as "no-fat" or "fat-free."

✓ **Low-Fat Ice Cream**

**Low-fat ice cream** is designed for consumers who want to enjoy ice cream but with reduced fat content for health or dietary reasons.

+ **Fat Content:**

- Contains **2%-3%** milk fat.

+ **Characteristics:**

- **Texture:** Lighter and slightly less creamy than full-fat ice cream, but still smooth.
- **Flavor:** May taste a bit less rich but can still be flavorful depending on the use of ingredients like milk solids, sweeteners, or flavorings.
- **Regulation:** In the U.S., low-fat ice cream must contain **less than 3 grams of fat per serving** (typically ½ cup).

+ **Common Varieties:**

- **Light Ice Cream:** Marketed as "light" or "low-fat."
- **Frozen Yogurt:** Can fall into this category if it contains milk fat in the lower range.

✓ **Medium-Fat Ice Cream**

This type of ice cream has a moderate amount of fat, providing a balance between richness and calorie control.

+ **Fat Content:**

- Contains between **3%-10%** milk fat.

+ **Characteristics:**

- **Texture:** Creamier than low-fat varieties but not as rich as high-fat ice cream.
- **Flavor:** Offers a good balance between flavor and richness, making it a popular choice for everyday consumption.

- **Common Varieties:** Often seen in **standard commercial ice cream** labelled as reduced-fat or light ice cream, where some fat has been reduced but not eliminated

#### ✓ **High-Fat Ice Cream**

**High-fat ice cream** is rich and indulgent, made with a significant amount of cream. This is the most common type of traditional ice cream.

#### + **Fat Content:**

- Contains between **10%-16%** milk fat.

#### + **Characteristics:**

- **Texture:** Dense, creamy, and smooth, with a luxurious mouthfeel due to the higher fat content.
- **Flavor:** Full and rich, with a silky finish. The fat content helps carry and enhance the flavor of the ingredients used.
- **Regulation:** In the U.S., ice cream labeled as "ice cream" must have at least **10% milk fat**.

#### + **Common Varieties:**

- **Premium Ice Cream:** Often contains **12%-14%** milk fat.
- **Artisan and Gourmet Ice Cream:** These varieties can push the fat content to the upper limits of the high-fat category, often between **14%-16%**.

#### + **Examples:**

- Brands like **Häagen-Dazs** and **Ben & Jerry's** are known for their high-fat content, contributing to their creamy, rich texture.

#### ✓ **Ultra-High-Fat Ice Cream**

**Ultra-high-fat ice cream** is extremely rich, with the highest fat content allowed for ice cream production. This type is very creamy and indulgent, often reserved for premium or super-premium products.

#### + **Fat Content:**

- More than **16%**, often going up to **20%** or higher.

#### + **Characteristics:**

- **Texture:** Incredibly rich and dense, with a very smooth, velvety texture. The high fat content reduces the ice crystal formation, making the ice cream extra creamy.
- **Flavor:** The richness of the fat amplifies the flavor, making it very intense and satisfying. Fat also acts as a carrier for flavor, giving the ice cream a more pronounced taste.
- **Mouthfeel:** Ultra creamy, coats the mouth with a luxurious texture.

#### + **Common Varieties:**

- **Super-Premium Ice Cream:** Often labeled as such, with brands or artisan producers creating these luxurious versions.

- **Custard-Based Ice Creams:** With added egg yolks for extra richness, these can fall into this category.



#### **Points to Remember**

- While identifying ice cream types, check for milk fat content, texture and other ingredients.



## Learning outcome 1 end assessment

### Written assessment

- I. Read the following statements related to preparation of the ice cream production workplace and **encircle the letter corresponding to the correct answer**
  1. One of the following is the reason for ensuring that all tools and equipment used in ice cream production are clean and sanitized:
    - A. To maintain the texture of the ice cream
    - B. To prevent contamination and ensure food safety
    - C. To improve the flavor of the ice cream
    - D. To reduce production costs
  2. Which one of the following tools is most essential for accurately measuring the ingredients for ice cream?
    - A. Thermometer
    - B. Scale
    - C. Blender
    - D. Ice cream scoop
  3. Before starting ice cream production, why is it important to check the condition of mixing machines?
    - A. To ensure they will blend flavors correctly
    - B. To prevent mechanical failure during production
    - C. To guarantee the ice cream will be soft
    - D. To reduce energy consumption
  4. Which type of equipment is used to rapidly freeze ice cream in production?
    - A. Blast chiller
    - B. Freezer
    - C. Pasteurizer
    - D. Refrigerated display case
  5. One of the following is the purpose of calibrating thermometers and temperature control equipment before ice cream production.
    - A. To achieve the correct freezing point for the ice cream
    - B. To avoid excess noise in the workspace
    - C. To reduce the fat content in the mixture
    - D. To maintain workplace cleanliness

6. Which one of the following best describes the layout of a hygienic ice cream production workspace?
- A. All equipment should be placed close together for easy access.
  - B. Workstations should be spaced to minimize contamination risks and facilitate workflow.
  - C. Machines should be placed randomly as long as there is enough space.
  - D. Ingredients and waste should be stored in the same area to save time.
7. When preparing equipment for ice cream production, which personal protective equipment (PPE) is recommended?
- A. Hairnet, gloves, lab coat, and safety boots
  - B. Goggles and face shield
  - C. Safety boots and hard hat
  - D. None of the above
8. What is the best way to prevent cross-contamination during ice cream production?
- A. Mixing all ingredients at once
  - B. Cleaning equipment between different batches
  - C. Storing ingredients at room temperature
  - D. Using multiple freezers for the same batch
9. What should be done to all tools and equipment before starting a new production cycle?
- A. They should be heated.
  - B. They should be stored in a freezer.
  - C. They should be thoroughly cleaned and sanitized.
  - D. They should be placed in cold water.
- II. Read carefully the statements below related to cleaning the workplace for ice cream production and answer by **True** if the statement is **correct**, or **False** if the statement is **wrong**.
- 1. Using the same cloth to clean different surfaces is an acceptable practice in ice cream production.
  - 2. Equipment should be disassembled and cleaned after each batch of ice cream is made.
  - 3. Cleaning products should be stored near ingredients to make them easily accessible during production.
  - 4. Regular cleaning of the production area helps to prevent contamination and ensures food safety.
  - 5. It is not necessary to clean the floors daily in an ice cream production facility as long as the equipment is clean.
  - 6. A clean workplace has no impact on the taste or quality of the ice cream produced.

III. Match the following cream separation methods in **Column C** with their corresponding descriptions in **Column B**. Write the answer in the provided space (**Column A**).

| Column A | Column B                                                                                                                          | Column C                                                                                                                                                                                                                                                                                                                                                                       |
|----------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 =....  | 1. This method is commonly used in traditional, small-scale dairy operations but is too slow for industrial use                   | <b>A.</b> Gravity method<br><b>B.</b> Centrifugal method<br><b>C.</b> Higher temperature aids separation<br><b>D.</b> Gravity method (traditional, slow)<br><b>E.</b> Centrifugal separator (mechanical, fast)<br><b>F.</b> Gravity method (natural force, no machine)<br><b>G.</b> Centrifugal method (fast and efficient)<br><b>H.</b> Lower efficiency at cold temperatures |
| 2 = ...  | 2. This method involves allowing milk to sit undisturbed so that the cream naturally rises to the top due to density differences. |                                                                                                                                                                                                                                                                                                                                                                                |
| 3 = ...  | 3. A modern, mechanical process that can handle large volumes of milk and is preferred in commercial dairy production.            |                                                                                                                                                                                                                                                                                                                                                                                |
| 4 =...   | 4. A technique that spins milk at high speeds, using centrifugal force to separate cream from skim milk.                          |                                                                                                                                                                                                                                                                                                                                                                                |
| 5 =...   | 5. In this method, cream separation happens more efficiently at higher temperatures due to the reduced viscosity of milk.         |                                                                                                                                                                                                                                                                                                                                                                                |
| 6 =....  | 6. In this method, no additional mechanical force is applied; the separation occurs due to natural forces over time.              |                                                                                                                                                                                                                                                                                                                                                                                |

IV. Below there are steps for weighing ice cream ingredients. Analyse and arrange them on the right order

#### Record ingredient weights

1. Double-check measurements
2. Gather ingredients and containers
3. Weigh each ingredient
4. Combine ingredients after weighing
5. Tare the scale
6. Set up a clean and calibrated scale

#### Practical assessment

Suppose that in your school there is a production unit that processes food products including ice cream. One of the school staff is preparing for a birthday party and requests your production unit to produce 5 kg of ice cream to be used in celebration of his birthday.

