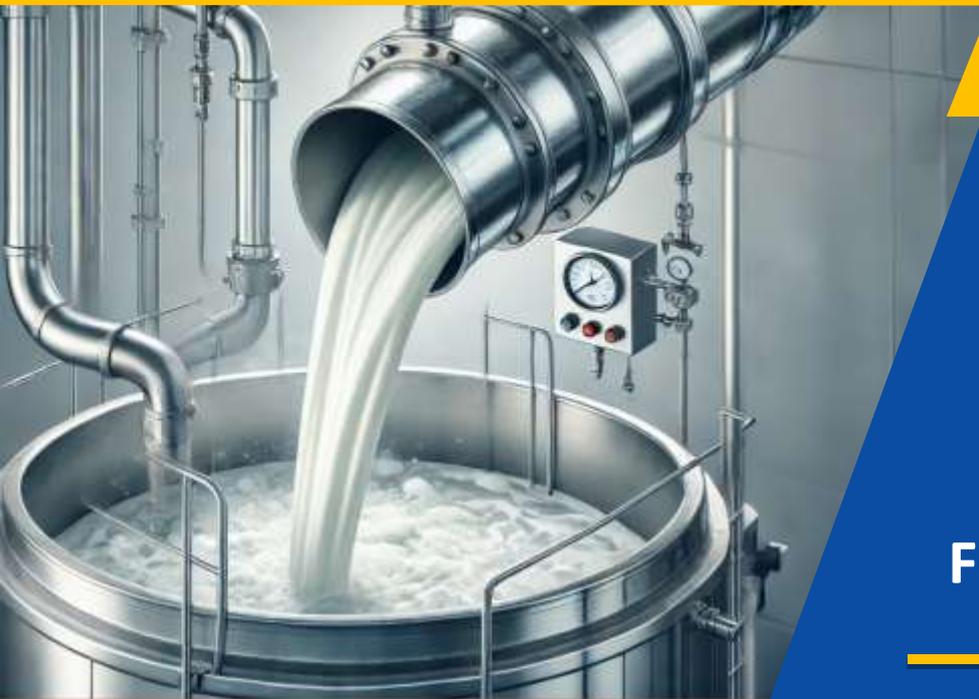




RQF LEVEL 3



FOPPM303

FOOD PROCESSING

Pasteurized Milk Production



TRAINER'S MANUAL

October, 2024



PASTEURIZED MILK PRODUCTION

KOICA
Korea International
Cooperation Agency

TQUM
TVET Quality Management Project

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ACRONYMS

%: Percentage

°C: Celsius

°F: degree Fahrenheit

AGR: Agriculture

CBC: Competence Based Curriculum

CIP: Cleaning in Place

COP: Cleaning Out of Place

FOP: Food Processing

HDPE: High Density Polyethylene

HTST: High Temperature Short Time

IC: Indicative content

Kg: Kilogram

L: Litre

Ltd.: limited

LTLT: Low Temperature Long Time

PM: Pasteurized milk

pH: Hydrogen Potential

PPE: Personal Protective Equipment

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

SOP: Standard Operating Procedure

TQUM: TVET Quality Management

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainer's manual includes all the methodologies required to effectively deliver the module titled "**Pasteurized 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 trainer'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 trainer, you will begin by asking questions related to the activities to encourage critical thinking and guide trainees toward real-world applications in the labor market. The manual also outlines essential information such as learning hours, didactic materials, and suggested methodologies.

This manual outlines the procedures and methodologies for guiding trainees through various activities as detailed in their respective trainee manuals. The activities included in this training manual are designed to offer students opportunities for both individual and group work. Upon completing all activities, you will assist trainees in conducting a formative assessment known as the end learning outcome assessment. Ensure that students review the key reading and the points to remember section.

MODULE CODE AND TITLE: FOPPM303 PASTEURIZED MILK PRODUCTION

Learning Outcome 1: Prepare workplace.

Learning Outcome 2: Pasteurize the milk.

Learning Outcome 3: Store pasteurized milk.

