RQF LEVEL 3

FOPFM303

FOOD PROCESSING

Fermented Milk Production

TRAINEE'S MANUAL

October, 2024

FERMENTED MILK PRODUCTION

KOICA Korea International Cooperation Agency

TQUM TVET Quality Management Project

2024

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TABLE OF CONTENT

ACRONYMS

%: Percentage

^{0}C: Celsius

^{0}F: Degree Fahrenheit

AGR: Agriculture

CBC: Competence Based Curriculum

CBT/A: Competency-Based Training /Assessment

CIP: Cleaning In Place

COP: Cleaning Out of Place

FM: Fermented Milk

FOP: Food Processing

HDPE: High Density Polyethylene

IC: Indicative Content

Kg: Kilogram

L: Litre

Ltd.: Limited

pH: potential Hydrogen

PPE: Personal Protective Equipment

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

SNF: Solid Non-Fat

SOP: Standard Operating Procedure

TQUM: TVET Quality Management

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainee's manual includes all the knowledge and skills required in food processing specifically for the module of **"Fermented Milk 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 and 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: FOPFM303 FERMENTED MILK PRODUCTION

Learning Outcome 1: Prepare workplace
Learning Outcome 2: Ferment the milk
Learning Outcome 3: Store fermented milk

Indicative contents
1.1 Selection of materials, tools and equipment
1.2 Arrangement of workplace
1.3 Preparation of ingredients for fermented milk

Key Competencies for Learning Outcome 1: Prepare Workplace

Knowledge	Skills	Attitudes
• Description of materials, tools and equipment used in fermented milk making • Description of methods and techniques of cleaning the workplace, tools and equipment • Description of fermented milk production process • Explanation of work area arrangement purpose • Description of Ingredients ratio	• Selecting of materials, tools and equipment • Adjusting tools and equipment • Cleaning of workplace, tools and equipment • Arranging workplace • Calculating and weighing ingredients	• Being careful when selecting materials, tools and equipment • Being careful when adjusting tools and equipment • Being attentive when cleaning workplace, tools and equipment • Being well organized when arranging workplace • Being accurate when Calculating and weighing ingredients

Duration: 10 hrs

Learning outcome 1 objectives:

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

1. Describe correctly the cleaning products according to the intended use
2. Describe correctly the ingredients according to their product specification
3. Select and adjust properly tools and equipment according to the intended use
4. Clean properly work place, tools and equipment according to the protocol
5. Describe correctly the production process according to the product type
6. Calculate and weigh accurately the ingredients according the ingredients ratios

Resources

Equipment	Tools	Materials
• Milk cooling tanks • Pasteurizers • Refrigerator • Freezer • Incubation vats • PPE • Packaging machine • Sealing machine • Labelling machine • Pressure cleaners • Gas cookers • Electronic balance • Mechanical balance	• Thermometer • pH meter • Milk can • Stirrer • Stainless steel table • Sauce pans • Buckets • Spoon • Beakers • Brushes • Mopes • Squeegees • Towels • Gloves • Filters • Sweeper • Basin • Waste bins	• Raw milk • Mesophilic and thermophilic starter cultures • Sugar • Flavours • Stabilizers • Sodium hydroxide • Liquid soaps • Solid soaps • Chalks • Papers • Alcohol • Gloves • Labels • Disinfectants • Water • Gas • Packaging materials • Flip chart

		• Mark pen • Aluminium foil • Scotch • Glue • Fire • Extinguisher • First aid kit

Indicative content 1.1: Selection of materials, tools and equipment

Duration: 4 hrs

Theoretical Activity 1.1.1: Identification of materials used in fermented milk

Tasks:

1: You are requested to answer the following questions:

i. What should be the cleaning products used in fermented milk production?

ii. While producing fermented milk, different ingredients are used, what are them?

2: Provide the answers to the asked question by writing them on papers, flip chart, Blackboard or white board

3: Present the findings/answers to the whole class

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 1.1.1.

Key readings 1.1.1.: Identification of materials used in fermented milk

- **Materials used in fermented milk**

  Materials used in fermented milk production are classified in two classes:

  i. Cleaning products used in cleaning work area in fermented milk production

  ii. Ingredients used to make fermented milk products

  ✓ **Cleaning products used in cleaning work area in fermented milk production**

  - **Types of Cleaning products are:**

  1. Water: the simplest cleaner of all. Applied under pressure it cleans hard surfaces such as floors and walls. Water can also be used to rinse out dirt removed from a surface by other cleaning agents.
  2. General purpose or neutral detergents: these are able to penetrate moderately greasy and dirty surfaces. They are suitable for cleaning floors and walls.
  3. Sanitizer: these agents clean and disinfect surfaces. However, they do not replace the need for thorough washing with a detergent. Sanitizer wipes are available for wiping small areas and specialized equipment such as temperature probes. These should be discarded after use.
  4. Hard surface cleaner: these are used for heavier or more specialized tasks. Care should be taken as they are corrosive and may damage surfaces if used incorrectly.
  5. Degreasers: dissolve heavy grease and oil which water-based cleaners cannot dissolve

6. Abrasive powders: mostly used for cleaning enamel and ceramic surfaces like tiles, e.g., Ajax.

✓ **Ingredients used to make fermented milk products**

Ingredients used in fermented milk production are:

- **Raw milk:** It is a white opaque liquid produced /secreted by the mammary glands of mammals for feeding infants and used for processing others dairy products for human consumption. Milk contains **proteins, carbohydrates, fat, vitamins, minerals and water as milk compositions.**

❖ **Milk composition**

1. An important milk protein is casein about 80% and whey protein or serum about 20%.

2. Milk fat is present in the form of small fat globules which are lighter than the other constituents of milk. When cow milk is allowed to stand, these globules gather on top of milk and form a layer of cream.

3. Milk sugar gives milk its sweet taste. The lactose ferments by the influence of microorganism (sour milk). lactose is complex carbohydrate composed by fructose and galactose

4. Milk is also a valuable source of vitamins: A; B1; B2; B3; B9; B12; D; E; vitamin C is little in milk.

5. Minerals: Raw milk is a rich source of various essential minerals that play vital roles in human nutrition.

Here are some of the key minerals found in raw milk:

Major Minerals: Calcium (Ca), Phosphorus (P), Potassium (K), Magnesium (Mg).

Trace Minerals: Zinc (Zn), Selenium (Se), Iodine (I), Iron (Fe), Manganese (Mn), Copper (Cu)

Other Minerals: Sodium (Na), Chloride (Cl)

❖ **Factors affecting physical state of milk**

- The feed consumed by animals may lead to some undesirable flavours and taste.
- Bacterial growth in milk causes fruity, malty or acid flavours and an unclean taste or bitter taste.
- Enzyme activities also may lead to unnatural flavours, rancidity due to lipase action being a classic example.
- Seasonal changes with milk flavours.

- Cleanliness or equipment use and maintenance cause milk flavours.
- Exposure to metals such as various light sources during storage affects milk taste and colour.
- Farm environment contribute to the taste of milk leaving the udder.
- Seasonal changes with milk compositions, these changes can be reflected in the taste and colour of the milk.
- Temperature and transportation way change milk taste.
- Cleanliness or equipment use and maintenance cause milk taste.
- Breed, stage of lactation, milking time, udder health status, pasture grazing and seasonal calving.

  - **Starter culture:** Those are microorganisms that are used in the production of fermented/ cultured dairy products such as yoghurt and IKIVUGUTO.

❖ **Classification of starter culture based on the growth temperature**

- **Mesophilic starter culture**: the optimum growth temperature of the culture is 30^0C. they have the growth temperature range of 22-40^0C. it is used for IKIVUGUTO

Eg: Lactococcus lactis SSP cremoris and Lactococcus lactis SSP Lactis biovar diacetyl

- **Thermophilic starter culture**: the optimum growth temperature of these starter is 40^0C and they have growth temperature range of 32-45^0C. it is used for Yoghurt

Eg: Lactobacillus delbrueckii subsp bulgaricus, Streptococcus thermophilus

❖ **Function of starter culture**

- Acid production: Gel formation, preservation of milk, help in development of flavour
- Flavour: formation of flavour compound flavour like diacetyl and acetaldehyde
- Preservation: lower pH and redox potential, production of lactic acid, production of antibiotics, production of H_2O_2, production of acetate
- Gas formation: eye formation in a certain cheese, production of open texture Stabilizer formation, development of body and viscosity
- Lactose utilization: reduce development of gas and off flavour, suitable for lactose intolerant people
- Lowering redox potential: help in preservation, help in development of flavour

  - **Flavouring agents:** are food additives that are used to enhance aroma and Taste of Yoghurt. **Example of yoghurt flavour**: straw belly flavour; vanilla flavour; chocolate flavour

- **Colouring agents:** Are food additives that are added in yoghurt to enhance the colour according to the customer preference.
- **Stabilizers:** is food additive added to yoghurts to increase texture, stability, physical characteristics. **Examples:** Gelatin, starch, pectin.
- **Sweetening agents:** are food additives that are added in yoghurt to increase the sweetness (sugar content) of yoghurt. White sugar is recommended but brown can also be used.

Theoretical Activity 1.1.2: Identification of tools and equipment used in fermented milk production

Tasks:

1: You are requested to answer the following questions:

i. While cleaning workplace there are many tools and equipment you can use, what ar e them?

ii. While producing fermented milk products there are many tools and equipment you c an use, what are them?

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

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

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 1.1.2.

Key readings 1.1.2.: Identification of tools and equipment used in fermented milk production

- **Tools and equipment used in cleaning workplace**

S/N	Tool/equip ment	Image	uses
1	Pressure cleaner		It uses high-pressure water to remove tough residues, grease, and bacteria from surfaces, ensuring a thorough and efficient cleaning process.

2	Broom dustpan		Broom: Sweeps dirt, dust, and debris from floors or other surfaces. It has a long handle with bristles attached, which gather the debris when brushed across a surface. Dustpan: Collects the dirt and debris swept by the broom. It is typically flat and wide, with a slight lip to help catch and hold the debris before disposal.
3	Buckets		are used for holding and transporting cleaning solutions, water, or waste
4	Mopes		Is used to soak up water or cleaning solutions and scrub away dirt and grime
5	Sponge		Sponges are used for cleaning kitchen utensils, and other cleaning tools
6	Squeegee		are used to push or remove liquids from surfaces, especially on floors

7	Towel		is a piece of absorbent cloth or paper used for drying or wiping a surface.
8	Waste bins		✓ are designed containers which are holds some solid waste before disposal

- **Tools and equipment used in fermented milk production**

S/N	**Tools or equipment**	**Image**	**uses**
1	Milk cooling tanks		This equipment used to cool milk
2	Pasteurizers		Equipment used to pasteurise milk (heating milk at specific temperature in specified time to kill microorganisms).

3	Incubator		is equipment used to maintain conditions required in (fermentation) incubation process.
4	Butyrometer		used to determine the fat content in milk and to make accurate adjustments of the butterfat percentage in standardised milk and milk products.
5	Milk cans		are containers used to hold milk during milk reception and breaking coagulum (stirring).
6	Working tables		used in processing of fermented milk to hold other tools and facilitate easy production

7	Refrigerator		used to cool milk after incubation in order to stop fermentation process or slow down the activity of microorganisms.
8	Freezer		it is equipment used to deep freeze processed milk (yoghurt, IKIVUGUTO) in order to slow down the fermentation process
9	Packaging machine		is a machine used in filling and packaging fermented milk into packaging materials
10	Sealing machine		used to seal packaged milk in order to avoid any entrance of microorganisms in packaged fermented milk
11	Labelling machine		Machine used to print information about products on packaging material.