Unfortunately, the workplace for the production unit is not well prepared. You are asked to go to the production unit's workshop to prepare the workplace, tools, equipment, and ingredients for ice cream production. The task should be performed in three hours and all needed materials, tools and equipment are available in the production unit's workshop.

**END**



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## Learning Outcome 2: Prepare Cream Mixture



### Indicative contents

#### 2.1 Mixing ingredients

#### 2.2 Pasteurizing cream mixture

#### 2.3 Filtering pasteurized cream mixture

#### 2.4 Chilling cream mixture

#### 2.5 Flavouring cream mixture

### Key Competencies for Learning Outcome 2: Prepare Ice Cream Mixture

| Knowledge                                                                                                                                                                                                                                  | Skills                                                                                                                                                                                                                                     | Attitudes                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Description of factors affecting mixing efficiency of cream mixture</li><li>• Description of factors effecting filtration</li><li>• Description of chilling conditions for cream mixture</li></ul> | <ul style="list-style-type: none"><li>• Mixing cream mixture ingredients</li><li>• Pasteurizing cream mixture</li><li>• Filtrating pasteurized cream mixture</li><li>• Chilling cream mixture</li><li>• Flavouring cream mixture</li></ul> | <ul style="list-style-type: none"><li>• Being careful while mixing ingredients</li><li>• Being attentive while pasteurizing cream mixture</li><li>• Being clean while filtering cream mixture</li><li>• Being accurate while flavouring cream mixture and when using chilling machine</li></ul> |



**Duration:20 hrs**

**Learning outcome 2 objectives:**



By the end of the learning outcome, the trainees will be able to:

1. Describe appropriately factors affecting mixing efficiency of cream mixture
2. Mix appropriately the ingredients for cream mixture
3. Pasteurize effectively cream mixture as applied in ice cream production
4. Describe clearly factors effecting filtration of cream mixture
5. Filtrate effectively pasteurized cream mixture
6. Describe appropriately chilling conditions for cream mixture
7. Chill appropriately cream mixture as applied in ice cream production
8. Flavour accurately cream mixture as applied in ice cream production



**Resources**

| Equipment                                                                                                                                                                       | Tools                                                                                                                                                                                                  | Materials                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Pasteurizer</li><li>• Homogenizer</li><li>• Fridge/Freezer</li><li>• Scales</li><li>• Working table</li><li>• Cream separator</li></ul> | <ul style="list-style-type: none"><li>• Filter</li><li>• PPEs</li><li>• Graduated cylinder</li><li>• Jags</li><li>• Thermometer</li><li>• Milk cans</li><li>• Spoon</li><li>• Stirrer/ whisk</li></ul> | <ul style="list-style-type: none"><li>• Fresh cream</li><li>• Fresh milk</li><li>• stabilizers</li><li>• Milk powder</li><li>• Butter/cream</li><li>• Sweeteners</li><li>• Colours</li><li>• Flavours</li></ul> |



## Indicative content 2.1: Mixing Ingredients



Duration: 4 hrs



### Practical Activity 2.1.1: Mixing ingredients for cream mixture



#### Tasks:

You are requested to go to the ice cream production workshop and mix ingredients for the cream mixture

- 1: Apply safety precautions
- 2: Mix ingredients for the cream mixture
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read key reading 2.1.1
- 5: Perform the task provided in the application of learning 2.1.



#### Key readings 2.1.1.: Mixing ingredients for the cream mixture

- **Purpose of mixing ingredients for the cream mixture**

Mixing ingredients is a critical step in ice cream production, and it serves several key purposes:

- ✓ **Uniform distribution of Ingredients:**

Mixing ensures that all ingredients, such as milk, cream, sugar, stabilizers, and flavorings, are evenly distributed throughout the mixture. This guarantees consistent taste and texture in every particle.

- ✓ **Incorporation of Air:**

During the mixing process, air is incorporated into the ice cream mixture. This is essential for creating a smooth and creamy texture. Without enough air, the ice cream would be dense and hard.

- ✓ **Stabilization of the Emulsion:**

Ice cream is a complex emulsion of fat and water. Mixing helps to disperse fat droplets evenly in the water phase, preventing them from clumping together, which is key to producing a stable product.

✓ **Dissolving Solids:**

Ingredients like sugar need to be fully dissolved to avoid a grainy texture. Proper mixing ensures that sugar and other solids are well integrated into the liquid base.

✓ **Hydration of Stabilizers and Emulsifiers:**

Stabilizers (like guar gum or gelatin) and emulsifiers (like lecithin) need time to absorb moisture and blend into the mixture. Proper mixing allows these ingredients to work effectively to control the texture and consistency.

✓ **Consistent Flavour:**

Mixing ensures that flavourings, whether natural or artificial, are evenly spread throughout the ice cream, providing a uniform flavour profile.

✓ **Prevention of Ice Crystal Formation:**

Proper mixing helps reduce the size of ice crystals that form during freezing, creating a smoother texture and preventing the ice cream from becoming too icy.

• **Factors affecting the mixing efficiency of cream mixture for ice cream production**

Cream mixture mixing efficiency for ice cream production may be affected by different factors, some common factors that affect the mixing efficiency of cream mixture for ice cream production are the following:

✓ **Fat content of cream**

A higher fat content improves the mixing efficiency by **stabilizing emulsions, enhancing aeration, reducing churning time, and providing a creamy texture.** Lower fat content leads to a more **challenging mixing process, a thinner texture, and a less stable ice cream mixture.**

For optimal results, balancing fat content, the mixing conditions, temperature, speed, time, ingredient ratios, and shear force are critical factors that influence the mixing efficiency of cream mixtures for ice cream production. The right balance of these conditions ensures proper aeration, emulsification, and texture, ultimately determining the quality and smoothness of the final ice cream product.

Adjusting these factors helps manufacturers achieve the desired creaminess, stability, and mouthfeel is key to achieving the desired quality of the final ice cream product.

✓ **Mixing conditions**

✓ **Blending or mixing method**

The blending or mixing method has a direct impact on the efficiency of the ice cream production process. High-speed or high-shear blending results in better aeration, smaller fat globules, and smoother ice cream, while lower-speed methods may result in denser textures but less uniformity. The choice of blending method depends on the desired texture, creaminess, and final product characteristics in ice cream production.

✓ **Ingredients to use**

The ingredients to be used in ice cream production directly affect the mixing efficiency. This refers to how easily and uniformly the ingredients combine to form a smooth, stable mixture.

Here's a breakdown of how various ingredients impact mixing efficiency:

**1. Fat content (Cream, Milk Fat, etc.)**

✚ **Role:** Fats (from cream, butter, or milk) contribute to the richness and creaminess of the ice cream.

✚ **Impact on Mixing:** Higher fat content can make the mixture thicker, which may slow down the mixing process. However, fats also act as a lubricant during mixing, promoting smoother blending. Too much fat can lead to separation (where fat and water do not emulsify properly), making mixing more challenging.

**2. Sugar (Sucrose, Glucose, etc.)**

✚ **Role:** Sweeteners improve taste and also impact texture by affecting freezing properties.

✚ **Impact on Mixing:** Sugars dissolve in water, and their solubility influences how easily the mixture blends. If sugar doesn't dissolve properly (due to a high concentration or inadequate mixing time), it can cause uneven consistency. Sugars

also lower the freezing point, affecting how efficiently the mixture churns during freezing.

### 3. Milk Solids (Non-fat Milk Powder, Whole Milk)

-  **Role:** Milk solids provide protein and lactose, which contribute to texture, smoothness, and body.
-  **Impact on Mixing:** Properly dissolving milk solids is crucial to avoid clumps. When well-mixed, they stabilize the mixture and contribute to a smooth final product. However, if not well mixed, they may not dissolve completely, leading to a lumpy or inconsistent texture.

#### ✓ **Stabilizers (corn starch, modified starch)**

-  **Role:** Stabilizers prevent ice crystal formation and improve texture stability.
-  **Impact on Mixing:** Stabilizers increase the viscosity of the mixture, which can make it more difficult to blend if used in excess. They require precise mixing to ensure they are evenly distributed throughout the mixture, as improper hydration or dispersion can lead to clumping or uneven texture.