Learning Outcome 1: Prepare Workplace



Indicative contents

1.1 Selection of materials, tools and equipment for pasteurized milk production

1.2 Cleaning of work area, tools and equipment

1.3 Checking the quality of raw milk

Key Competencies for Learning Outcome 1: Prepare Workplace

| Knowledge | Skills | Attitudes |
|---|--|--|
| <ul style="list-style-type: none"> • Description of materials, tools and equipment for pasteurized milk production • Identification of criteria for selecting materials, tools and equipment for pasteurized milk production • Differentiation of types of contaminants that can be found in workplace for pasteurized milk production • Explanation of cleaning methods and techniques | <ul style="list-style-type: none"> • Selecting materials, tools and equipment used in pasteurized milk production • Arranging the workplace • Adjusting tools and equipment • Preparing cleaning products • Preparing reagents for milk testing • Cleaning the work area, tools and equipment • Checking of the cleaning effectiveness • Testing the quality of raw milk | <ul style="list-style-type: none"> • Being attentive when using cleaning products as some can be harmful to life • Being accurate while preparing ingredients • Being careful when using electric connected tools and equipment • Being organized when organizing workplace • Being protective • Attentive when using cleaning products as some can be harmful to life |



Duration: 10 hrs



Learning outcome 1 objectives:

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

1. Describe correctly tools and equipment needed to produce pasteurized milk
2. Identify appropriately materials used in pasteurized milk production
3. Select properly materials, tools and equipment used in pasteurized milk production
4. Explain clearly cleaning methods and techniques used in pasteurized milk production
5. Prepare adequately cleaning agents used in pasteurized milk production
6. Cleaning effectively the work area, tools and equipment for pasteurized milk production
7. Check effectively the cleanliness of work area, tools and equipment according to sanitary standard operating procedures
8. Test appropriately the quality of raw milk referring to raw milk specifications



Resources

| Equipment | Tools | Materials |
|--|--|---|
| <ul style="list-style-type: none"> • Pasteurizer • Cooling tank • Mechanical balance • Electronic balance • Personal protective equipment (PPE) • Tables • Refrigerator | <ul style="list-style-type: none"> • Thermometers • Chronometers (timers) • Milk samplers • Alcohol gun • Glassware (Beakers, graduated cylinders, petri dishes) • Milk cans, • Mop, • Buckets | <ul style="list-style-type: none"> • Raw milk. • Cleaning agents: nitric acid, caustic soda, potable water, soaps, swabs, scouring powder. • Chemicals for milk testing: Ethyl alcohol, distilled water. |

| | | |
|--|---|---|
| | <ul style="list-style-type: none"> • Washing basins, • Brooms, • Towels, • Scouring pads, • Pipes, • Measuring cups | <ul style="list-style-type: none"> • Packaging materials |
|--|---|---|



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the classroom
- Ensure that the workshop is available but disorganized
- Avail tools and equipment and make sure that they are in good working conditions
- Verify materials if they are not expired
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuals, protocols)



Indicative content 1.1: Selection of materials, tools and equipment for pasteurized milk production



Duration: 4 hrs



Theoretical Activity 1.1.1: Description of tools and equipment for pasteurized



Notes to the trainer:

- The trainer may use small groups to describe tools and equipment used Pasteurized milk production
- Trainer may use photos, videos, illustration or any other didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- i. Basing on your understanding, State any tools and equipment used in Pasteurized milk production do you know?
- ii. Give the uses of tools and equipment given(i)

Step 2:: Monitor discussions in groups and ask trainees to write the findings on papers, flip chart, blackboard or white board

Step 3:Asks trainees to discuss on the provided answers and choose the correct ones.

Step 4:Provide the expert view and clarify ideas by using didactic materials.

Step 5:Address any questions or concerns.

Step 6:Ask trainees to read the key reading 1.1.1 in trainee manual



Points to Remember

In pasteurized milk production main equipment is pasteurizer used for raw milk pasteurization



Practical Activity 1.1.2: Selecting tools and equipment to be used in pasteurized milk production



Notes to the trainer

- The trainer is supposed to demonstrate how to select tools and equipment used in pasteurized milk production.
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials,
 - ✓ Avail various tools and equipment in which those for pasteurized milk production will be selected.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and select tools and equipment used in pasteurized milk production.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to select tools and equipment for pasteurized milk production.

While demonstrating, explain the selection criteria of tools and equipment used in pasteurized milk production and the procedure for selection.

Step 4: Ask trainees to select tools and equipment for pasteurized milk production, and monitor the procedures

Step 5: Verify whether tools and equipment for pasteurized milk production are well selected and provide feedback where necessary.

Step 6: Ask trainees to read key reading 1.1.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.1



Points to Remember

- When select tools and equipment key factors you consider are efficiency, safety, and compliance, and durability, eases of maintenance, cost, and energy efficiency



Practical Activity 1.1.3: Adjustment of tools and equipment to be used in pasteurized milk production



Notes to the trainer

- The trainer is supposed to demonstrate how to adjust tools and equipment used in pasteurized milk production
- For the effective delivery, it is recommended to:
 - ✓ Avail videos as didactic materials for pasteurized milk production
 - ✓ Avail tools and equipment for pasteurized milk production to be adjusted.