12	Gas cookers		Used to heat milk in the pasteurization process when cooking pans used.
13	Thermometer		Used to measure milk temperature during pasteurization
14	PH meter		Measure the pH of milk in order to show the acidity and alkalinity of milk.
15	Stirrer		Used to break coagulum of fermented milk and at the same time homogenize milk.
16	Saucepans		used in pasteurization of milk
17	Spoons		used in measuring of ingredient like starter culture

18	Electronic balance & mechanical balance		used to measure the weight of ingredients required in fermented milk production
19	Beakers		are used in milk sampling during milk testing
20	Milk separator		Separate fat in milk and remove visible foreign matter in milk through clarification process
21	Lacto scan		Instrument used for measuring the milk freezing point of fat (FAT), solids non-fat (SNF), density, proteins, lactose, salts, water content percentages, temperature (°C), freezing point, pH, as well as total solids of one and the same sample directly after milking, at collecting and during processing
22	Sieves		used in filtration of milk in order to remove foreign particles from milk like hair

- **Safety precaution of tools and equipment**
  - ✓ Use of PPE's (Safety shoes, Safety helmet, cotton hand gloves, leather apron, safety goggles) must be ensured

- ✓ Do not switch on or off any electrical equipment's with bare hand
- ✓ Do not use any damaged electrical associates
- ✓ Ensure work permit & adequate isolation before start of any critical routine and non-routine maintenance job
- ✓ Training to workforce. Display of Safety instructions and posters
- ✓ Calibration of measuring systems
- ✓ Proper housekeeping and hygiene practices
- ✓ Ensure provision and use of cold safety apron in cold room
- ✓ Monitoring temperature of cold room
- ✓ Fire protection systems
- ✓ Provision of smoke detectors and alarms

Practical Activity 1.1.3: Selecting and adjusting tools and equipment

Task:

1: Referring to the previous theoretical activities 1.1.2, you are requested to go to the food processing workshop select and adjust tools and equipment used in fermented milk production according to their use and tools/equipment manual

2: Apply safety precautions of tools and equipment used in fermented milk production

3: Present out:

i. The selection criteria tools and equipment used in fermented milk production
ii. The steps of selecting tools and equipment used in fermented milk production
iii. The steps of adjusting tools and equipment used in fermented milk production

4: Referring to the selection criteria, steps provided on task 3, select and adjust tools and equipment used in fermented milk production.

5: Present your work to the trainer and whole class. Ask for clarification where necessary

6: Read key reading 1.1.3.

7: Perform the task provided in application of learning 1.1

Key readings 1.1.3: Selecting and adjusting tools and equipment

- **Selection criteria of tools and equipment**
  - ✓ **Working condition of tools and equipment:** during processing tools and equipment with high speed are more preferred than those with low and medium speed, tools and equipment with and defects are not selected.

- ✓ **Availability of tools and equipment:** the processor must prefer to use available tools and equipment on local markets and those they financially access.
- ✓ **Cost of tools and equipment:** most of tools and equipment in food processing are more expensive if processor found cheapest tools and equipment buy them instead of the expensive one.
- ✓ **Efficiency of tools and equipment:** they are selected according their ability to perform the intended use well; tools and equipment of high efficient are selected.
- ✓ **Durability:** tools and equipment with long lifespan is more preferred than those of short life span.
- ✓ **Clean and hygienic:** stainless steel tools and equipment meet the international food hygiene standard
- ✓ **Convenient and fast:** The machine uses saving time and effort.

- **Steps of selecting tools and equipment**

  Steps of selecting tools and equipment:

  - ✓ List the tools and equipment needed based on the activity to be done
  - ✓ Present a list of available tools and equipment that can fulfil the task needs
  - ✓ Follow the safety guidelines for handling of each tool and equipment.
  - ✓ Hands-on Selection or physically handle and assess different tools and equipment
  - ✓ Make decisions on the most appropriate tools and equipment for specific task

- **Adjustment and functionality of tools and equipment**

Adjustment is defined as the operation of bringing a measuring instrument into a state of performance suitable for its use. This is not calibration.

Example of adjustment of equipment: adjustment of pasteurizer (adjusting temperature and time).

Functionality: is considered as the ability of equipment to perform desired task appropriately.

- ✓ **Procedures of adjusting tools and equipment**

- Identify the problem: determine what needs to be adjusted or repaired and understand the nature of the issue.
- Follow user manuals: If available, refer to user manuals or guidelines for both the equipment you are adjusting and the adjustment tool you are using.

- Make precise Adjustments: Use the adjustment tool to make careful and precise changes to the equipment. Gradually adjust and test as necessary.
- Monitor progress: Continuously check the results of your adjustments to ensure you are moving in the right direction. make further adjustments if needed.
- Test and verify: After completing the adjustments, test the equipment to verify that it now functions correctly or that the problem has been resolved.
- Seek Expert Help: If you are uncertain about the adjustments or if they involve complex systems, consider consulting with a qualified technician or expert.

Points to Remember

- Water is cleaning product which also be used to rinse out dirt removed from a surface by other cleaning agents.
- In all ingredients used in fermented milk production raw milk is main ingredient because all other ingredients refer to raw milk
- Milk protein is composited by casein about 80% and whey protein or serum about 20%.
- Mesophilic starter culture has optimum growth temperature of 30^0c
- Thermophilic starter culture has optimum growth temperature of 40^0c
- Each tool and equipment has its function but some can be used in more than one fun ction **example:** lacto scan used for measuring freezing point of fat, Solid Non Fat, prot eins, density, lactose, salts and temperature.
- While using tools and equipment better to respect all safety precautions for preventi ng some accident, injury which can cause death.
- Select tool or equipment based on the task to work on
- Some tools and equipment need to be adjusted before use and others don't
- While adjusting tools and equipment follow manufacturer manuals

Application of learning 1.1.

You are asked to go in your school workshop for fermented milk production to select and adjust tools and equipment used in fermented milk production.

Indicative Content 1.2: Arrangement of Workplace

Duration: 3 hrs

Practical Activity 1.2.1: Cleaning of workplace, tools and equipment in fermented milk production

Task:

1: You are requested to go to the food processing workshop and clean workplace, tools and equipment used in fermented milk production.
2: Apply safety precautions (wear PPE).
3: Present out the procedures of Cleaning of workplace, tools and equipment used in fermented milk production
4: Referring to the procedures provided on step 3, clean workplace, tools and equipment used in fermented milk production
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 1.2.1
7: Perform the task provided in application of learning 1.2

Key readings 1.2.1.: Cleaning of workplace, tools and equipment in fermented milk production

- **Cleaning of workplace, tools and equipment in fermented milk production**
  - ✓ **Cleaning methods of tools and equipment**

    Cleaning methods of tools and equipment are:
    - **Dry cleaning:** is a method of cleaning without using water.
    - **Wet cleaning:** is a method of cleaning by using water.
    - **Manual Cleaning** is the process of cleaning by hands, requires total disa ssembly for cleaning and inspection.
    - **Mechanical cleaning** is method of cleaning by using specialized equipm ent in cleaning.
  - ✓ **Cleaning techniques of tools and equipment**
    - **Clean-In-Place (CIP)** is the process of cleaning which does not require di sassembling of equipment.
    - **Clean-Out-Place (COP)** is defined as the process which involves the part ially or total disassembling of equipment. It is manual washing techniqu es used for cleaning small equipment, tools and utensils and areas of fo od processing that wouldn't be cleaned by a CIP system.

- ✓ **Steps of cleaning the workplace, tools and equipment**
  - Pre-rinsing: this initial step involves rinsing the surfaces or equipment with water to remove loose debris, dirt and residues.
  - Caustic treatment: caustic treatments help to breakdown and dissolve organic materials like grease, oils and proteins. This step is crucial for removing stubborn residues that water alone cannot address
  - Intermediate rinsing: an intermediate rinse with water removes the caustic solution and any loosened debris. This step ensures that no caustic residues remain.
  - Acidic treatment: this often, containing substances like phosphoric acid or citric acid. This helps to dissolve inorganic residues such as scale and mineral deposits that may have built up. It also helps neutralize any remaining caustic residues.
  - Intermediate rinsing: rinse with water is performed after acidic treatment to remove the acidic solution and any dissolved residues.
  - Disinfection: this step involves applying a disinfectant to kill any remaining microorganisms.
  - Final Rinsing: the final rinse with water removes any remaining disinfectant and residues from the previous cleaning steps.
- ✓ **Steps of cleaning used in CIP**
  - Pre-rinsing with warm water for about 10 minutes.
  - Circulation of an alkaline detergent solution (0.5 – 1.5%) for about 30 minutes at 75°C.
  - Rinsing out alkaline detergent with warm water for about 5 minutes.
  - Circulation of (nitric) acid solution (0.5 – 1.0 %) for about 20 minutes at 70°C.
  - Post-rinsing with cold water.
  - Gradual cooling with cold water for about 8 minutes.

Theoretical Activity 1.2.2: Description of purpose of work area arrangements

Tasks:

1: You are requested to answer the following questions:

i. Why is it important to arrange work area in fermented milk production?

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

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

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 1.2.2**.**

Key readings 1.2.2. Description of purpose of work area arrangements

The purpose of arranging the work area:

1. Optimize workflow and efficiency.
2. Ensure cleanliness and hygiene.
3. Enhance safety for workers and the product.
4. Organize equipment and materials for smooth operations.
5. Maximize space utilization.
6. Facilitate quality control and consistency in production

Theoretical Activity 1.2.3: Description of work area layout (production process)

Tasks:

1: You are requested to answer the following questions:

I. How can you design fermented milk production layout?

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

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

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 1.2.3.