#### ✓ **Solids Content (Milk Powder, Cocoa Powder, etc.)**

-  **Effect on Mixing:** Ingredients like milk powder or cocoa powder increase the solid content, potentially making the mixture harder to mix uniformly. If not evenly dispersed, they may cause clumping or uneven texture.
-  **Proper Dispersion:** Solids must be evenly distributed for optimal mixing, as clumps of undissolved powders can affect both mixing efficiency and texture.

#### • **Mixing procedures**

The mixing procedures for cream mixture ingredients in ice cream production are as follows:

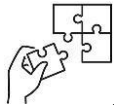
- ✓ **Weigh and Measure Ingredients:** Measure out milk, cream, sugar, stabilizers, and emulsifiers in the correct proportions.
- ✓ **Blend Ingredients:** Combine liquid ingredients (milk and cream) with dry ingredients (sugar, stabilizers, and emulsifiers). Stir until the sugar dissolves and the stabilizers are well-dispersed.
- ✓ **Heat the Mixture:** Gently heat the mixture to help dissolve solids and hydrate the stabilizers and emulsifiers, ensuring smooth mixing.
- ✓ **Pasteurization:** Heat the mixture to 82–85°C (180–185°F) for 15–30 seconds to kill bacteria and ensure proper ingredient integration.
- ✓ **Homogenization:** Homogenize the mixture at high pressure to evenly distribute fat molecules and create a smooth texture.

- ✓ **Cool and Age:** Cool the mixture rapidly to below 4°C (39°F) and allow it to age for 4–24 hours for better texture before freezing.



#### **Points to Remember**

- Use fresh Ingredients: Always use fresh cream, milk, and eggs (if included) for the best flavor and texture
- Follow your recipe accurately for the right balance between fat, sugar, and liquid. This affects the texture and how the ice cream freezes.
- While mixing ingredients for the cream mixture avoid over-mixing as it can cause the cream to curdle or form butter, leading to a grainy texture in the ice cream.



#### **Application of learning 2.1.**

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to mix ingredients.



## Indicative content 2.2: Pasteurizing Cream Mixture



Duration: 4 hrs



### Practical Activity 2.2.1: Pasteurizing cream mixture for ice cream production



#### Tasks:

You are requested to go to the ice cream production workshop and pasteurize cream mixture for ice cream production

- 1: Apply safety precautions
- 2: Pasteurize cream mixture for ice cream production
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read key reading 2.2.1
- 5: Perform the task provided in the application of learning 2.2.



#### Key readings 2.2.1. Pasteurizing cream mixture for ice cream production

- **The purpose of cream mixture pasteurization**

The purpose of **pasteurizing the cream mixture** in ice cream production is primarily to ensure **food safety** and improve the **quality** of the final product.

Here's a breakdown of the key reasons:

- ✓ **Eliminating harmful microorganisms:** Pasteurization heats the cream mixture to a specific temperature for a set time, effectively killing harmful bacteria (such as Salmonella, E. coli, or Listeria) that could be present in raw dairy ingredients. This makes the ice cream safe to consume.
- ✓ **Improving ingredient integration:** Heating the mixture during pasteurization helps to blend and stabilize the different ingredients, such as fats, sugars, and proteins. This ensures that the mix is **uniform** and smooth, which leads to better texture in the final product.
- ✓ **Enhancing shelf life:** By reducing the microbial load, pasteurization extends the **shelf life** of the ice cream, preventing spoilage during storage and transportation.
- ✓ **Activating stabilizers and emulsifiers:** Many ice cream recipes include stabilizers (like guar gum or carrageenan) and emulsifiers (like lecithin). Pasteurization helps to **activate these additives**, which contributes to the smooth and creamy texture of the ice cream by preventing ice crystal formation and improving the structure.

- **Cream mixture pasteurization methods**

- ✓ **HTST (High-Temperature Short-Time)** pasteurization is a widely used method for pasteurizing liquid products, particularly in the dairy industry. It involves rapidly heating a product to a high temperature for a short duration to eliminate harmful microorganisms while preserving the product's quality.

**Key features of HTST:**

- ✚ **Temperature and Time:** The product is heated to **72°C (161°F)** for **15 seconds**. This temperature-time combination is effective at killing pathogens without significantly affecting the taste, nutritional content, or quality of the product.

- ✚ **Process:**

- The liquid (such as milk or cream) is first preheated, then quickly brought to the required temperature using a heat exchanger.
- It is held at the target temperature for the required 15 seconds.
- The liquid is then rapidly cooled to below 4°C (39°F) to prevent bacterial growth and ensure freshness.

- ✓ **LTLT (Low-Temperature Long-Time)** pasteurization, also known as **batch pasteurization**, is one of the traditional methods used for pasteurizing liquid products, particularly in small-scale or artisanal food production. In this process, the liquid is heated at a relatively low temperature for a longer period compared to other methods like HTST.

**Key Features of LTLT:**

- ✚ **Temperature and Time:** The liquid is heated to **63°C (145°F)** and held at that temperature for **30 minutes**. This extended exposure to moderate heat ensures that harmful microorganisms are effectively killed.

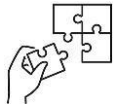
- ✚ **Batch Process:**

- LTLT pasteurization typically takes place in a batch pasteurizer, where the product is placed in a large tank and heated uniformly.
- Once the required temperature is reached, it is held there for 30 minutes, and then the product is cooled rapidly.



### Points to Remember

- Follow the correct temperature guideline by heating the mixture to at least **165°F (74°C)** and holding it for **at least 30 seconds** or heat it to **145°F (63°C)** and hold it for **30 minutes** then after pasteurizing, cool the mixture rapidly to **below 40°F (4°C)** to prevent bacterial growth.
- Stir the mixture continuously to ensure even heating, prevent scorching, and avoid fat separation.
- Ensure all equipment is thoroughly sanitized before use because pasteurization will kill pathogens, but contamination can occur during post-pasteurization if hygiene is neglected.



### Application of learning 2.2

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to pasteurize the cream mixture for ice cream production.



## Indicative content 2.3: Filtering Pasteurized Cream Mixture



Duration: 4 hrs



### Practical Activity 2.3.1: Filtering pasteurized cream mixture



#### Task:

You are requested to go to the ice cream production workshop and filter pasteurized cream mixture for ice cream production

- 1: Apply safety precautions
- 2: Filtrate the pasteurized cream mixture
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read key reading 2.3.1
- 5: Perform the task provided in the application of Learning 2.3.



#### Key readings 2.3.1 Filtrating pasteurized cream mixture

- **Filtration of pasteurized cream mixture**

Cream filtration is the process of separating solid particles or impurities from a cream mixture, which may be used in food, cosmetics, or pharmaceuticals. The goal is to achieve a smooth, consistent texture and improve product quality by removing unwanted materials. The filtration process involves passing the cream mixture through a filter medium, which can vary in size and composition depending on the specific application.

- ✓ **Steps involved in cream mixture filtration**

- ✚ **Preparation of the Cream Mixture:**

The cream is first mixed or emulsified to ensure uniform consistency. If the cream is viscous, it might be heated slightly to reduce viscosity and make filtration easier.

- ✚ **Choice of Filter Medium:**

The type of filter depends on the cream's intended use and the size of the particles to be removed. Filters can range from simple cloth or mesh screens to more advanced filter papers, membranes, or sieves.

- ✚ **Filtration Process:**

- The cream mixture is poured or pumped through the filter medium.
- Solid particles, such as undissolved ingredients, impurities, or contaminants, are trapped by the filter, while the purified cream passes through.

- In some industrial applications, pressure or vacuum filtration may be employed to enhance the efficiency and speed of the process.



#### **Collection of Filtered Cream:**

- The filtered cream is collected in a container, free from unwanted particles or impurities.
- The solids or contaminants trapped by the filter can either be discarded or, in some cases, further processed or analysed.

- **Purpose of filtrating pasteurized cream mixture**

- ✓ **Removal of Physical Impurities:**

Pasteurization does not remove physical debris or solid particles (e.g., bits of curd, undissolved solids, or residual fat clumps) that might remain in the cream mixture. Filtration ensures these particles are removed, resulting in a smooth, homogeneous cream.

- ✓ **Improved Texture and Consistency:**

Filtering the pasteurized cream helps to achieve a uniform, silky texture. This is especially important in the production of products like whipped cream, butter, or dairy-based sauces, where smoothness and consistency are critical for consumer satisfaction.