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** You are asked to go in the pasteurized milk production workshop and adjust tools and equipment used in pasteurized milk production.
- Step 2:** Explain the task and provide clear work instruction (PPE, Time allocated)
- Step 3:** Demonstrate how to adjust tools and equipment for pasteurized milk production.
While demonstrating, explain the procedure for adjusting tools and equipment used pasteurized milk production.
- Step 4:** Ask trainees to adjust tools and equipment for pasteurized milk production, and monitor the procedures.
- Step 5:** Verify whether tools and equipment for pasteurized milk production are correctly adjusted and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 1.1.3 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.1



Points to Remember

During adjustment equipment and tools pass through those steps:

- Identify the problem
- Consult the manual (Review the manufacturer's instructions)
- Gather necessary tools
- Turn off the equipment
- Make necessary adjustment
- Test the equipment
- Repeat if necessary



Theoretical Activity 1.1.4: Differentiation of materials for pasteurized milk



Notes to the trainer:

- The trainer may use small groups to differentiating materials used in pasteurized milk production
- The use of drawings, pictures or videos as didactic materials is required.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- What do you understand by the term raw milk as raw material for pasteurized milk production?
- Basing on your understanding, discuss on the reagent (alcohol) used in testing raw milk for pasteurized milk production
- Basing on your understanding, describe cleaning agents used in pasteurized milk production

Step 2: Monitor discussions in groups and ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Asks trainees to discuss on the provided answers and choose the correct ones.

Step 4: Provide the expert view and clarify ideas by using didactic materials.

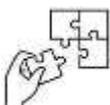
Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.1.4 in trainee manual



Points to Remember

- Cleaning agent is harmful when you use inappropriately, you recommend to use it properly
- During pasteurized milk production main chemical reagent used for raw milk testing are: alcohol, Distilled water, Phenolphthalein indicator and Buffer solutions,
- Based on pH of cleaning agent, main types of cleaning agent used in pasteurized milk production are alkaline cleaning agent, acid cleaning agent and neutral cleaning agent



Application of learning 1.1.

Good Life dairy located in neighboring schools produces pasteurized milk. Every morning before processing, tools and equipment have to be selected and adjusted basing on that company activities. In your workshop, ask trainees to perform the same activity as performed by Good life dairy before processing.

Checklist

| SN | Criteria | Indicator | Score | |
|----|---|--------------------------------|-------|----|
| | | | Yes | No |
| 1 | Tools and equipment are properly selected | Tools are selected | | |
| | | Equipment are selected | | |
| 2 | Tools and equipment are properly adjusted | Tools are adjusted | | |
| | | Equipment are adjusted | | |
| 3 | Reporting is properly done | Report format is considered | | |
| | | key competencies are mentioned | | |



Indicative content 1.2: Cleaning of work area, tools and equipment



Duration: 3 hrs



Practical Activity 1.2.1: Preparation of cleaning agents for pasteurized milk



Notes to the trainer

- Trainer may use demonstration
- Trainer may use individualized works
- Trainer may use videos, illustration or any other didactic materials



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and prepare cleaning agents used in pasteurized milk production.

Step 2: Explain the task and provide clear work instruction (Task, PPE, Time allocated)

Step 3: Demonstrate how to prepare cleaning agents for pasteurized milk production. While demonstrating, explain the procedure of preparing cleaning agents used in pasteurized milk production.

Step 4: Ask trainees to prepare cleaning agents to be used in pasteurized milk production, and monitor the procedures.

Step 5: Verify whether cleaning agents are properly prepared and provide feedback where necessary.

Step 6: Ask trainees to read key reading 1.2.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning



Points to Remember

1. During cleaning reagent preparation for pasteurized milk production, pass through those steps:
 - ✓ Determine the type of cleaning product needed
 - ✓ Gather ingredients and materials

- ✓ Follow a recipe or formula or review the manufacturer's instructions
- ✓ Mix ingredients
- ✓ Store properly



Practical Activity 1.2.2: Cleaning the work area, tools and equipment used in pasteurized milk production

Notes to the trainer

- Trainer supposed to demonstrate how to clean the work area, tools and equipment used in pasteurized milk production
- The use videos as didactic materials related to clean the work area, tools and equipment used in pasteurized milk production



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and clean work area, tools and equipment by applying cleaning methods and techniques.