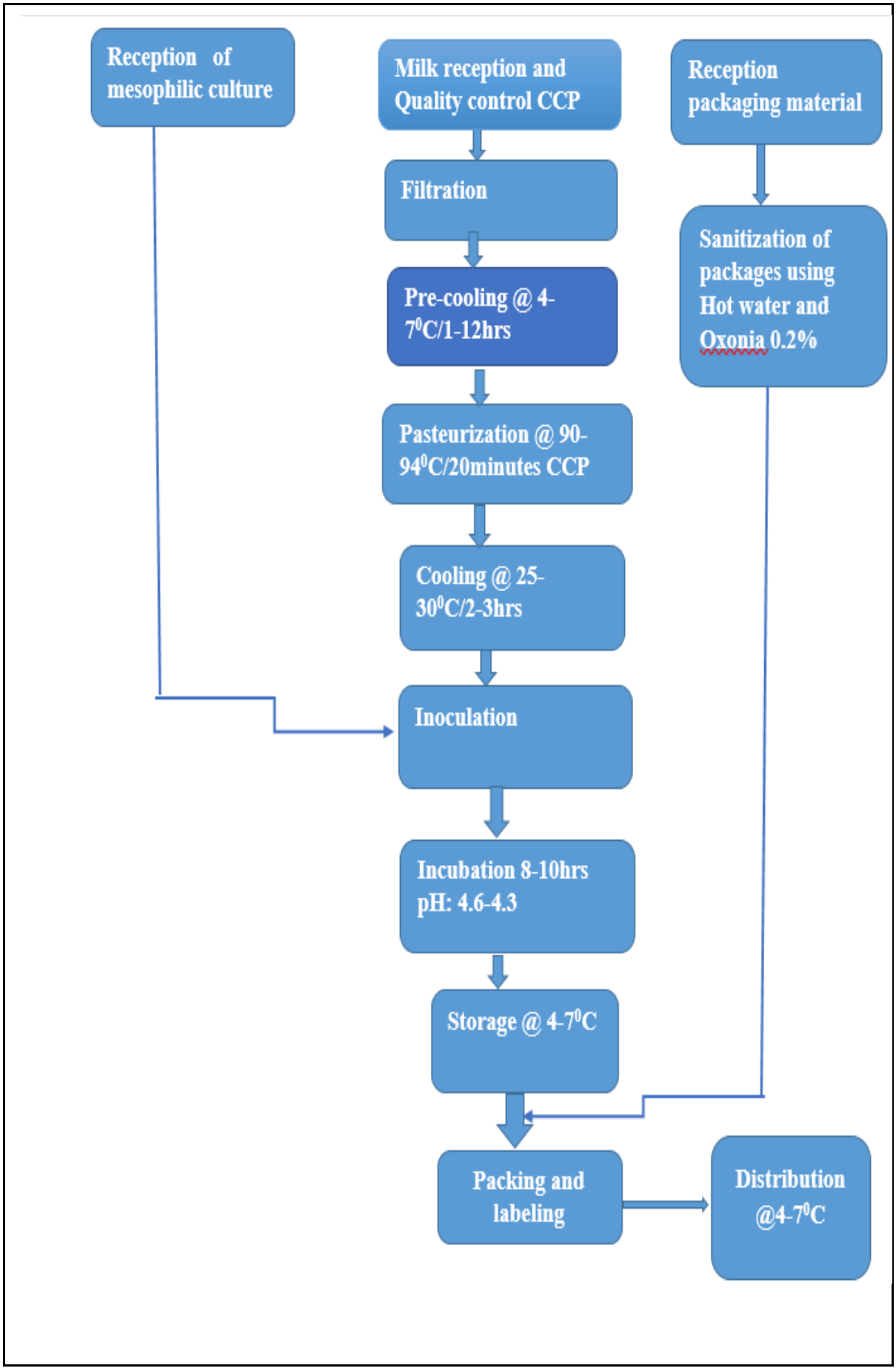
Key readings 1.2.3.: Description of work area layout (production process)

- **Work area layout (production process)**

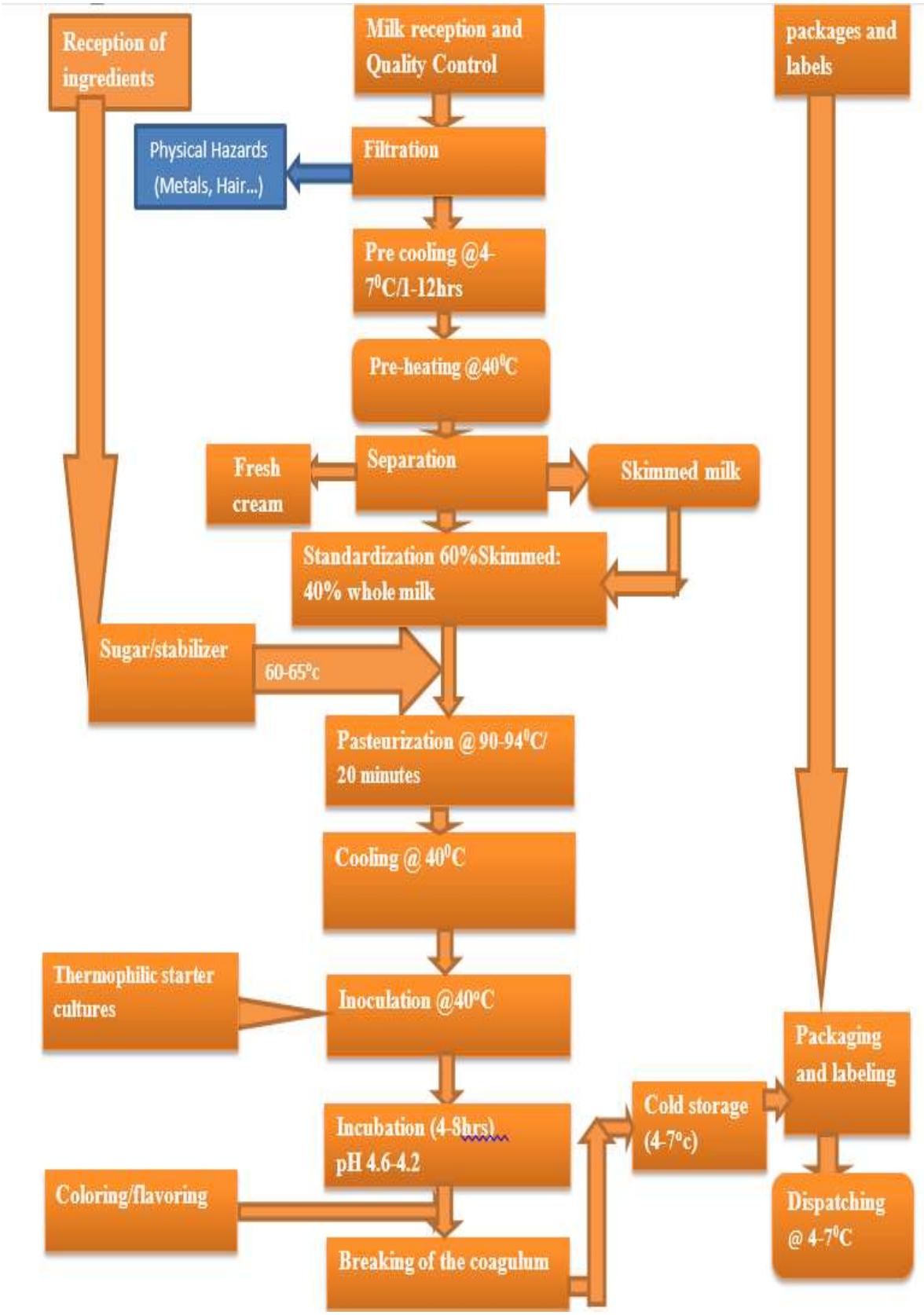
Work area layout (production process) of fermented milk production involves:

- ✓ **Milk Reception:** Raw milk is received, inspected, and tested for quality and safety. It is then stored in appropriate tanks.
- ✓ **Milk Pasteurization:** The milk is heat-treated to kill harmful bacteria and pathogens while preserving the beneficial bacteria. Pasteurization temperatures and times can vary based on the desired product.
- ✓ **Homogenization:** The milk is subjected to high-pressure homogenization to break down fat globules and achieve a uniform milk texture. This step prevents cream separation.

- ✓ **Cooling**: The milk is rapidly cooled to the desired fermentation temperature, typically around 40^0c for yoghurt and 25-30^0c for IKIVUGUTO
- ✓ **Inoculation:** Lactic acid bacteria cultures, such as Lactobacillus bulgaricus and Streptococcus thermophiles for yoghurt and mesophilic bacteria for IKIVUGUTO, are added to the milk to initiate fermentation. The specific bacteria strains may vary depending on the product types
- ✓ **Fermentation:** The milk is allowed to ferment at the designated temperature for a specific period, usually several hours, during which the bacteria convert lactose into lactic acid. This acidification process gives fermented milk its characteristic taste and texture.
- ✓ **Cooling and Holding:** After fermentation, the product is cooled to stop the fermentation process and then held at a lower temperature to maintain its quality.
- ✓ **Flavour and Ingredient Addition**: Flavourings, sweeteners, and other ingredients (e.g., fruit puree for flavoured yogurt) may be added at this stage.
- ✓ **Packaging**: The fermented milk product is filled into containers, which can include cups, bottles, or cartons, depending on the product type.
- ✓ **Cooling and Storage:** The packaged products are rapidly cooled and stored in refrigerated storage areas to maintain freshness and extend shelf life.
- ✓ **Quality Control:** Quality control checks are conducted throughout the process to ensure that the product meets the required standards for taste, texture, and safety.
- ✓ **Labelling and Coding:** Containers are labelled, and coding is applied for product identification and traceability.
- ✓ **Distribution:** The finished fermented milk products are prepared for distribution to retailers, supermarkets, or other outlets.
- ✓ **Production process of IKIVUGUTO**


Reception of mesophilic culture
Milk reception and Quality control CCP
Reception packaging material
Filtration
Sanitization of packages using Hot water and Oxonia 0.2%
Pre-cooling @ 4-7⁰C/1-12hrs
Pasteurization @ 90-94⁰C/20minutes CCP
Cooling @ 25-30⁰C/2-3hrs
Inoculation
Incubation 8-10hrs pH: 4.6-4.3
Storage @ 4-7⁰C
Packing and labeling
Distribution @4-7⁰C

✓ **Production process of yoghurt**



Points to Remember

- It is a must to respect temperature and ratio of cleaning product in cleaning to ensure the effectiveness of cleanliness
- While cleaning workplace follow this steps: pre-rinsing, caustic treatment, intermediate rinsing, acidic treatment, intermediate rinsing, disinfection and final rinsing
- While arranging work area make sure that all to be arranged are cleaned
- In production of IKIVUGUTO and yoghurt follow all process don't miss any one in order to get a product with good quality

Application of learning 1.2.

You are requested to identify and visit any dairy in your community, to observe:

I. How they clean workplace, tools and equipment,
II. How they arrange work area and
III. Production process they use while making IKIVUGUTO and yoghurt. Produce a visit report.

Indicative content 1.3: Preparation of ingredients for fermented milk

Duration: 3 hrs

Practical Activity 1.3.1: Weighing ingredients

Task:

1. You are requested to go to the food processing workshop to weigh the ingredients used in production of yoghurt and IKIVUGUTO
2. Apply safety precautions.
3. Present out the ratios to use in weighing the ingredients used in production of yoghurt and IKIVUGUTO
4. Weigh the ingredients used in production of yoghurt and IKIVUGUTO.
5. Read key reading 1.3.1
6. Perform the task provided in application of learning 1.3

Key readings 1.3.1.: Weighing ingredients

- **Weighing ingredients**
  - ✓ **Ingredients ratio used in IKIVUGUTO**
    - **Raw milk:** is main ingredient used in IKIVUGUTO making. Use ratio of 100% and All other ingredients depend on the quantity of milk used.
    - **Starter culture:** Addition of mesophilic starter culture **at 0.004%(Powder) or (3- 5% mother culture)**
    - **Stabilizers:** Stabilizer like corn-starch is used in amount of 1.2%/L of milk of whole milk and N-duldge 0.6%/L of milk if milk separated but if not separated only Corn-starch.

  E.g.: if 500l of milk is used calculation are as follow:
  500*1.2%=6kg of corn starch and 3kg of N-duldge
  - ✓ **Ingredients ratio used in yoghurt**
- **Raw milk:** The main ingredient in yogurt is raw milk. Use ratio of 100% and other ingredients are calculated based on it.
- **Stabilizers** are added at this time to maintain the texture (viscosity) and consistence of yoghurt. For yoghurt corn-starch 0.8%/l of whole milk is added to maintain texture or viscosity of milk and if milk is separated (0.7%/l of separated milk) of N-duldge starch is also added to maintain.