- ✓ **Enhanced Product Quality:**

By eliminating any residual particles that could affect the appearance or mouthfeel, filtration improves the overall quality of the cream. A clean, lump-free cream mixture is more desirable in both food products and cosmetic applications.

- ✓ **Removal of Post-Pasteurization Contaminants:**

Although pasteurization kills bacteria, it doesn't remove potential contaminants that may enter the cream afterward (e.g., dust or debris during handling). Filtration adds an additional level of purification, ensuring that these are removed before packaging or further processing.

- ✓ **Increase in Shelf Life:**

Filtering out small particles, which could promote faster spoilage or microbial growth, can help prolong the shelf life of the pasteurized cream. While pasteurization handles the microbial aspect, filtration ensures that no physical contaminants accelerate deterioration.

- ✓ **Improved Process Efficiency:**

In industrial settings, filtration helps downstream processes, such as homogenization or packaging, by preventing clogging or malfunction due to unwanted particulates. This ensures that equipment runs smoothly and the final product remains consistent.

- **Factors effecting filtration**

✓ **Temperature**

When the pasteurized cream is warmed, the viscosity (thickness) of the cream decreases. This means the cream becomes more fluid and flows more easily through the filter. The reduced resistance allows for faster filtration because the cream can pass through the filter pores without causing blockages or slowing down the process.

While as the temperature drops, the cream becomes thicker and more viscous. Cold temperatures cause the fat molecules to solidify or thicken, making the cream flow more slowly through the filter. This increase in viscosity can reduce filtration speed and efficiency, potentially clogging the filter or requiring more force (such as increased pressure or vacuum) to complete the filtration process.

✓ **Homogenization**

Homogenization is a mechanical process that breaks down fat globules in cream into much smaller, uniform sizes and evenly disperses them throughout the liquid. This process directly impacts the filtration of pasteurized cream in several ways: Without homogenization, fat globules in cream tend to be larger and can cluster together, causing an uneven distribution of fat. These larger fat globules can create blockages or clogs in filters, slowing down the filtration process.

**Homogenization reduces the size of fat globules and ensures that the cream is uniformly emulsified.** The smaller, more evenly dispersed fat globules flow more smoothly through the filter medium, making filtration more efficient and reducing the risk of clogging.

✓ **Types of filter**

The type of filter used in the filtration of pasteurized cream affects the process in several key ways:

➤ **Coarse Filters:**

- Characteristics: Have larger pore sizes.
- Effect on Filtration: Allow larger particles and fat globules to pass through more quickly, resulting in faster filtration but less thorough impurity removal. They are suitable for removing larger debris but may leave behind smaller particles.

➤ **Fine Filters:**

- Characteristics: Have smaller pore sizes.
- Effect on Filtration: Remove smaller particles and fine impurities, producing a cleaner, smoother cream. However, they slow down the filtration process and are more prone to clogging, especially with thicker or higher-fat creams.

✓ **Pressure**

Pressure plays a crucial role in the filtration of pasteurized cream, influencing both the efficiency and effectiveness of the process. Here's how pressure affects the filtration:

✓ **Filtration Speed**

○ **Increased Pressure:**

Applying higher pressure to the cream during filtration speeds up the process. This is because the increased force pushes the cream through the filter medium more rapidly. This can be especially beneficial in industrial settings where large volumes need to be processed quickly.

○ **Decreased Pressure:**

Lower pressure results in slower filtration because the cream flows more slowly through the filter medium. This can be less efficient for large-scale operations but might be suitable for more controlled or smaller-scale processes.

✓ **Filtration Efficiency**

○ **Higher Pressure:**

Higher pressure can improve the efficiency of filtration by increasing the flow rate of cream through the filter. This allows finer filters to be used effectively, which can remove smaller particles and impurities from the cream, resulting in a cleaner final product.

○ **Lower Pressure:**

Lower pressure may not force the cream through fine filters as effectively, potentially leading to incomplete removal of impurities and less efficient filtration.

● **Procedure of filtrating pasteurized cream mixture**

Filtration of pasteurized cream mixture is an important step in dairy processing to ensure the final product is smooth and free of impurities. Here's a step-by-step overview of the procedure:

✓ **Preparation**

Ensure that all equipment and filtration units are clean and sterilized to prevent contamination.

Check that the pasteurized cream mixture is at the correct temperature for filtration. It's usually done at a temperature of around 4-10°C (39-50°F) to maintain viscosity and prevent microbial growth.

✓ **Selection of Filter**

Choose the appropriate filter based on the desired particle size and the nature of impurities. Common types include mesh filters, cartridge filters, and membrane filters.

✓ **Filtration Process**

**Coarse Filtration:** The cream mixture is first passed through a coarse filter to remove larger particulates and residues.

**Fine Filtration:** After coarse filtration, the cream goes through a fine filter or membrane filter to remove smaller particles, such as fat globules, microorganisms, or protein aggregates.

✓ **Monitoring**

Continuously monitor the filtration process to ensure it is operating correctly. Check for any pressure drops or flow rate changes, which can indicate filter clogging or other issues.

✓ **Cleaning**

Regularly clean and sanitize filters to prevent fouling and maintain efficiency. This is typically done using specialized cleaning solutions and processes depending on the filter type.

✓ **Quality Control**

After filtration, the cream mixture should be tested to ensure it meets quality standards. This includes checking for clarity, consistency, and absence of contaminants.

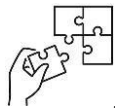
✓ **Storage:**

Store the filtered cream mixture in clean, sanitized containers or tanks to avoid recontamination. Ensure that it's kept at a controlled temperature to maintain its quality.



### **Points to Remember**

- Select filters specifically designed for dairy products. Ensure that they are appropriate for the desired particle size and volume of cream
- Ensure all equipment, including filters and tanks, is thoroughly cleaned and sanitized before and after use to prevent contamination.
- Avoid exceeding the recommended capacity of the filter, as this can lead to excessive clogging and reduced filtration efficiency.
- Never skip cleaning and sanitizing procedures, as residual creams or contaminants can spoil the final product and cause safety issues.
- Discard any filters that are damaged or worn out. Using damaged filters can compromise the filtration process and contaminate the cream.



### **Application of learning 2.3.**

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to filtrate pasteurized cream mixture.



## Indicative content 2.4: Chilling Cream Mixture



Duration: 4 hrs



### Practical Activity 2.4.1: Chilling the cream mixture for ice cream production



#### Tasks:

You are requested to go to the ice cream production workshop and chill the cream mixture

- 1: Apply safety precautions
- 2: Chill the cream mixture
- 3: Present your work to the trainer/workshop assistant lass. Ask for clarification where necessary
- 4: Read key reading 2.4.1
- 5: Perform the task provided in the application of learning 2.4.



#### Key readings 2.4.1.: Chilling the cream mixture for ice cream production

- **Chilling conditions**  
Chilling of the cream mixture for ice cream production refers to cooling the prepared mixture in the refrigerator, typically for 4 to 24 hours, before churning. This step allows the mixture to thicken, develop flavours, and solidify fats, ensuring a smoother texture and better freezing during the churning process.  
  
**Temperature, relative humidity, time, and closed container** are conditions for the chilling process
- ✓ **Temperature:**  
The cream mixture should be chilled to around **40°F (4°C)** or lower before churning. This ensures it is sufficiently cold for the freezing process to occur quickly and prevents large ice crystal formation.
- ✓ **Chilling Time:**  
The mixture is typically chilled for a minimum of **4 hours**, but **8 to 24 hours** is ideal to allow the flavours to meld and the fats to solidify.
- ✓ **Relative:**  
Relative humidity impacts the cooling process of a cream mixture in ice cream production by affecting the rate of moisture evaporation. In environments with **low humidity**, moisture from the cream mixture evaporates more quickly, which can lead to a faster cooling process but might also cause drying or a skin to form

on the mixture's surface. In **high humidity** environments, evaporation is slower, which may prolong the cooling time. Proper humidity control ensures consistent cooling without altering the mixture's texture or moisture balance.

✓ **Container:**

Use an **airtight container** to avoid absorbing any unwanted odours from the fridge. A shallow container is preferred for faster cooling.

• **Applying chilling of cream mixture**

✓ **Cool to room temperature**

Remove the mixture from heat and let it cool to room temperature. Stir occasionally to speed up cooling and prevent a skin from forming.