Step 2: Explain the task and provide clear work instruction (Task, PPE, Time allocated)

Step 3: Demonstrate how to clean work area, tools and equipment for pasteurized milk production. While demonstrating, explain the cleaning methods, techniques and procedure used in pasteurized milk production

Step 4: Ask trainees to clean the work area, tools and equipment to be used in pasteurized milk production and monitor the procedures.

Step 5: Verify whether cleaning is well performed and provide feedback where necessary.

Step 6: Ask trainees to read key reading 1.2.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.2



Points to Remember

- Before using cleaning product used in pasteurized milk production, you should read the instruction use and follow a recipe or formula
- During cleaning tools, equipment and work area in pasteurized milk production, dry cleaning and wet cleaning methods must be used
- When cleaning the interior surface of pipelines, vessels, filters, process equipment and associated things without dismantling in pasteurized milk production, it recommends to use cleaning in place(CIP) cleaning techniques
- When using cleaning out of place (COP) techniques in pasteurized milk production, make sure all parts are completely submerged to ensure that adequate efficient cleaning
- in pasteurized milk production, cleaning large or bulky equipment that can be accommodated in CIP systems.



Practical Activity 1.2.3: Checking of the effectiveness of cleaning the work area, tools and equipment for pasteurized milk production

Notes to the trainer

- The trainer is supposed to demonstrate how to check effectiveness of cleaning the work area, tools and equipment for pasteurized milk production.
- Avail videos as didactic materials related to checking effectiveness of cleaning tools, equipment and work area in pasteurized milk production
- Avail cleaned tools, equipment and work area being checked for pasteurized milk production.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and check the cleaning effectiveness for work area, tools and equipment used in pasteurized milk production.

Step 2: Explain the task and provide clear work instruction (Task, PPE, Time allocated)

Step 3: Demonstrate how to check the cleanliness of work area, tools and equipment for pasteurized milk production. While demonstrating, explain the methods and procedure used in checking the cleaning effectiveness for work area, tools and equipment used in pasteurized milk production

Step 4: Ask trainees to check the cleanliness of work area, tools and equipment for pasteurized milk production, and monitor the procedures.

Step 5: Verify whether the cleanliness is correctly checked and provide feedback where necessary.

Step 6: Ask trainees to read key reading 1.2.3 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.2



Points to Remember

- During checking cleaning effectiveness of work area, tools and equipment for pasteurized milk production, you recommend to use the following method: Visual inspection, SWAB test, SWAB test, pH test and Phenolphthalein test.



Practical Activity 1.2.4: Arranging of work area for pasteurized milk production



Notes to the trainer

- The trainer is supposed to demonstrate how to arrange the work area, tools and equipment for pasteurized milk production.
- Trainer may use disorganize the work area so that trainees could be able to arrange it.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and arrange the work area for pasteurized milk production.

Step 2: Explain the task and provide clear work instruction (Task, PPE, Time allocated)

Step 3: Demonstrate how to arrange the work area for pasteurized milk production. While demonstrating, explain the procedure for workshop arrangement used in pasteurized milk production

Step 4: Ask trainees to arrange the work area for pasteurized milk production, and monitor the procedures.

Step 5: Verify whether the work area is properly arranged and provide feedback where necessary.

Step 6: Ask trainees to read key reading 1.2.4 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.2



Points to Remember

- The purpose of arranging work place for pasteurized milk production are optimize efficiency, maximize productivity, ensure safety, enhance comfort at work, facilitate communication and utilize space effectively



Application of learning 1.2

Bakame dairy located in neighboring schools produces pasteurized milk. Every morning before processing, they have to clean work area, check cleaning effectiveness and arrange their workplace. In your workshop, ask trainees to perform the same activity as performed by Bakame dairy before processing.

Checklist:

| SN | Criteria | Indicator | Score | |
|----|--|--------------------------------|-------|----|
| | | | Yes | No |
| 1 | Work area, tools and equipment are properly cleaned | Work area are cleaned | | |
| | | Tools are cleaned | | |
| | | Equipment are cleaned | | |
| 2 | Work area, tools and equipment are properly arranged | Work area are arranged | | |
| | | Tools are arranged | | |
| | | Equipment are arranged | | |
| 3 | Reporting is properly done | Report format is considered | | |
| | | key competencies are mentioned | | |