E.g.: if 100L of milk is processed into yoghurt and in that amount only 50L is separated. Calculate the amount of corn starch and N-duldge starch which will be used in that amount: 100*0.8%=800grs of corn starch and 50*0.7%= 350grs of N-duldge starch.

- **Yoghurt flavours (natural/artificial)**
  1. Natural flavours are created using ingredients from fruits etc. eg: use fruit juice like straw berry, use sliced fruits…
  2. Artificial or synthetic flavourings are created from chemical sources rather than natural source eg: vanilla essence, straw berry flavour, mango flavour… etc.

Flavours are used in different quantity depend on industry's protocol. A range of 0.1-0.2%

- **Starter culture:** add 0.002-0.004% of active thermophilic starter culture and use 3-5% of mother culture.
- **Add sugar** 0.0625kg /litter or use 6.25% of milk to increase yoghurt taste and sweetness
- **Food colour:** 0.05-0.06% of colouring like strawberry and or mango is used

✓ **Weighing procedures**

- **Make sure the balance is levelled.**

Use a spirit level to check the level of the balance platform. If the balance is not levelled, adjust the feet until it is levelled.

- **Zero the balance.**

Place a tared weight on the balance platform and press the zero button. The balance should now read zero.

- **Adjust the sensitivity.**

The sensitivity of the balance controls how much the balance needle moves in response to a change in weight. Adjust the sensitivity so that the needle moves smoothly and evenly.

- **Calibrate the balance.**

Calibration is the process of comparing the readings of the balance to a known standard weight. To calibrate the balance, use a calibration weight that is certified by a recognized laboratory.

Calibration procedures:

1. Place the calibration weight on the balance platform.
2. Read the weight displayed on the balance.
3. Adjust the balance so that the displayed weight matches the known weight of the calibration weight.
4. Repeat steps 2 and 3 for each calibration weight that you are using.

- **Weighing the ingredients with respecting the ratios**
- **Recording the finished weighing for each ingredient**

Points to Remember

- In calculating and weighing the ingredients you must respect the ratio of each ingredient
- The amount of other ingredients used in IKIVUGUTO and yoghurt depending on the quantity of main ingredient (raw milk)

Application of learning 1.3.

You are asked to go in your school workshop for fermented milk production to calculate and weigh the ingredients used in making IKIVUGUTO and yoghurt.

Learning outcome 1 end assessment

Theoretical assessment

Q1. Underline tools used in fermented milk production and cleaning work area

a) Freezer
b) Plastic bottles
c) Sauce pan
d) bucket
e) Stabilisers
f) Mopes
g) squeegees

Q2. Answer by True if the given statement is correct or False if the given statement is incorrect

a) The main ingredient used in fermented milk production is stabilizer
b) Both beakers and sugar are the ingredients used in fermented milk production
c) Flavouring agent used in fermented milk products to provide colour of milk
d) Is it necessary to identify the problem while you are adjusting the tools and equipment?

Q3. During cleaning workplace, tools and equipment used in fermented milk production the cleaning products are used for proper cleanliness. List two types of cleaning products.

Q4. Complete the sentence below with given appropriate term (refrigerator, homogenization, packaging, cooling, inoculation, flavouring)

a) **……** …… The milk is subjected to high-pressure homogenization to break do wn fat globules and achieve a uniform milk texture. This step prevents cream sep aration

b) **……** The fermented milk product is filled into containers, which can inclu de cups, bottles, or cartons, depending on the product type

c) **……** used to cool milk after incubation in order to stop fermentation proc ess or slow down the activity of microorganisms.

Q5. CIP is one of technique used in cleaning of equipment in fermented milk production. Describe the steps to follow in performing this technique.

Practical assessment

SAWA -SAWA dairy ltd located in MUSANZE District processes flesh milk and it has a problem of distributing fermented milk products (IKIVUGUTO and yoghurts) don't meet the customer preferences as claimed by the customers. Production manager of this dairy found the root cause of this problem is low skilled labour who don't know how to prepare the workplace and ingredients to use in IKIVUGUTO and yoghurt. As a skilled trainee, you are requested to solve this problem by performing the following tasks:

Task 1: Select materials, tools and equipment
Task 2: Arrange the workplace
Task 3: Prepare ingredients used to make IKIVUGUTO and yoghurt

N.B:

- During preparation of ingredients use 100L of raw milk for IKIVUGUTO and 100L of raw milk for yoghurt
- All resources needed are available in the work area
- Time to accomplish the activity is 5hours

END

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Indicative contents

2.1 Pasteurize the milk

2.2 Milk cooling according to the product specification

2.3 Incubation of inoculated milk

Key Competencies for Learning Outcome 2: Ferment the milk

Knowledge	Skills	Attitudes
• Description of types of yoghurt • Identification of the purposes of milk standardization • Explanation of milk standardization techniques • Identification of the purpose of milk homogenization • Explanation of homogenization conditions and procedures • Description on checking the pasteurization effectiveness • Identification of purpose of cooling and inoculating the milk • Identification of incubation conditions of fermented milk products • Description of quality parameters of fermented milk	• Adding ingredients into the milk • Homogenizing the milk • Standardizing the milk • Checking the effectiveness of pasteurization • Cooling and inoculating milk for IKIVUGUTO and yoghurt production • Incubating inoculated milk Checking the quality of fermented milk	• Being respective when adding ingredients into the milk • Being careful when homogenizing the milk • Being careful when standardizing the milk • Being careful when checking the effectiveness of pasteurization • Being attentive when cooling and inoculating milk for IKIVUGUTO and yoghurt production • Being attentive when incubating inoculated milk • Being careful when checking the quality of fermented milk

Duration: 40 hrs

Learning outcome 2 objectives:

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

1. Describe correctly the types of yoghurt according to the ingredients and incubation
2. Perform properly milk standardization according to the milk standardization techniques
3. Perform properly milk homogenisation according to the homogenisation procedures
4. Check correctly pasteurization effectiveness according to the checking methods
5. Cool and inoculate properly milk according to the type of product
6. Incubate properly inoculated milk according to the type of product
7. Check correctly the quality parameters according to the product standard

Resources

Equipment	Tools	Materials
● Milk cooling tanks ● Pasteurizers ● Homogenizer ● Incubator ● Milk cans ● Black board ● Projector ● Computer ● Tables ● Incubation vats ● PPEs, ● sealer	● Thermometer ● pH meter ● Stirrer ● Sauce pans ● Buckets ● Spoons ● Electronic balance ● Mechanical balance, ● Beakers ● Filters	● Raw milk ● Starter cultures ● Sugar ● Flavours ● Stabilizers ● Papers ● Gloves ● Water ● Gas ● Bottles ● Colouring agent

Indicative content 2.1: Pasteurize the milk

Duration: 25 hrs

Theoretical Activity 2.1.1: Description of types of yoghurt

Tasks:

1: You are requested to answer the following question:

i. What should be the types of yoghurt based on ingredients used and how incubation is performed

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

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

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 2.1.1

Key readings 2.1.1.: Description of types of yoghurt

- **Types of yoghurt**

  Yoghurt types are classified according to the:

1. Ingredients which were used
2. Incubation which was performed

✓ **Types of yoghurt based on ingredients**

Yoghurt is divided into two types

- **Flavoured yoghurt:** is a type of yoghurt where all ingredients and flavour are usually added at or just prior to filling into pots (mango, strawberry, vanilla, banana, chocolate and pineapple flavoured yoghurt).
- **Plain Yoghurt:** is type of yoghurt which is naturally produced by milk and starter culture only without addition of flavour and other additives like sugar and colouring.

✓ **Types of yoghurt based on how the incubation is performed**

- **Set yoghurt** is a type of yoghurt where incubated in the retail container, usually a plastic or glass cup. It is the preferred method for production of natural yoghurt and yoghurt with fruit and/or nuts. The consumer breaks the curd with a spoon at the time of consumption.

- **Stirred yoghurt** is a type of yoghurt where incubated in bulk vats after which the curd is stirred, mixed with sugar and flavours, then packaged in retail cups and sealed.

Practical Activity 2.1.2: Performing milk standardization

Task:

This activity will take place in workshop. You are asked to standardize a batch of milk to ensure it meets the required fat content

1: Receive the instruction provided by trainer
2: Follow attentively the demonstration given by trainer
3: Perform standardization of milk, work collaboratively,
4: Seek assistance from the trainer where necessary.
5: Present your work to the trainer
6: Read key reading 2.1.2
7: Perform the task provided in application of learning 2.1.

Key readings 2.1.2.: Performing milk standardization

- **Milk standardization**

  Milk standardization Is the process of adjusting fat percentage in milk to required levels.

  Milk primarily separated into two products skim milk (about 0.3%) and cream (about 40%fat) by using centrifugal separator. So, milk Separation is consisting of process by which milk components divided into cream and skimmed milk. The streams of skim and cream after separation must be recombined to a specified fat content.

- **Purpose of milk standardization**

  - ✓ The main purpose of standardization of milk is to achieve the desired fat content.
  - ✓ It is used to ensure that every customer gets milk with constant fat content and consistency.
  - ✓ To comply with the legal requirements for fermented milk

- ✓ To ensure economics in production. Addition of skim milk increase the volume of milk available for sale and removal of cream allows the production of other value-added dairy product like table cream, butter, ghee and or other high fat products.

- **Categories of fermented milk products based on fat percentage and SNF**

S/No	Characteristic	Requirement					Test method
		Fermented whole milk	Fat reduced fermented milk	Fermented low fat milk	Fermented fat free milk	Fermented high fat milk	
i.	Milk fat content, %, m/m	3.25 – 4.5	1.51 – 3.24	0.5 – 1.50	< 0.5	4.6 – 10	ISO 2446
ii.	Milk solids non-fat, %, m/m, min.	8.5	8.5	8.5	8.5	8.5	ISO 6731

- **Milk standardization techniques**

  - ✓ **Milk separation**

    - Pour the milk into the separator.
    - Turn on the separator and let it run for a few minutes.
    - Collect the cream and skim milk separately.

  - ✓ **Calculating the amount of cream and skim milk**
    - Calculate the amount of cream and skim milk needed to achieve the desired fat content (will vary depending on the original fat content of the milk and the desired fat content)
    - There are a number of ways to calculate the amounts, but one common method to use are the Pearson Square Method and Algebraic method which help to:

      - ➢ Determine the original fat content of the milk.
      - ➢ Determine the desired fat content of the milk.