✓ **Transfer to a Container:**

Pour the cooled mixture into an airtight container. This helps avoid contamination and absorption of odours

✓ **Refrigerate:**

Place the container in the refrigerator. Chill the mixture for at least **4 hours**, but ideally for **8 to 24 hours**. The cooler temperature helps thicken the mixture and enhance flavour development.

✓ **Use an Ice Bath (Optional:)**

For quicker chilling, place the mixture in a bowl set in an ice bath (ice and cold water) to cool it down faster before refrigeration.

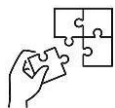
✓ **Check Temperature:**

Ensure the mixture has reached around **40°F (4°C)** or lower before churning. This ensures the mixture is cold enough for proper freezing and smooth texture.



### Points to Remember

- Ensure the cream mixture reaches around **40°F (4°C)** or lower before churning to achieve the best texture and flavour.
- Store the mixture in airtight containers to prevent it from absorbing odours and to avoid forming skin on the surface.
- If chilling a large batch, stir the mixture periodically to ensure even cooling and to prevent warm spots.
- Use a thermometer to check that the mixture is properly chilled before transferring it to the ice cream maker.
- Don't place the hot mixture directly into the refrigerator. Allow it to cool to room temperature first to prevent raising the refrigerator's temperature.
- Avoid handling the mixture with unclean utensils or containers to prevent contamination.



### Application of learning 2.4.

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to chill the cream mixture.



## Indicative content 2.5: Flavouring Cream Mixture



Duration: 4 hrs



### Practical Activity 2.5.1: Flavouring cream mixture for ice cream production



#### Tasks:

You are requested to go to the ice cream production workshop and Flavour the cream mixture.

- 1: Apply safety precautions
- 2: Flavour the cream mixture..
- 3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary
- 4: Read key reading 2.5.1
- 5: Perform the task provided in the application of learning 2.5.



#### Key readings 2.5.1.: Flavouring cream mixture for ice cream production

##### Flavourings for cream mixture

Flavouring of the cream mixture for ice cream production involves adding various ingredients to infuse the mixture with desired flavours and tastes. This can include:

- ✓ Extracts and Essences: Such as vanilla, almond, or mint extracts.
- ✓ Fruits and Purees: Like strawberry, mango, or raspberry purées.
- ✓ Spices and Herbs: Including cinnamon, nutmeg, or basil.
- ✓ Chocolate or Coffee: Cocoa powder, melted chocolate, or brewed coffee

##### Applying cream mixture flavouring procedure

Flavouring the cream mixture typically involves the following steps:

- ✓ **Prepare Flavourings:**  
Choose your flavouring ingredients (e.g., extracts, fruit purees, chocolate, spices) and prepare them as needed. For instance, fruit purees should be smooth, and spices should be finely ground.
- ✓ **Blend with Base Ingredients:**  
Incorporate the flavourings into the cream mixture before heating. This ensures the flavours are evenly distributed throughout the mixture. For extracts, add them to the cream and sugar. For fruits or chocolate, blend them into the base before heating.
- ✓ **Heat if Necessary:**

If using ingredients that need to be dissolved or infused, heat the mixture as required. For example, chocolate should be melted and mixed in during heating, while extracts can be added directly without heating.

✓ **Taste and Adjust:**

Taste the mixture and adjust the flavourings if needed. This is the time to add more flavouring or adjust sweetness to your preference.

✓ **Chill the Mixture:**

After flavouring, chill the mixture according to the recipe instructions, usually for at least 4 hours. This helps the flavours meld and intensify.

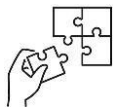
✓ **Churn:**

Once chilled, churn the mixture in an ice cream maker to incorporate air and achieve the desired texture.



### Points to Remember

- Measure flavouring ingredients precisely to achieve the desired taste and flavour without overpowering the mixture.
- Ensure flavourings are evenly mixed into the cream mixture for consistent flavour throughout the ice cream.
- Always taste the mixture before chilling to adjust the flavouring as needed. Add more if necessary to achieve the desired flavour profile.
- Use high-quality extracts, purees, and spices to enhance the overall flavour and quality of the ice cream.
- If adding flavourings that can evaporate or degrade with heat, wait until the mixture has cooled to room temperature.
- Inadequate mixing can result in uneven flavour distribution and affect the final product's consistency.



### Application of learning 2.5.

In a practical activity prepared by your trainer, you are requested to go to ice cream production workshop to flavour cream mixture.



## Learning outcome 2 end assessment

### Written assessment

I. Read the following statement related to the mixing of ingredients for cream mixture and **encircle the letter corresponding to the correct answer.**

1. In ice cream production, which one of the following is the purpose of mixing the cream mixture thoroughly before freezing?
  - A. To ensure the ingredients remain separated
  - B. To incorporate air and achieve a smooth texture
  - C. To increase the temperature of the mixture
  - D. To prevent the mixture from thickening
2. Which one of the following ingredients is used to stabilize the ice cream mixture and prevent ice crystals from forming?
  - A. Milk
  - B. Sugar
  - C. Guar gum or carrageenan
  - D. Vanilla extract
3. What role does fat play in the mixing process of ice cream?
  - A. It helps to reduce the sweetness of the mixture
  - B. It acts as a natural preservative
  - C. It contributes to a creamy texture by emulsifying the mixture
  - D. It lowers the freezing point of the ice cream
4. When is air incorporated into the ice cream mixture?
  - A. Before the ingredients are mixed
  - B. During the freezing process, as the mixture is churned
  - C. After the ice cream is fully frozen
  - D. Only during the heating phase of production
5. Why is the cream mixture pasteurized during ice cream production?
  - A. To enhance the flavour of the mixture
  - B. To reduce the fat content of the mixture
  - C. To kill harmful bacteria and ensure food safety

D. To improve the freezing speed of the mixture

II. Read carefully the following statements related to the filtration of pasteurized cream mixture and answer by **True** if the statement is correct or **False** if the statement is **wrong**.

- A. Filtration helps to improve the texture and consistency of the pasteurized cream mixture by removing solid particles and impurities.
- B. Filtration of the pasteurized cream mixture in ice cream production is primarily used to remove microorganisms.
- C. In ice cream production, proper mixing of the cream mixture helps evenly distribute fat, sugar, and other ingredients, ensuring a smooth and consistent texture.
- D. Chilling the cream mixture slowly after pasteurization helps to prevent the formation of large ice crystals in ice cream production.

III. Read the following statements related to cream mixture preparation and fill in empty space by using the appropriate term in parenthesis (**particles, air, cooling, promote fat crystallization, texture, freezing**)

- 1. Chilling the cream mixture before freezing in ice cream production is essential because it helps to \_\_\_\_\_, which improves the texture and consistency of the final product.
- 2. The process of mixing ice cream ingredients helps to incorporate \_\_\_\_\_ into the mixture, giving the ice cream a light and smooth texture
- 3. Filtration of pasteurized cream is primarily done to remove any remaining \_\_\_\_\_ from the mixture, ensuring a smoother texture.
- 4. Proper chilling of the pasteurized cream helps maintain the \_\_\_\_\_ of the ice cream mixture, which is essential for the final product's quality.
- 5. Adding flavouring to the pasteurized cream mixture should be done at the \_\_\_\_\_ stage to ensure even distribution and preservation of the flavour.

**IV. Match the flavouring process of the cream mixture in **column A** with their corresponding explanations in **column B**. Write the answer in the provided space (**Column C**)**

| Column C | Column A                       | Column B                                                                                                                                               |
|----------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1→.....  | 1. Prepare flavourings         | a) After flavouring, chill the mixture according to the recipe instructions, usually for at least 4 hours. This helps the flavours meld and intensify. |
| 2→.....  | 2. Blend with base ingredients | b) This is the time to add more flavouring or adjust sweetness to your preference                                                                      |
| 3→.....  | 3. Heat if necessary           | c) If using ingredients that need to be dissolved or infused, cook the mixture as required                                                             |
| 4→.....  | 4. Taste and adjust            | d) Incorporate the flavourings into the cream mixture before heating. This ensures the flavours are evenly distributed throughout the mixture.         |
| 5→.....  | 5. Chill the Mixture           | e) Ingredients like sugar need to be fully dissolved to avoid a grainy texture.                                                                        |
|          |                                | f) Choose your ingredients (e.g., extracts, fruit purees, chocolate, spices) and prepare them as needed.                                               |

### Practical assessment

the task must be performed within 4 hours.