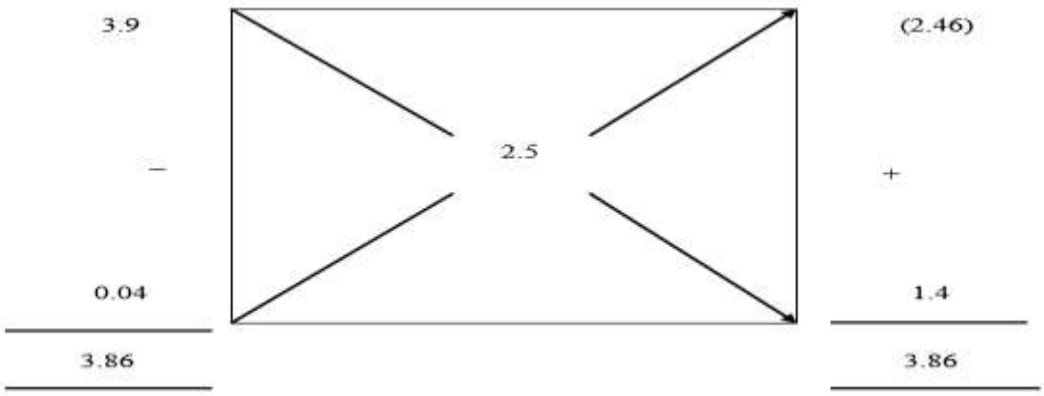
- **Pearson's square method**

Draw a square and place in the centre of it the desired fat percentage. Place at the left-hand corners of the square, the fat percentage of the materials to be mixed. Next, Substract the number in the centre from the larger number at left hand side of the square and place the remainder at the diagonally opposite right-hand side now represents the number of parts of each of the original material that must be blended to have the desired fat content in resultant mix.

The number at the upper right corner refers to the parts of material whose fat test was placed at the upper left corner and the number at the lower right corner refer to the parts of material whose fat test was placed at the lower left corner. If the number on the right are added, the sum obtained will represent the total parts of finished product

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

Answer:



- Proportion of raw milk=2.46/3.86
- Amount whole milk required= (2.46/3.86) *2000=1274.6kg
- Proportion of skimmed =1.4/3.86
- Mount of skimmed milk required = (1.4/3.86) *2000=725.4kg
- Or 2000-1274.6=725.4kg

- **Algebraic method:** this method involves solving a system of linear equations to determine the quantities of different types of milk needed to achieve a desired fat content. The key steps involve setting up equations based on the fat content and the total mass of the final mixture.

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

Answer:

To determine the amounts of whole milk and skimmed milk needed, we'll set up an equation based on the fat content:

1. **Define Variables:**
   - Let x be the kilograms of whole milk (3.9% fat).
   - Then, (2000 - x) will be the kilograms of skimmed milk (0.04% fat).
2. **Set Up the Equation:**
   The total fat from both milks should equal the desired fat in 2000 kg of standardized milk (2.5% fat):

$$0.039x + 0.0004(2000 - x) = 0.025 \times 2000$$

3. **Simplify and Solve:**

$$0.039x + 0.8 - 0.0004x = 50$$

$$0.0386x = 49.2$$

$$x = \frac{49.2}{0.0386} \approx 1274.61\,\text{kg}$$

Therefore:

- **Whole Milk Needed:** Approximately **1274.61 kg**
- **Skimmed Milk Needed:** $2000 - 1274.61 = 725.39\,\text{kg}$

Conclusion: To produce 2000 kg of standardized milk with 2.5% fat, you need approximately **1274.61 kg of whole milk** and **725.39 kg of skimmed milk**.

✓ **Mixing cream and skim milk**

- Combine the cream and skim milk in the correct proportions.
- Measure out the required amount of cream and skim milk.
- Combine the cream and skim milk in a clean container.
- Stir the mixture well to ensure that the fat is evenly distributed.

✓ **Verifying fat content**

- Verify the fat content of the standardized milk.
- A milk fat meter is a device that can be used to measure the fat content of milk.

- Take a sample of the standardized milk.
- Test the sample using the milk fat meter.

Adjust the cream and skim milk proportions as needed to achieve the desired fat content.

Practical Activity 2.1.3: Performing milk homogenisation

Task:

1: You are requested to go to the food processing workshop and homogenize milk
2: Apply safety precautions (wear PPE).
3: Present out the procedures of homogenization of milk
4: Referring to the procedures provided in step 3 homogenize milk
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.1.3
7: Perform the task provided in application of learning 2.1.

Key readings 2.1.3.: Performing milk homogenisation

- **Homogenization**

  Homogenization is a mechanical treatment of the fat globules in milk which is achieved by passing milk under high pressure 10 MPa or/and 150 bars (optional)through a tiny orifice, which results in a decrease in the average diameter and an increase in number and surface area of the fat globules.
- **Homogenization conditions are:**
  - ✓ Pressure: 150-200 bar
  - ✓ Temperature: 58-60^{o}C
- **Purpose of milk homogenization**

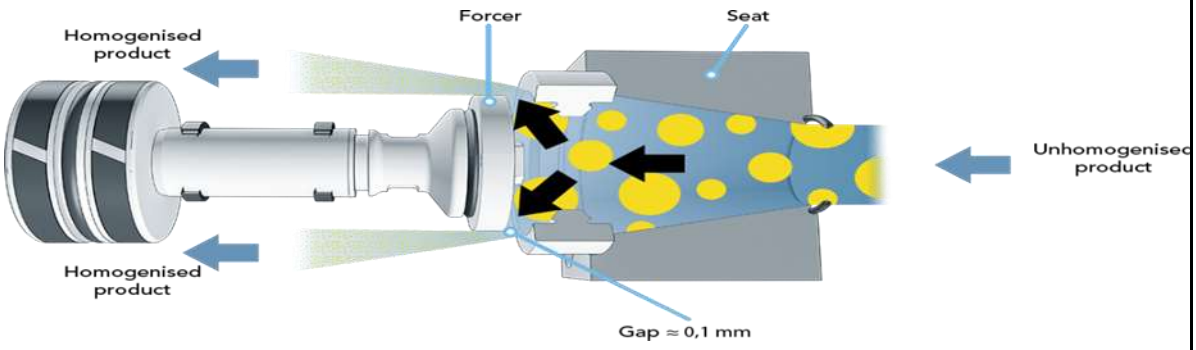
The main purpose of homogenization of the milk are:

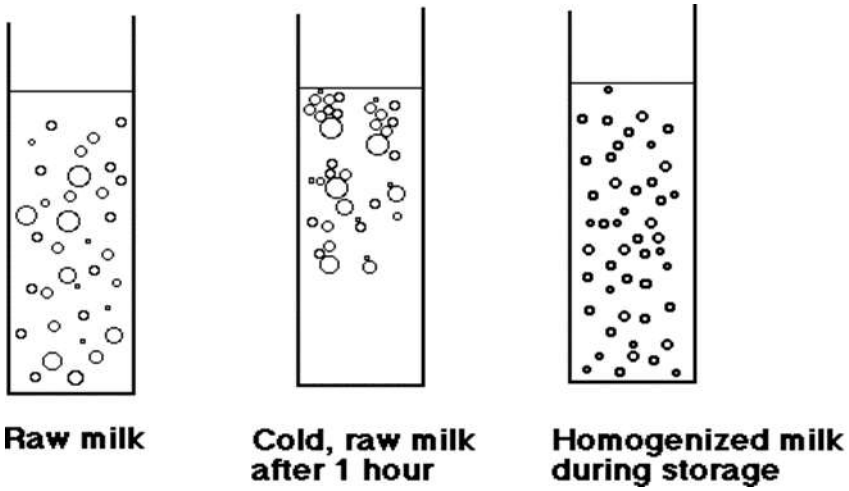
✓ To decrease the size of the fat globules to avoid cream separation in the fermentation tank

✓ To improve the mouth-feel of the product, especially if any additives in powder forms have been used

✓ To improve the water-holding capacity of the milk proteins and reduce the tendency to syneresis.

- **Milk homogenisation procedures:**
  - ✓ Pumping the standardized milk into a homogenizer machine which contains a high-pressure pump and a narrow gap valve system.
  - ✓ Apply High-Pressure Treatment: As the milk passes through the narrow gap valve, it experiences intense pressure and turbulence. This high-pressure treatment breaks down the fat globules into smaller sizes, typically between 0.1 to 2 micrometres in diameter
  - ✓ Emulsion Formation: The intense pressure and turbulence during homogenization cause the fat globules to disperse uniformly throughout the milk, creating an emulsion. The smaller fat globules remain suspended in the liquid phase instead of rising to form cream.
  - ✓ Cooling: After homogenization, the milk is cooled to a specific temperature to stabilize the emulsion and prevent any further separation. Cooling also helps in maintaining the freshness and quality of the milk.





Practical Activity 2.1.4: Checking the effectiveness of pasteurization

Task:

1: You are requested to go to the food processing workshop and check the effectiveness of pasteurization

2: Apply safety precautions (wear PPE).

3: Present out the procedures checking the pasteurization effectiveness

4: Referring to the procedures, check the effectiveness of pasteurization.

5: Present your work to the trainer and whole class. Ask clarification where necessary

6: Read key reading 2.1.4

7: Perform the task provided in application of learning 2.1.

Key readings 2.1.4.: Checking the effectiveness of pasteurization

- **The effectiveness of pasteurization**

  The effectiveness of pasteurization can be assessed by using the following methods:

  ✓ **Time and Temperature:**

  ✓ Time and temperature are important condition in pasteurization which if not monitored during and checked after pasteurization milk should not well pasteurized to the desired level. Depending on pasteurization technics used check if specific time and temperature achieved. Use thermometer to check the temperature

  ✓ **Alkaline phosphatase test:**

  This test is used to determine whether the pasteurization has been adequate or not, and explain any possible contamination of the milk and milk products. The phosphatase enzyme, present in raw fresh milk, is completely destroyed by heat during both low temperature long time pasteurization (LTLT) and high temperature short time pasteurization (HTST). Thus, if phosphatase is present after pasteurization, this may indicate that the pasteurization has not been adequate, or there has been contamination after pasteurization.

  Apparatus:

  - Test tubes
  - Lovibond comparator
  - Volumetric flask
  - Pipettes

Procedures

- 5ml of sodium carbonate buffer solution is pipetted into a clean and a dry test tube

- 1ml milk sample is added into the solution in the test tube, closed with a stopper and mixed by inversing

- The test tube is placed in a water bath at 37°C for 2 hours

- At the same time, a control sample test tube containing 5ml buffer solution and 1ml boiled milk (pasteurized milk) of the same kind as that under test is placed in water bath for the same time period

- After 2 hours, the test tubes are removed from the water bath, and inversed

- The test tube containing the boiled control milk is placed on the left stand and that containing the milk under test on the right stand of the lovibond comparator, and the color developed is read

-The reading is recorded as parts per million nitro-phenols in milk (ppm)

✓ **Organoleptic test**

The efficiency of pasteurization is also tested by using Sensory organs:

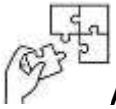
- Visual inspection: by your naked eyes you can check if your milk has not changed colour as result of creaming or burnt (overcooked). And should be free from any other physical contaminants.
- The smell and taste of milk must be free from burnt flavour.

Points to Remember

- When classifying yoghurt, consider the ingredients used and performed incubation
- In making plain yoghurt is a must to use only raw milk and yoghurt starter culture
- Respect all techniques used in milk standardization: milk separation, calculating the amount of cream and skim milk, mixing cream and skim milk, verifying fat content
- Skim milk has 0.3% of fat
- Achieving of fat content required is the main purpose of milk standardization
- Follow all steps used in milk homogenisation: pumping the standardized milk into a homogenizer machine, apply high-pressure treatment, emulsion formation and cooling.
- While homogenizing milk use presure of 150-200 bar and tempersature of 58-60^{0}c
- Size reduction of fat globules is the main pupose of milk homogenisation
- In organoleptic test:

- ✓ Smell and taste of milk must be free from burnt flavour
- ✓ Milk should be free from any other physical contaminants.

- In alkaline phosphatase test, if phosphatase is present after pasteurization, this may i ndicate that the pasteurization has not been adequate, or there has been contamina tion after pasteurization.



Application of learning 2.1.

You are asked to identify and visit any dairy in your community, to observe how they standardize the milk, homogenize milk and how they check milk pasteurization effectiveness. Produce a visit report.

Indicative content 2.2: Milk cooling according to the product specification

Duration: 5hrs

Practical Activity 2.2.1: Cooling and inoculating milk for IKIVUGUTO making

Task:

1: You are requested to go to the food processing workshop, cool and inoculate milk for IKIVUGUTO making
2: Apply safety precautions (wear PPE).
3: Present out procedures of cooling and inoculating milk for IKIVUGUTO making
4: Referring to the procedure provided on step 3, cool and inoculate milk for IKIVUGUTO making
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.2.1.
7: Perform the task provided in application of learning 2.1.

Key readings 2.2.1: Cooling and inoculating milk for IKIVUGUTO making

- **Cooling milk for IKIVUGUTO making**
  - ✓ **Purpose of cooling milk**
    After desired pasteurization temperature is reached, milk needs to be cooled dow n to inoculation temperature in order to ensure the growth of starter culture beca use the temperature above the starter culture growth required inhibit their growt h.
  - ✓ **Inoculation of milk for fermented milk production**
    Inoculation refers to the process of putting starter/mother culture into the milk w here they can grow and reproduce which helps in converting lactose sugar into lac tic acid.
  - ✓ **Cooling and inoculation condition of milk for IKIVUGUTO making**
    The cooling temperature for making IKIVUGUTO is in range of 20-35 °C (30^0c as op timum temperature) as favourable condition for the growth of starter culture (Me sophilic) used in fermentation of IKIVUGUTO.
  - ✓ **Procedures of cooling milk**
    1. Chill water to use in cooling milk
    2. Check if pasteurization achieved well
    3. Pour pasteurized milk in sterilized milk can
    4. Pour cold water in container to cool in

5. Put milk can in cold water
6. Stir milk which is in milk can and measure the temperature continuously
7. If water raising temperature remove hot one and re-introduce cold water again
8. Check if temperature of milk reach to inoculation temperature(20-35^{0}c) stop to cool

N.B:

- In modern industry use automatic cooling system where milk finish to be pasteurized automatically cooled by respecting the cooling condition.
- In performing all procedures of cooling and inoculating milk sterilize the workplace and sanitize yourself to avoid cross contamination

✓ **Procedures of inoculating milk for IKIVUGUTO making**

1. Calculate and weigh starter/mother culture based on milk quantity
2. Check if temperature of milk is in range (20-35^{0}c) by using thermometer
3. Add starter/mother culture in milk
4. Mix gently to spread culture in whole milk
5. Cover the container using sterilized can lid

Practical Activity 2.2.2: Cooling and inoculating milk for yoghurt making

Task:

1: You are requested to go to the food processing workshop, cool and inoculate milk for yoghurt making
2: Apply safety precautions (wear PPE).
3: Present out procedure of cooling and inoculating milk for yoghurt making
4: Referring to the procedure provided on step 3, cool and inoculate milk for yoghurt making
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.2.2.
7: Perform the task provided in application of learning 2.2.

Key readings 2.2.2.: Cooling and inoculating milk for yoghurt making

- **Purpose of cooling milk**

After desired pasteurization temperature is reached, milk needs to be cooled down to inoculation temperature in order to ensure the growth of starter culture because the temperature above the starter culture growth required inhibit their growth.

- **Cooling and inoculation condition of milk for yoghurt making**

The cooling and inoculating temperature for making yoghurt is in range of 38-45°C (40^0c as optimum temperature) as favourable condition for the growth of starter culture (thermophilic) used in fermentation of yoghurt.

- **Procedures of cooling milk**
  1. Chill water to use in cooling milk
  2. Check if pasteurization achieved well
  3. Pour pasteurized milk in sterilized milk can
  4. Pour cold water in container to cool in
  5. Put milk can in cold water
  6. Stir milk which is in milk can and measure the temperature continuously
  7. If water raising temperature remove hot one and re-introduce cold water again
  8. Check if temperature of milk reach to inoculation temperature (38-45°C) stop to cool
  9. In performing all procedures said above make sure you are protected to avoid cross contamination

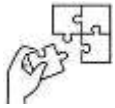
N.B:

- In modern industry use automatic cooling system where milk finish to be pasteurized automatically cooled by respecting the cooling condition.
- In performing all procedures of cooling and inoculating milk sterilize the workplace and sanitize yourself to avoid cross contamination

- **Procedures of inoculating milk for yoghurt making**
  1. Calculate and weigh starter/mother culture based on milk quantity
  2. Check if temperature of milk is in range (38-45°C) by using thermometer
  3. Add starter/mother culture in milk
  4. Mix gently to spread culture in whole milk
  5. Cover the container using sterilized can lid

Points to Remember

- While performing all procedures of cooling and inoculating the milk sterilize the workplace and sanitize yourself to avoid cross contamination
- Inoculation temperature of IKIVUGUTO is 20-35^{0}c
- Inoculation temperature of yoghurt is 38-45^{0}c



Application of learning 2.2.

You are asked to go in your school workshop for fermented milk production to cool and inoculate milk for making IKIVUGUTO and yoghurt.

Indicative content 2.3: Incubation of inoculated milk

Duration: 10 hrs

Practical Activity 2.3.1: Incubating inoculated milk for IKIVUGUTO production.

Task:

1: You are requested to go to the food processing workshop and incubate inoculated milk for IKIVUGUTO production.
2: Apply safety precautions (wear PPE).
3: Present out steps of incubating inoculated milk for IKIVUGUTO production.
4: Referring to the steps provided on step 3, incubate inoculated milk for IKIVUGUTO production.
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.3.1
7: Perform the task provided in application of learning 2.3.

Key readings 2.3.1.: Incubating inoculated milk for IKIVUGUTO production.

- **Incubating inoculated milk for IKIVUGUTO production**
  Incubation is step in IKIVUGUTO production which is defined as the process of providing and maintaining favourable condition for Lactic acid bacteria to grow and multiply in order to produce IKIVUGUTO with good quality and texture.
- **Incubation conditions of inoculated milk for IKIVUGUTO production**.
  The incubation conditions are time and temperature. Time depends on temperature and can vary as temperature increase or reduced. Temperature is independent but here in incubation of IKIVUGUTO a range of temperature used as depending on where Mesophilic starter culture can grow. Let milk stand for 10-12 hours or overnight at 20-30°C to allow for the fermentation process to complete. Keep milk (20-30°C) until a pH 4.6 is reached as iso-electric point.

- **Steps of incubating IKIVUGUTO**
  - Cool pasteurized milk to reach on 20-30^{0}c
  - Add starter /mother culture
  - Mix gently to ensure that culture spread evenly in whole vat
  - Pour inoculated milk in incubation vat (incubator)
  - Check temperature of milk if is still in range of 20-30^{0}c
  - Monitor the temperature of incubated milk to remain constant until reach to 10-12hrs

Practical Activity 2.3.2: Incubating inoculated milk for yoghurt production.

Task:

1: You are requested to go to the food processing workshop and incubate inoculated milk for yoghurt production.

2: Apply safety precautions (wear PPE).

3: Present out steps of incubating inoculated milk for yoghurt production.

4: Referring to the steps provided on step 3, incubate inoculated milk for yoghurt production.

5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.3.2
7: Perform the task provided in application of learning 2.3.

Key readings 2.3.2.: Incubating inoculated milk for yoghurt production

- **Incubating inoculated milk for yoghurt production**
  Incubation is step in yoghurt production which is defined as the process of providing and maintaining favourable condition for Lactic acid bacteria to grow and multiply in order to produce yoghurt with good quality and texture.
- **Incubation conditions for yoghurt**
  The incubation conditions are time and temperature. Time depends on temperature and can vary as temperature increase or reduced. Temperature is independent but here in incubation of yoghurt a range of temperature used as depending on where thermophilic starter culture can grow. Let milk stand for 3-6 hrs at 38-45°C to allow for the fermentation process to complete. Keep milk (38-45°C) until a pH 4.6 is reached as iso-electric point.

- **Steps of incubating yoghurt**
  - After pasteurized milk is cooled to reach on 38-45^{0}c
  - Add starter /mother culture
  - Mix gently to ensure that culture spread evenly in whole vat
  - Pour inoculated milk in incubation vat (incubator)
  - Check temperature of milk if is still in range of 38-45^{0}c
  - Monitor the temperature of incubated milk to remain constant until reach to 3-6 hrs

Practical Activity 2.3.3: Checking the quality parameters of fermented milk

Task:

1: You are requested to go to the food processing workshop and check the quality parameters of fermented milk
2: Apply safety precautions (wear PPE).
3: Present out steps of checking quality parameters of fermented milk.
4: Referring to the steps provided on step 3, check the quality parameters of IKIVUGUTO and yoghurt
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 2.3.3 in trainee manual
7: Perform the activity in application of learning 2.3.

Key readings 2.3.3.: Checking the quality parameters of fermented milk

✓ **Yoghurt quality parameters**
- **pH for yoghurt:** iso-electric point must be range between 4.5-4.6
- **Organoleptic quality:**

1. Texture: Gel like
2. Colour: white to slightly yellow
3. Viscosity: high viscosity
4. Taste: clean, rich mouth fell, sweetness, typical yoghurt flavour accordingly.

✓ **Quality parameters of IKIVUGUTO**
- **pH for IKIVUGUTO:** iso-electric point must be range between 4.5-4.6

✓ **Organoleptic quality:**

1. Texture: Gel like
2. Colour: white to slightly yellow
3. Viscosity: high viscosity
4. Taste: Clean, rich mouth feel, acidic, typical IKIVUGUTO Flavour

✓ **Procedures of testing organoleptic parameter:**

- Clean and disinfect your hand
- Open a can/incubator of yoghurt/IKIVUGUTO
- Take sample without shaking the can/incubator
- Observe the appearance of the milk
- Taste the milk, but do not swallow it

N.B: Stir yoghurt/IKIVUGUTO to breakdown the coagulum after testing all recommended test to avoid stopping fermentation while it is not fermented completely.

✓ **Procedures of testing the pH:**

- Calibrate the pH Meter: calibrate pH meter using standard buffer solutions usually pH 4.00 and 7.00
- Prepare the milk sample: if milk is cold, allow it to reach room temperature as temperature can affect pH reading
- Clean the electrode: rinse the pH meter's electrode with distilled water to avoid contamination
- Measure the pH:
  1. Place the electrode into the milk sample
  2. Allow the reading to stabilize, which may take a few seconds to a minute
  3. Record the pH value displayed on the meter
  4. Clean up: rinse the electrode with distilled water after measurement to maintain its condition for future use

Points to Remember

- While incubating milk to produce IKIVUGUTO monitor temperature of 20-30^{0}c within 10-12 hrs
- Keep milk at 20-30°C until a pH of 4.6 is reached
- While incubating milk to produce yoghurt monitor temperature of 38-45^{0}c within 3-6 hrs
- Keep milk at 38-45°C until a pH of 4.6 is reached
- While taking the sample for using in testing don't shake the milk to prevent stopping the fermentation process early
- Follow all procedures of testing the pH: calibrate the pH meter, prepare milk sample, clean the electrode and measure the PH.
- Stir yoghurt/IKIVUGUTO to breakdown the coagulum after testing all recommended test to avoid stopping fermentation early

Application of learning 2.3.