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### Learning Outcome 3: Preserve Ice Cream



**Indicative contents**

**3.1 Hardening ice cream**

**3.2 Packaging ice cream**

**3.3 Storing ice cream**

**Key Competencies for Learning Outcome 3: Preserve ice cream**

| <b>Knowledge</b>                                                                                                                                  | <b>Skills</b>                                                                                                                   | <b>Attitudes</b>                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Identification of ice cream hardening conditions</li><li>• Description of labelling information</li></ul> | <ul style="list-style-type: none"><li>• Hardening ice cream</li><li>• Packaging ice cream</li><li>• Storing ice cream</li></ul> | <ul style="list-style-type: none"><li>• Being vigilant while hardening ice cream</li><li>• Being clean while packaging ice cream</li><li>• Having accuracy while filling and sealing ice cream</li><li>• Being careful while managing ice cream store</li></ul> |



**Duration: 10 hrs**

**Learning outcome 3 objectives:**



By the end of the learning outcome, the trainees will be able to:

1. Identify correctly ice cream hardening conditions
2. Harden appropriately Ice cream according to ice cream specification
3. Describe correctly labelling information of ice cream
4. Package appropriately ice cream according to ice cream packaging requirements
5. Store properly ice cream basing on storage conditions



**Resources**

| Equipment                                                                                                                                                                                     | Tools                                                                                                                                                                                                                                            | Materials                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Deep freezer</li><li>• Fridge</li><li>• Cold room</li><li>• Chilling machine</li><li>• Ice cream hardening machine</li><li>• Working table.</li></ul> | <ul style="list-style-type: none"><li>• Cup</li><li>• Thermometer</li><li>• Milk cans</li><li>• whisks</li><li>• Lactometer</li><li>• Alcoholic gun</li><li>• Sieve</li><li>• Jags</li><li>• pH meter</li><li>• Mops</li><li>• Brushes</li></ul> | <ul style="list-style-type: none"><li>• Labels</li><li>• Cleaning agents</li><li>• Packaging materials</li><li>• Pasteurized cream mixture</li><li>• Colours</li><li>• Flavours</li><li>• Packaging materials</li><li>• Labels</li><li>• Alcohol</li></ul> |



## Indicative content 3.1: Hardening ice cream



Duration: 3hrs



### Theoretical Activity 3.1.1: Description of ice cream hardening process



#### Tasks:

- 1: Answer the following questions related to the description of the ice cream hardening process:
  - i. What do you understand by the term “ice cream hardening”?
  - ii. What is the purpose of hardening ice cream?
  - iii. Identify different ice cream hardening conditions.
- 2: Provide the answers to asked questions by writing them on paper, flip chart.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the key readings 3.1.1



#### Key readings 3.1.1. Description of ice cream hardening

- **Meaning of the term ice cream hardening**

Ice cream hardening refers to the process of reducing the temperature of ice cream after it has been churned and mixed to its desired consistency. This step solidifies the mixture, enhances its texture, and helps to form a dense, creamy product

- **Purpose of hardening ice cream**

The purpose of **hardening ice cream** is to ensure it reaches the correct texture, firmness, and consistency before serving or packaging. After the ice cream is churned and initially frozen during production, it typically has a soft, semi-frozen consistency. Hardening is a crucial final step that involves rapidly freezing the ice cream at very low temperatures, usually between -20°C to -30°C (-4°F to -22°F), to complete the freezing process.

Here are the key reasons for hardening ice cream:

- ✓ **Firmness and Stability:** Hardening ensures that the ice cream develops the right firmness, making it scoopable while maintaining its structure. It prevents the ice cream from being too soft or melting too quickly when served.

- ✓ **Microcrystal Formation:** During the hardening process, rapid freezing prevents the formation of large ice crystals. Small, evenly distributed ice crystals result in a smooth, creamy texture rather than a grainy or icy one.
  - ✓ **Preservation:** Proper hardening also helps preserve the quality and shelf life of the ice cream by stabilizing its temperature. It prevents changes in texture and flavour over time, especially if the product is stored or transported before consumption.
  - ✓ **Reduced Overrun Loss:** Ice cream contains air (overrun) that is added during the churning process. Rapid hardening locks in the incorporated air, helping maintain volume and preventing the ice cream from collapsing or losing air, which would affect its lightness and consistency.
- NB: Improper hardening of ice cream leads to a grainy texture due to large ice crystal formation, soft or unstable structure, loss of air (overrun), quick melting, reduced shelf life, and potential flavour deterioration.

- **Ice cream Hardening conditions**

- ✓ **Temperature**

Ice cream is typically hardened at very low temperatures, between -20°C to -30°C (-4°F to -22°F), with the optimal range around -25°C (-13°F). This rapid freezing prevents large ice crystals from forming.

- ✓ **Container type**

Ice cream is often packaged immediately after churning, so the containers used must allow for proper cold air exposure during the hardening process.

- **Ice cream hardening methods**

Ice cream hardening methods involve freezing the ice cream rapidly after the churning process to achieve the desired texture and stability. The main hardening methods are:

- ✓ **Blast Freezing**

✚ **Description:** Ice cream is exposed to very cold air, typically between -30°C to -40°C (-22°F to -40°F), in a blast freezer. High-velocity cold air circulates around the ice cream, ensuring rapid and uniform freezing.

✚ **Advantages:** Quick and efficient, preventing large ice crystals and preserving texture.

- ✓ **Tunnel Freezing**

✚ **Description:** Ice cream passes through a long, cold tunnel where it is exposed to cold air at temperatures between -30°C to -40°C. The product moves on a conveyor belt or in batches through different stages of cooling.

✚ **Advantages:** Suitable for large-scale production, allowing continuous hardening of large quantities.

✓ **Cryogenic Freezing**

+ **Description:** This method uses liquid nitrogen or carbon dioxide, both of which have extremely low boiling points. Ice cream is sprayed or immersed in these gases, which evaporate quickly, rapidly freezing the product.

+ **Advantages:** Fastest hardening method, ensuring minimal ice crystal formation and superior texture.

✓ **Static Freezing**

+ **Description:** Ice cream is placed in static freezers (e.g., storage freezers) at low temperatures of around **-20°C to -30°C** (-4°F to -22°F). This method relies on ambient cold air without forced air circulation.

+ **Advantages:** Simple and cost-effective, though slower than blast or tunnel freezing.



### Practical Activity 3.1.2: Hardening ice cream



#### Task:

You are requested to go to the ice cream production workshop and harden ice cream

1: Apply safety precautions

2: Harden ice cream

3: Present your work to the trainer/workshop assistant. Ask for clarification where necessary

4: Read key reading 3.1.2

5: Perform the task provided in the application of learning 3.1.



### Key readings 3.1.2 Hardening ice cream

- **The procedure of hardening ice cream**

Hardening ice cream involves lowering the temperature of the ice cream after the initial freezing process to stabilize its texture and prevent it from melting too quickly. The goal is to create a smooth, firm, and scoopable product. Here's a typical procedure:

✓ **Freezing and Churning:**

+ **Base Preparation:** Make the ice cream base by mixing ingredients such as cream, milk, sugar, and flavorings.

+ **Churning:** Once the base is ready, churn it in an ice cream maker. Churning

introduces air and prevents the formation of large ice crystals, keeping the texture creamy.

- ✚ **Initial Freezing:** During the churning process, the mixture is cooled to a semi-solid state (soft serve consistency) at around -5°C to -7°C (23°F to 19°F).

✓ **Transfer to Freezer:**

- ✚ **Packaging:** Once the churning is done, transfer the soft ice cream into an airtight container to prevent ice crystals from forming.

- ✚ **Smoothing the Surface:** Level and smooth the top surface of the ice cream to ensure even hardening.

✓ **Blast Freezing (Optional but Ideal):**

- ✚ **Blast Freezer:** For commercial operations, ice cream is placed in a blast freezer that quickly lowers the temperature to around -30°C to -40°C (-22°F to -40°F). This rapid cooling reduces the size of ice crystals, resulting in a smoother texture.

- ✚ **Home Freezing Alternative:** At home, place the ice cream in the coldest part of your freezer, ideally at -18°C (0°F) or colder. Although not as fast as a blast freezer, this will still effectively harden the ice cream.