You are asked to go in your school workshop for fermented milk production to incubate inoculated milk for making IKIVUGUTO and yoghurt and to check the quality of fermented milk.

Learning outcome 2 end assessment

Theoretical assessment

1. Fill the appropriate term to the following definitions (Pasteurisation, homogenisation, standardisation, incubation)

a) ……. Is the process of adjusting fat percentage in milk and other solid non-fat (SNF) to required level?

2. Underline the right answer in the following statements

a) What is the enzyme is tested to determine the effectiveness of pasteurisation?
   i. Lipase
   ii. Amylase
   iii. Phosphatase
   iv. Protease

b) What is the purpose of milk standardisation?
   i. To increase milk's sweetness
   ii. To reduce milk's shelf life
   iii. To adjust the fat percentage in milk
   iv. To add artificial flavourings
   v. To adjust the fat percentage and Solid Non-Fat in milk

c) Homogenization is performed to:
   i. Decrease fat globule size
   ii. Prevent cream separation
   iii. Decrease the mouth-feel of the product
   iv. Reduce water-holding capacity

d) Which methods are used for calculating the proportions of cream, skimmed milk, and whole milk for standardisation?
   i. Algebraic method
   ii. Pearson's square method
   iii. Pythagorean theorem
   iv. Fermi estimation
   v. I and ii are correct

e) What is the type of starter culture used to make yoghurt?
   i. Thermophilic starter culture
   ii. Mesophilic starter culture

f) What is the incubation condition of yoghurt?
   i. 38-45^{0}c with 3-6hrs
   ii. 20-35^{0}c with 12 hrs

g) What is the normal pH of IKIVUGUTO?
   i. pH of 4.5-4.6

ii. pH of 3-5

3. Answer by True if the given statement is correct or False if the given statement is incorrect

a) The presence of enzyme phosphatase after pasteurisation indicates that the milk has been well pasteurised

b) Ingredients like artificial flavouring agents and colourings are added to yoghourt at the beginning of pasteurisation

c) Milk standardisation is primarily performed to ensure that every customer gets desired milk fat content and consistency

d) The alkaline phosphatase test is used to determine whether the pasteurisation has been adequate and whether there has been contamination after pasteurisation.

e) During production of plain yoghurt it is recommended to use yoghurt starter culture and milk only?

4. How much whole milk with 3.9% fat and skimmed milk with 0.04% fat content will you ne ed to produce 2000 kg of standardized milk with 2.5% fat?

Practical assessment

DEAR DAIRY Ltd located in MUSANZE district processes fermented milk products such as IKIVUGUTO and yoghurts. Has a problem of producing poor quality of yoghurt but production manager found that it is not problem of raw milk quality due to all test conducted well at a reception. The root cause of this problem start from pasteurization to quality checking of final product.

Task: As a qualified technician in food processing, you are asked to solve this problem by performing pasteurization of milk, performing cooling and inoculation of milk, performing incubation of milk and checking quality parameters for the milk. For the first time you will use 50L of raw milk as an entry exam. Perform the task within eight (8) hours. All required resources are available at the working area.

END

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IKIVUGUTO

Indicative contents
3.1. Preparation of packaging material
3.2. Packaging of fermented milk products
3.3. Monitoring of storage conditions of fermented milk

Key Competencies for Learning Outcome 3: Store Fermented Milk

Knowledge	Skills	Attitudes
• Description of types of packaging materials • Description of techniques of labelling • Description of storage techniques of fermented milk • Identification of storage conditions of fermented milk products • Differentiation of storage conditions of fermented milk products	• Selecting and cleaning packaging materials • Filling and sealing fermented milk products • Labelling the fermented milk products • Applying cold room and refrigerator • Monitoring storage conditions of fermented milk	• Being careful when selecting and cleaning packaging materials • Being attentive when filling and sealing of fermented milk products • Being careful when labelling the fermented milk products • Being careful when applying cold room and refrigerator • Being punctual when monitoring storage conditions of fermented milk

Duration: 10 hrs

Learning outcome 3 objectives:

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

1. Identify properly the types of packaging materials used for IKIVUGUTO and yoghur t
2. Prepare properly packaging materials used for IKIVUGUTO and yoghurt
3. Package properly fermented milk products according to the packaging techniques
4. Perform properly labelling of fermented milk according to the labelling techniques
5. Describe correctly the storage conditions of fermented milk according to the type of product
6. Apply properly the storage techniques of fermented milk according to the storage conditions

 **Resources**

Equipment	Tools	Materials
● Milk cans ● Black board ● Refrigerator ● Freezer ● PPEs ● Packaging machine ● Sealing machine ● Labelling machine ● Homogenizers ● Incubator	● Thermometer ● Timer ● Stirrer ● Wooden spoon ● Cooking pan ● Electronic and ● Mechanical balance ● Jags	● Gloves ● Labels ● Packaging materials ● Scotch ● Glue

Indicative content 3.1: Preparation of packaging materials

Duration: 2 hrs

Theoretical Activity 3.1.1: Identification of types of packaging material

Tasks:

1: You are requested to answer the following questions:

i. While packaging IKIVUGUTO and yoghurt what are the packaging materials should you use?

ii. What are the selection criteria of packaging material used for yoghurt and IKIVUGUTO?

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

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

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 3.1.1.

Key readings 3.1.1.: Identification of types of packaging materials

- **Identification of packaging materials**

  Packaging is the process of enclosing processed product in packaging material to protect it from any damage, contamination, spoilage, pest attacks and tempering during transport, storage and retail sale.

  Packaging material means any item or material which is intended to contain processed or semi-processed food in order to protect it.

  The material used for packaging fermented milk products must be compatible with the special physical chemical and bacteriological properties of fermented milk.

- **Selection criteria of packaging material for fermented milk (IKIVUGUTO and yoghurt)**

  ✓ It should be free from off-flavours

  ✓ It should not impart any taste or flavour to the product.

  ✓ It should act as barrier to bacterial contamination

  ✓ It should be resistant to UV light (max transmission: 8% at 500 nm & 2% at 400nm)

  ✓ It should have no physiological effects on the products

  ✓ It should possess good mechanical properties (sealing, tensile, structural strength etc.)

- ✓ It should be tampering proof.
- ✓ It should possess good oxygen barrier properties
- ✓ It should be economical
- ✓ It should fit in to processing- in-Line.
- ✓ Quality and functionality**:** packaging is only effective if it protects the yoghurt against damage.
- ✓ Size, shape and design: use standard it is always a good idea to use standard sizes and shapes for yoghurt packaging.
- ✓ Not only does this improve flexibility and convenience during storage, handling and transportation, but also reduces production costs for bespoke packaging.
- ✓ Pricing and cost savings**:** the cost-effectiveness of packaging material depends on more than just its price. some packaging types are lighter than others, reducing transportation costs, while others are easier to handle and help boost production efficiency.
- ✓ Distribution and storage: understanding how your yoghurt makes it from a production unit to storage and distribution facility, retail outlet or customer the distance your shipments need to travel, modes of transportation used, as well as storage conditional at each step.
- ✓ Long-term sustainability: focusing on sustainability and using recycled or recyclable packaging creates a more eco-conscious image for your brand.
- ✓ All package must provide safe, convenient, attractive, functional, and cost – effective means for protecting the yoghurt throughout distribution and merchandising, for presenting it to the consumer and enable easy consumption.

- **Packaging materials for IKIVUGUTO and yoghurt**

The packaging materials used for IKIVUGUTO and yoghurt are:

- ✓ Glass bottle
- ✓ Coated paper board containers
- ✓ Plastics bottle/cup: (polyethylene, HDPE cups, Co extrusion plastic complexes, polystyrene, (polyvinyl alcohol and ethylene co polymer, polyethylene glycol Terephthalate).

Practical Activity 3.1.2: Preparing packaging materials

Task:

1: You are requested to go to the food processing workshop and prepare packaging materials for yoghurt and IKIVUGUTO production

2: Apply safety precautions (wear PPE).

3: Present out:

i. Steps of selecting packaging materials
ii. Steps of cleaning packaging materials

4: Referring to the steps provided on task 3, prepare packaging materials for yoghurt and IKIVUGUTO production

5: Present your work to the trainer and whole class. Ask clarification where necessary

6: Read key reading 3.1.2 in trainee manual

7: Perform the activity in application of learning 3.1.

Key readings 3.1.2: Preparing packaging materials

- **Steps of selecting packaging materials**

  Here are the steps on selecting packaging materials:

  - ✓ List the packaging materials needed based on the activity to be done
  - ✓ Present a list of available packaging materials that can fulfil the task needs
  - ✓ Follow the safety guidelines for handling packaging materials
  - ✓ Hands-on selection or physically handle and assess packaging materials
  - ✓ Make decisions on the most appropriate packaging materials

- **Steps of cleaning packaging materials**
  - ✓ Mechanical removal of dirt
  - ✓ Rinsing with tempered (or cold) water
  - ✓ Washing with hot water (40-70^{o}c) with detergent
  - ✓ Rinsing with tempered/cold water
  - ✓ Sterilize the packaging materials using boiled water with oxonia 0.2%

Points to Remember

- Glass bottles, coated paper board containers and plastic bottles/cup are types of packaging materials used in IKIVUGUTO and yoghurt
- While selecting packaging materials follow the safety guidelines to prevent the accident and injury
- While cleaning the packaging remember to use hot water 40-70^{o}c and detergent where necessary
- Sterilize the packaging materials using boiled water with oxonia 0.2%

Application of learning 3.1.

You are asked to go in your school workshop for fermented milk production to select and clean the packaging materials used in fermented milk production.

Indicative content 3.2: Packaging of fermented milk products

Duration: 6 hrs

Practical Activity 3.2.1: Packaging the fermented milk products

Task:

1: You are requested to go to the food processing workshop and package IKIVUGUTO and yoghurt
2: Apply safety precautions
3: Present out:
   i. Steps of filling IKIVUGUTO and yoghurt into packaging material
   ii. Steps of sealing IKIVUGUTO and yoghurt into packaging material
4: Referring to the steps provided on task 3, package yoghurt and IKIVUGUTO
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 3.2.1 in trainee manual
7: Perform the activity in application of learning 3.2.

Key readings 3.2.1.: Packaging the fermented milk products

- **Packaging IKIVUGUTO and yoghurt**
  - ✓ **Techniques of packaging:**

Primary technique consists of packaging food product in primary or sales packaging material i. e. packaging considered so as to constitute a sales unit to the final user. The packaging material is therefore, in direct contact with the product. It provides the initial and usually the major protective barrier.

Examples of primary packages include glass bottles and plastic bottles/cups. It is frequently the only primary package which the consumer sees and purchases at retail outlets and use.

Secondary technique consists of packaging food product in grouped packaging or secondary packaging, i. e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units for instance a corrugated fibre, board case or shipping container, contains a number of primary packages.

It is the physical distribution carrier and is sometimes so designed as it can be used in retail outlets for the display of primary packages.

Tertiary technique involves the usage of transport packaging or tertiary packaging i. e. packaging conceived so as to facilitate handling and transport of a number of sales units. A tertiary package is made up of a number of secondary packages, the common example being a stretch-wrapped pallet of corrugated cases.

- ✓ **Filling IKIVUGUTO/yoghurt in packaging material**

  Filling (Bottling) is a process of pouring IKIVUGUTO/yoghurt into packaging material.

  Steps of filling are:

  - Check the cleanliness of packaging material.
  - Pour the yoghurt/IKIVUGUTO into packaging material
  - Remember to head space the packaging material
  - In small scale industry manual bottling/cupping is mostly used while in large industry aseptic packaging is used with specialized equipment which automatically fill under sterile condition therefore to produce shelf stable product

- ✓ **Sealing the packaging material**

  Sealing is the process of tight and perfect closure of packaging material against gas or any other product in or out. Sealing is the surface-to-surface joining technique of materials using a substance which usually is of a different type, and which adheres to the surfaces of the packaging material.

  - **Sealing techniques**

    1. **Heat sealing:** is one of the most widely used sealing methods to heat seal of a package, heat is applied to a thermoplastic material such as polyethylene or polypropylene to create a bond between two surfaces (packaging material and seal).
    2. **Adhesive sealing:** it typically requires applying a liquid or hot melt adhesive onto one surface and then pressing the two surfaces together to create a secure seal. This technique is most used for packaging materials like pouches or bags.
    3. **Induction sealing:** this used for sealing containers with foil. This method is often used for sealing bottles, jars, or other containers for products like pharmaceuticals, food, or beverages.
    4. **vacuum sealing:** this involves removing air from a package or container before sealing it. It requires a vacuum sealing machine that sucks out the air, creating a tight seal. This technique is most often used for food packaging to extend the shelf life and maintain product freshness.
    5. **Zipper sealing:** simply interlock plastic zippers or tracks in a reversible format that allows for repeated opening and closing of the package.

    Steps of sealing are:

    1. Connect sealing machine to electrical power
    2. Switch on sealing machine to get electrical heat
    3. Link the seal which cover package with the outlet of sealing machine
    4. Check if the seal is attached tightly on the packaging material

NB:
In small scale industry manual sealing is mostly used by using food handler hands, simple sealing machine/ iron for cloths while in large industry aseptic packaging is used with specialized equipment which automatically seal under sterile condition therefore to produce shelf stable product.

Practical Activity 3.2.2: Performing labelling of fermented milk products

Task:

1: You are requested to go to the food processing workshop and Perform labelling of IKIVUGUTO and yoghurt.
2: Apply safety precautions
3: Present out the steps of labelling of IKIVUGUTO and yoghurt.
4: Referring to the selection criteria and procedure provided on step 3, label fermented milk products.
5: Present your work to the trainer and whole class. Ask clarification where necessary
6: Read key reading 3.2.2
7: Perform the task provided in application of learning 3.2.

Key readings 3.2.2.: Performing labelling of fermented milk products

- **Performing labelling of fermented milk products**

  Labelling is defined as the process of attaching a descriptive word or phrase to someone or something about a product on its package.

  Label is piece of paper which contains the information about the product packaged.

  ✓ **Techniques of labelling**
    - **Applied/ indirect labelling:** It is technique of labelling at which all information is pointed on the paper which is applied on the package.
    - **Direct labelling:** it is technique of labelling at which all information is printed on the package.

  ✓ **Some Labelling information to put on packages of IKIVUGUTO and yoghurt are:**
    - Product name: The product should be named for its identification
    - Quantity of product / Net quantity: The quantity of product to the label is very crucial as its even justifies its price

- List of ingredients in descending order
- Company location/ producer location: Food processing company should be located such that anyone can know it. Its name should be in well-known to everybody.
- Shelf -life information: Including production date, expiration date or best before date.
- Company/ produce address: Company address plays a critical function as it is helpful in knowing company and getting different information about is that will attract many customers.
- Batch number: It is a number given to food product by food processing company which helps in product traceability.
- Allergens content (if any): The food manufacturer has to clearly identify and explain the allergens content if they are present for helping clients to whom they are allergic.
- Nutritional information.
- Instruction of use: Instruction about the product utilization or usage is very important to achieve its effectiveness.
- Storage conditions: Identification of product storage conditions is very important to contribute to product quality and safety
- Lot number or batch number, Bar code.
- Universal product card/barcode.
- Advertising: Sealed for freshness, aroma
- Direction for use.
- Nutritional information.
- Serving quantity
- Manufactured date and expiration date

✓ **Steps of labelling fermented milk products**

- Check if all information needed on label are indicated
- Check if label has glue itself
- If label has not glue bring your own/you can also use scotch
- Attach label on the package
- Check if label is attached tightly on the package

Points to Remember

- While filling the fermented milk products remember to head space the package
- Hygiene is a must while you are filling IKIVUGUTO and yoghurt
- Seal properly the package to prevent cross contamination from air to the product
- Before labelling, check well to ensure if all required information are indicated on label

Application of learning 3.2.

You are asked to go in your school workshop for fermented milk production to fill, seal and label the fermented milk products.

Indicative content 3.3: Monitoring of storage conditions of fermented milk

Duration: 2 hrs

Theoretical Activity 3.3.1: Description of storage conditions of fermented milk products

Tasks:

1: You are requested to answer the following question:

i. What are the storage conditions of IKIVUGUTO and yoghurt?

2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.

3: Present the findings/answers to the whole class

4: Ask the trainer for clarification if any

5: For more clarification, read the key readings 3.3.1.

Key readings 3.3.1.: Description of storage conditions of fermented milk products

Fermented milk products should be stored in the following conditions:

- ✓ **Storage conditions of IKIVUGUTO**
  - Storage 4-6^{o}C for 5-7 days in refrigerator or at room temperature for 2-3 days.
  - Pack in appropriate packaging material
  - Store under hygienic conditions
- ✓ **Storage conditions for yoghurt (temperature, time, shelf life)**
  - If yoghurt is stored accurately however already opened, then this yoghurt can last a maximum of about 2 hours, so it recommended to consume it immediately after opening.
  - Unopened or sealed yoghurt keep its quality for 1 to 2 weeks.
  - Yoghurt can be kept in freezer at 0-degree F for 6 to 8 weeks but it just might lose taste or texture.
  - Yoghurt is stored in cold room at 4-7°C for 30 days to 90 days.
  - Do not leave yoghurt at room temperature for longer than two hours or one hour if temperature is 90^{o}degree F or above.

Practical Activity 3.3.2: Applying storage techniques of fermented milk products

Task:

1: You are requested to go to the food processing workshop apply storage techniques of fermented milk products

2: Apply safety precautions

3: Present out the steps of applying storage techniques of fermented products

4: Referring to the steps provided on step 3, apply storage techniques of fermented milk products

5: Present your work to the trainer and whole class. Ask clarification where necessary

6: Read key reading 3.3.2

7: Perform the task provided in application of learning 3.3.

Key readings 3.3.2.: Applying storage techniques of fermented milk products

- **Storage techniques of fermented milk**

  Storing fermented milk in different environments, can be made in different technics such as a cold room or a refrigerator.

  ✓ **Cold Room**: Cold rooms typically have temperatures ranging from 0°C to 10°C (32°F to 50°F). While this is colder than room temperature, it may not be as cool as a refrigerator.

  Steps of applying cold room

  1. Switch on the cold room
  2. Check the temperature on the thermostat of cold room
  3. If temperature is in range 0^{o}c-10^{o}c put products inside the cold room
  4. Monitor the cold room condition (temperature)
  5. If the temperature of cold room reach to 0^{o}c will automatically switch off

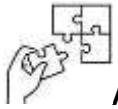
  ✓ **Refrigerator**: Refrigerators should maintain temperatures between 0°C and 4°C (32°F to 39°F). This temperature range slows down bacterial growth and helps preserve the quality of fermented milk.

  Steps of applying refrigerator

  1. Switch on the refrigerator
  2. Check the temperature on the thermostat of refrigerator
  3. If temperature is in range 0^{o}c-4^{o}c put products inside the refrigerator
  4. Monitor the refrigeration condition (temperature)
  5. If the temperature of refrigerator reach to 0^{o}c will automatically switch off

Points to Remember

- IKIVUGUTO can be stored in refrigerator at 4-6^{0}c for 5-7 days and 2-3 days at room t emperature
- Yoghurt can be kept in freezer at 0-degree F for 6 to 8 weeks but it just might lose ta ste or texture.
- Yoghurt is stored in cold room at 4-7°C for 30 days to 90 days.
- Cold room temperature ranging from 0°C to 10°C
- Remember that if the temperature of cold room and refrigerator reaches to 0^{0}c will automatically switch off itself
- Refrigeration temperature is between 0°C and 4°C



Application of learning 3.3.

You are asked to identify and visit any dairy nearby your community to observe how they apply cold room and refrigerator used in storing fermented milk products. Produce a visit report.

Learning outcome 3 end assessment

Theoretical assessment

1. Fill the sentence below with given appropriate term (packaging**,** packaging material**,** fill ing, sealing, labelling)
   a) ……is the process of enclosing processed product in packagin g material to protect it from any damage, contamination, spoilage, pest attacks an d tempering during transport, storage and retail sale.
   b) ……means any item or material which is intended to contain processed or semi-processed food in order to protect it.
   c) ……is a process of pouring product into packaging material.
   d) …… is the process of tight and perfect closure of packaging material ag ainst gas or any other product in or out?
2. Read careful the following statement and choose the correct answer:
   i. The primary purpose of packaging fermented milk products is:
      a) To add flavour to the product
      b) To increase the cost of production
      c) To protect the product from damage and contamination
      d) To reduce the shelf life of the product

   ii. The following are criteria to consider when selecting packaging material for fermen ted milk products except

      a) Resistance to UV light
      b) High oxygen barrier properties
      c) Not imparting a strong flavour to the product
      d) Mechanical properties

   iii. The purpose of sterilizing packaging materials before filling yoghurt or IKIVUGUTO is:

      a) To reduce the shelf life
      b) To make the packaging materials easier to handle
      c) To kill and eliminate microorganisms
      d) To add flavour to the product

   iv. Labelling technique involves printing all information directly on the packaging is:

      a) Applied labelling
      b) Direct labelling

c) Transparent labelling
d) Indirect labelling

3. Outline five labelling information that should be indicated on label of yoghurt
4. Storage techniques for IKIVUGUTO and yoghurt are cold room and refrigeration storag e. Differentiate these two (2) techniques.

Practical assessment

AYERA DAIRY Ltd located in MUSANZE district processes fermented milk products such as IKIVUGUTO and yogurts. This dairy has problem of the product that get spoiled quickly due to the packaging and storage conditions provided by the dairy workers. Dairy manager requests you as skilled trainee in fermented milk making to solve that problem by performing the following tasks:

Task 1: Prepare packaging materials for IKIVUGUTO and yogurt

Task 2: Fill and seal IKIVUGUTO and yoghurt

Task 3: Perform labelling of IKIVUGUTO and yoghurt

Task 4: Store IKIVUGUTO and yoghurt

N.B:

- You are requested to use plastic bottles 500ml for each bottle in yoghurt
- Use plastic cans of 2L for each can in IKIVUGUTO
- Quantity of IKIVUGUTO to use is 10L and 10L of yoghurt
- All resources needed are available in the working area
- Time to accomplish the activity is 5 hours

END

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