✓ **Hardening Stage:**

- ✚ **Hardening Temperature:** Allow the ice cream to harden for at least 4 to 6 hours, or overnight. The ice cream's internal temperature should reach around -15°C (5°F) or colder for optimal texture and scoopability.

✓ **Storage:**

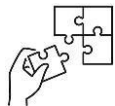
- ✚ **Long-term Storage:** After the ice cream has hardened, it should be stored at a temperature of -18°C (0°F) to maintain its texture and prevent freezer burn.

- ✚ **Avoid Fluctuations:** Keep the ice cream at a stable, low temperature to avoid melting and refreezing, which can degrade the texture.



### Points to Remember

- While hardening ice cream, keep the freezer at  $-20^{\circ}\text{C}$  to  $-30^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$  to  $-22^{\circ}\text{F}$ ) to ensure rapid freezing, which helps prevent large ice crystals from forming.
- Move ice cream directly to the hardening freezer after it's churned to maintain its texture and prevent softening.
- Make sure ice cream is packaged in airtight containers to avoid freezer burn and ensure it hardens uniformly.
- Ensure freezers are well-maintained and operating at optimal conditions to avoid any fluctuations in temperature.
- Minimize the opening of freezer doors during hardening to avoid temperature fluctuations, which can affect consistency.
- Avoid overcrowding freezers, as this reduces air circulation, slowing down the hardening process and causing uneven freezing.



### Application of learning 3.1.

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to harden the ice cream.



## Indicative content 3.2: Packaging Ice Cream



Duration: 4 hrs



### Theoretical Activity 3.2.1: Description of ice cream packaging process



#### Tasks:

1: Answer the following questions related to the description of the ice cream hardening process:

- i. What is the purpose of packaging ice cream?
- ii. Identify key information to be put on the ice cream package.
- iii. Differentiate different methods for ice cream labelling.

2: Provide the answers to asked questions by writing them on paper or flip chart.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 3.2.1



#### Key readings 3.2.1. Description of ice cream packaging process

- **Purposes of packaging ice cream**

The following are the purposes of packaging ice cream:

- ✓ **Protection:** Packaging protects the ice cream from contamination, moisture loss, and freezer burn, preserving its freshness and quality.
- ✓ **Preservation:** It maintains the ice cream's temperature and prevents fluctuations, ensuring a stable texture and flavour.
- ✓ **Convenience:** Packaging allows for easy handling, transportation, storage, and portion control for consumers.
- ✓ **Marketing:** It serves as a medium for branding, product information, and attracting customers with appealing designs.
- ✓ **Environmental Impact:** Proper packaging reduces waste and ensures eco-friendly disposal or recycling options.

- **The key information to be put on ice cream label**

Here are the key pieces of information to include on an ice cream package:

- ✓ **Product Name:** Clear name of the flavour (e.g., "Vanilla Bean").

- ✓ **Brand Name:** The manufacturer's or brand's name.
- ✓ **Ingredients List:** Complete list of ingredients in descending order by weight.
- ✓ **Nutritional Information:** Nutrition facts panel detailing calories and nutrient amounts.
- ✓ **Allergen Information:** Highlight common allergens (e.g., milk, nuts).
- ✓ **Net Weight/Volume:** Quantity of the product (e.g., 1.5 quarts).
- ✓ **Storage Instructions:** Guidelines for proper storage (e.g., "Keep frozen").
- ✓ **Best Before/Expiration Date:** Date for optimal consumption.
- ✓ **Barcode:** For inventory and sales tracking.
- ✓ **Contact Information:** Manufacturer's contact details for customer inquiries.

- **Labelling methods used in ice cream production**

In ice cream labeling, **direct labeling** and **applied labeling** are two methods used to add information to packaging:

- ✓ **Direct Labelling**

- + **Definition:** Direct labelling involves printing information directly onto the ice cream container or packaging, without the use of separate labels.
- + **Process:** This is typically done using inkjet or laser printers integrated into the production line, which print the required information (e.g., product details, expiration dates, barcodes) directly onto the surface of the container.
- + **Advantages:** It eliminates the need for adhesive labels, reducing material costs and waste, and offers flexibility in adding custom information during production.
- + **Example:** Printing a barcode or expiration date directly on a plastic tub or paper wrapper.

- ✓ **Applied Labelling**

- + **Definition:** Applied labeling refers to attaching pre-printed labels onto ice cream containers. These labels are usually printed separately and then applied manually or by machine to the packaging.
- + **Process:** The labels, which can be adhesive-backed or shrink-wrap labels, are physically placed onto the containers after being printed.
- + **Advantages:** Applied labels often offer higher-quality graphics and more detailed information compared to direct labeling, making them ideal for branding and marketing.
- + **Example:** A pre-printed sticker or shrink sleeve applied to an ice cream tub.



### Practical Activity 3.2.2: Packaging ice cream



#### Task:

You are requested to go to the ice cream production workshop and Package ice cream

1: Apply safety precautions

2: Package ice cream.

3: Present your work to the trainer/ workshop assistant. Ask for clarification where necessary

4: Read key reading 3.2.2

5: Perform the task provided in the application of learning 3.2.



#### Key readings 3.2.2 Packaging ice cream

- **Filling and sealing methods**

- ✓ **Manual filling and sealing**

The manual filling and sealing method in ice cream production involves the following steps:

- + **Preparation of Containers:** Clean and sanitize the ice cream containers (cups, tubs, or cones) to ensure they are ready for filling.

- + **Manual Filling:** The ice cream mixture, after being frozen and churned, is manually scooped or poured into the containers. This can be done using spoons, spatulas, or funnels depending on the consistency of the ice cream and container size.

- + **Levelling:** The surface of the ice cream may be levelled or smoothed by hand to ensure an even fill, leaving enough space for proper sealing.

- + **Sealing:** Once filled, lids are manually placed onto the containers. If using foil or paper seals, they are pressed or crimped to ensure they are airtight.

- + **Final Inspection:** The filled and sealed containers are inspected to ensure proper closure and hygiene before storage.

- ✓ **Semi-automated filling and sealing**

The semi-automated filling and sealing method in ice cream production combines manual labor with machinery to improve efficiency while maintaining control over the process. Here's a brief overview:

- + **Preparation of Containers:** Containers (cups, tubs, or cones) are manually loaded into the filling machine's designated slots or conveyor system.

- + **Filling:** The ice cream mixture is dispensed automatically by the machine into the

containers. The amount of ice cream is pre-set, ensuring consistent portions.

-  **Manual Adjustments:** Operators may adjust the machine settings or intervene if any issues arise during filling, such as uneven distribution or container misalignment.
-  **Sealing:** After filling, lids or foil seals are applied automatically by the machine. Operators may manually ensure proper alignment of lids and check seals for quality.
-  **Inspection and Packaging:** The filled and sealed containers are inspected, and workers may perform final adjustments before packing them into larger cartons for storage or shipment.

#### ✓ **Automated filling and sealing**

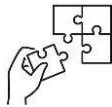
The automated filling and sealing method in ice cream production involves fully mechanized systems that handle the process with minimal human intervention. Here's a brief explanation:

-  **Automated Container Loading:** Empty containers (cups, tubs, or cones) are automatically fed into the machine via a conveyor belt or rotating system.
-  **Filling:** The machine accurately dispenses pre-measured portions of the ice cream mixture into each container. The amount is controlled by the system to ensure consistent filling.
-  **Sealing:** After filling, lids or foil seals are automatically placed and sealed onto the containers. The machine ensures tight, airtight seals using either heat-sealing, pressure, or crimping, depending on the packaging type.
-  **Inspection and Rejection:** Integrated sensors and cameras check the quality of the filling and sealing. Any container that doesn't meet standards is automatically rejected.
-  **Packaging:** Once filled and sealed, the containers are moved to another section of the line for automated packing into larger cartons or trays for storage and distribution.



### Points to Remember

- Keep packaging area well cleaned and sanitized to avoid product contamination.
- Remember to check if packaging materials are safe and clean.
- Make sure that all required information is clear and readable on the label
- Remember to check if ice cream is properly churned and mixed before packaging
- Ensure that packaging materials are food-grade and safe for direct contact with ice cream to avoid contamination
- Use airtight seals to prevent freezer burn and maintain product freshness.
- Keep ice cream at appropriate temperatures during packaging and storage to prevent melting or quality degradation.
- Avoid packaging materials that could leach harmful substances into the ice cream
- Leave appropriate headspace to allow for expansion during freezing and to prevent spillage.
- Avoid leaving ice cream at ambient temperatures for extended periods, as this can affect texture and quality.



### Application of learning 3.2.

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to package two (2) cups of home-made ice cream, each containing 500 ml.



### Indicative content 3.3: Storing Ice Cream



Duration: 3 hrs



#### Practical Activity 3.3.1: Storing ice cream



##### Task:

You are requested to go to the ice cream production and Store packaged home-made ice cream

- 1: Apply safety precautions
- 2: Store packaged home-made ice cream
- 3: Present your work to the trainer and whole class. Ask clarification where necessary
- 4: Read key reading 3.3.1
- 5: Perform the task provided in application of learning 3.3.



#### Key readings 3.3.1

- **Purposes of storing ice cream**

The purpose of storing ice cream is essential for maintaining its quality, safety, and shelf life. Here are the key reasons:

- ✓ **Preservation of Quality:** Proper storage helps maintain the texture, flavour, and overall quality of ice cream, preventing it from becoming too hard, icy, or losing its creaminess.
- ✓ **Prevention of Contamination:** Storing ice cream at the correct temperatures prevents the growth of bacteria and other pathogens, ensuring food safety for consumers.
- ✓ **Control of Temperature Fluctuations:** Consistent storage temperatures prevent freezer burn and the formation of ice crystals, which can negatively impact the texture and taste.
- ✓ **Extend Shelf Life:** Proper storage methods can extend the shelf life of ice cream, allowing it to be sold and consumed over a more extended period without compromising quality.
- ✓ **Inventory Management:** Effective storage practices help manage inventory levels, ensuring that ice cream products are rotated properly and reducing waste from expired or unsold items.

- **Ice cream Storage requirements**

✓ **Storage conditions**

The storage conditions for ice cream are crucial to maintaining its quality, safety, and texture. Here are the key conditions:

+ **Temperature:**

Ice cream should be stored at a consistent temperature of **-20°C (-4°F)** or lower. This prevents melting and refreezing, which can lead to ice crystal formation and affect texture.

+ **Humidity:**

Maintain low humidity levels in storage areas to prevent condensation on packaging, which can cause freezer burn and degrade the quality of the ice cream.

+ **Airflow:**

Ensure proper airflow around ice cream containers to promote even cooling and prevent hot spots, which can occur when products are overcrowded.

+ **Sealing:**

Use airtight and moisture-proof packaging to protect against contamination and freezer burn, helping to retain flavor and texture.

+ **Avoid Frequent Temperature Fluctuations:**

Limit the frequency of opening storage units to maintain stable temperatures and prevent quality degradation.

✓ **Shelf Life Monitoring:**

Regularly check expiration dates and rotate stock to ensure that older products are sold first, maintaining freshness and reducing waste.

✓ **Stock management (FIFO)**

**Stock management using the FIFO (First In, First Out) method** is crucial for ensuring the quality and freshness of ice cream products. Here's a brief explanation of how FIFO works in ice cream stock management:

+ **Definition:** FIFO is an inventory management strategy that ensures the oldest stock (the first items received) is sold or used first, minimizing the risk of expired or spoiled products.

+ **Implementation:**

**Organize Storage:** Arrange ice cream containers so that older products are at the front and newer products are placed behind them. This makes it easy for staff to access the oldest stock first.

+ **Regular Monitoring:** Conduct routine checks on inventory to ensure that older items are sold before their expiration dates. This helps in tracking stock levels and identifying items that need to be prioritized for sale.

+ **Clear Labelling:** Use clear labelling with production or expiration dates on ice cream containers to facilitate easy identification of older stock.



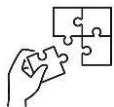
#### **Benefits:**

- **Quality Assurance:** By rotating stock effectively, FIFO helps maintain the quality and taste of ice cream, as older products are consumed before they degrade.
- **Reduced Waste:** Implementing FIFO reduces the risk of products expiring on the shelf, leading to less waste and more efficient use of resources.
- **Improved Inventory Control:** Regular monitoring and organization help manage inventory levels effectively, ensuring that the stock is fresh and ready for sale.



#### **Points to Remember**

- Ice cream should be stored at or below **-18°C (0°F)** to prevent melting and freezer burn.
- Store ice cream in the coldest part of the freezer (usually the back) to avoid temperature fluctuations caused by frequently opening the door.
- Don't repeatedly take the ice cream out of the freezer, as temperature changes lead to ice crystals and a grainy texture.
- Never store ice cream in the freezer without a lid or some form of covering, as this leads to freezer burn and absorption of unpleasant odours.



#### **Application of learning 3.3.**

In a practical activity prepared by your trainer, you are requested to go to the ice cream production workshop to store packaged homemade ice cream.



### Learning outcome 3 end assessment

#### Written assessment

I. Read the following statement related to the hardening of ice cream and **encircle the letter corresponding to the correct answer**

1. One of the following is the purpose of the hardening process in ice cream production.
  - A. To reduce the fat content
  - B. To improve the texture by freezing the remaining unfrozen water
  - C. To remove excess air from the mixture
  - D. To increase the sugar content
2. At what temperature range is ice cream typically hardened after it is initially frozen?
  - A.  $-5^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$
  - B.  $0^{\circ}\text{C}$  to  $5^{\circ}\text{C}$
  - C.  $-20^{\circ}\text{C}$  to  $-40^{\circ}\text{C}$
  - D.  $10^{\circ}\text{C}$  to  $20^{\circ}\text{C}$
3. What effect does rapid hardening have on the quality of ice cream?
  - A. It creates larger ice crystals, leading to a grainy texture
  - B. It increases the air content, making the ice cream fluffier
  - C. It prevents the growth of large ice crystals, leading to a smoother texture
  - D. It reduces the overall sweetness of the ice cream

II. Read carefully the following statements related to the packaging of ice cream and answer by **True** if the statement is **correct** or **False** if the statement is **wrong**.

- 1) Ice cream packaging must be airtight to prevent the absorption of unwanted odours from the environment.
- 2) The colour and design of ice cream packaging do not affect a consumer's purchasing decisions.
- 3) Ice cream packaging must be able to withstand temperatures as low as  $-20^{\circ}\text{C}$  to  $-40^{\circ}\text{C}$  during storage and distribution.
- 4) Packaging ice cream in transparent containers helps to slow down the melting process.
- 5) Sustainable packaging options for ice cream, such as biodegradable materials, are becoming more popular in the industry.

III. Read the following statements related to labelling methods and fill the empty spaces by using the appropriate terms in parenthesis (**a paper, cost-effective, screen printing, cream, milk**)

1. In direct labelling, information is printed directly onto the packaging material using methods such as \_\_\_\_\_ .
2. Applied labelling involves attaching pre-printed labels to the packaging, typically using materials like \_\_\_\_\_ to create eye-catching designs
3. One advantage of direct labelling over applied labelling is that it can be more \_\_\_\_\_ for large-scale production, eliminating the need for separate label materials

IV. Match the purposes of storing ice cream in **column A** with their corresponding explanations in **column B**. Write the answer in the provided space (**Column C**)

| Column C | Column A                               | Column B                                                                                                      |
|----------|----------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 1→.....  | 1) Preservation of Quality             | a) Prevent freezer burn and the formation of ice crystals, which can negatively impact the texture and taste. |
| 2→.....  | 2) Inventory Management                | b) Prevents the growth of bacteria and other pathogens, ensuring food safety for consumers                    |
| 3→.....  | 3) Control of Temperature Fluctuations | c) Allowing it to be sold and consumed over a more extended period without compromising quality.              |
| 4→.....  | 4) Extend Shelf Life                   | d) Ensuring that ice cream products are rotated properly and reducing waste from expired or unsold items.     |
| 5→.....  | 5) Prevention of Contamination         | e) Increasing expenses for ice cream                                                                          |
|          |                                        | f) Preventing it from becoming too hard, icy, or losing its creaminess.                                       |

### **Practical assessment**

Your school started operating a production unit in food processing with two newly recruited employees and it started with supplying 100 cups of 200ml for each strawberry flavoured ice cream per day at the nearest supermarket called “INGENZI SUPERMARKET”. Unfortunately, one month ago some customers complained that the supplied ice cream was looking watery due to poor preservation. As a way of solving this problem, your school management decided to recruit you, and you are requested to handle the problem mentioned above.

All materials, tools, and equipment are available in the ice cream processing workshop of your school and the task should be performed within 6 hours.

**END**



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