Indicative content 1.3: Checking the quality of raw milk



Duration: 3 hrs



Practical Activity 1.3.1: Test raw milk quality



Notes to the trainer

- The trainer is supposed to demonstrate how to check raw milk used for pasteurized milk production.
- For the effective delivery; it is recommended to:
 - ✓ Avail raw milk to be checked
 - ✓ Avail videos as didactic materials related to checking raw milk used in pasteurized milk production
 - ✓ Avail various tools and equipment in which those for pasteurized milk production will be used for checking quality of raw milk.
 - ✓ Avail various reagent in which those for pasteurized milk production will be used for checking quality of raw milk



Key steps:

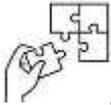
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in the pasteurized milk production workshop and test raw milk for pasteurized milk production.
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated)
- Step 3:** Demonstrate how to test raw milk for pasteurized milk production. While demonstrating, explain different milk tests and procedures for testing raw milk used in pasteurized milk production
- Step 4:** Ask trainees to test raw milk for pasteurized milk production, and monitor the procedures.
- Step 5:** Verify whether raw milk is well tested and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 1.3.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 1.3



Points to Remember

- In pasteurized milk production, Platform test used in raw milk quality are Organoleptic test and Alcohol test



Application of learning 1.3.

Organize learner's field trip to the dairy near the school that produce pasteurized milk where individual trainee will be able to perform organoleptic and alcohol tests in pasteurized milk production. Ask learner to perform organoleptic and alcohol tests

Checklist:

| SN | Criteria | Indicator | Score | |
|----|-------------------------------------|---------------------------------------|-------|----|
| | | | Yes | No |
| 1 | Organoleptic test is well performed | Appearance is checked | | |
| | | Odor is checked | | |
| | | Taste is checked | | |
| | | Texture is checked | | |
| 2 | Alcohol test is well performed | Fresh sample is collected | | |
| | | Ethanol is prepared | | |
| | | Alcohol test is done | | |
| 3 | Field study report is well done | company identification is mentioned | | |
| | | key competencies gained are mentioned | | |



Learning outcome 1 end assessment

Written assessment

Question 1. In the table below, classify the following tools and equipment (in bracket) used in pasteurized milk production accordingly. (Samplers, Milk cans, Alcohol gun, heat source, Beakers, Pasteurizer, Thermometers, test tubes, Graduated cylinders, pipettes, glassware, alcohol gun).

| Tools and equipment for milk testing | Tools and equipment for milk pasteurization | Tools and equipment for milk storage |
|--------------------------------------|---|--------------------------------------|
| | | |

Answer

| Tools and equipment for milk testing | Tools and equipment for milk pasteurization | Tools and equipment for milk storage |
|--|--|--------------------------------------|
| Samplers, Alcohol gun, Beakers, Graduated cylinders, Glassware Pipettes, Test tubes | Pasteurizer, Thermometers, Heat Source | Milk cans |

Question 2. The following statements refer to pasteurized milk production. Read each of them and answer by **True** if it is correct and **False** if it is wrong:

- Alcohol and organoleptic tests are used to detect milk freshness
- Pasteurizer: it is the milk that has been heated to a specific temperature for a specific period of time to kill harmful bacteria
- Mop, broom, bucket, basin are used in pasteurizing milk.
- Adjusting: refers to the process of making necessary changes or modifications to something in order to achieve a desired outcome or result
- Pasteurized milk: it is a device that is used to pasteurize milk
- Milk pasteurization process is a process that involves heating milk to a specific temperature for a specific period of time to kill harmful bacteria.

Answer

- a) Alcohol and organoleptic tests are used to detect milk freshness: **True**
- b) Mop, broom, bucket, basin are used in pasteurizing milk. **False**
- c) Pasteurizer: it is the milk that has been heated to a specific temperature for a specific period of time to kill harmful bacteria **False**
- d) Adjusting: refers to the process of making necessary changes or modifications to something in order to achieve a desired outcome or result **True**
- e) Pasteurized milk: it is a device that is used to pasteurize milk **False**
- f) Milk pasteurization process is a process that involves heating milk to a specific temperature for a specific period of time to kill harmful bacteria. **True**

Question 3. Which of the following statements is considered to be false?

- 1. Safety precautions of the tools and equipment are:
 - a. Before use equipment you should read the instruction for uses equipment and check cleanliness and functionality
 - b. Wear PPE when you use tools and equipment
 - c. Clean and sanitize food contact surfaces of tools and equipment routinely and as frequently as practicable
 - d. Use unapproved equipment and utensils designed for food
 - e. C and d are incorrect

Answer: d & e

- 2. Safety and health precaution of cleaning product are:
 - a. To know Chemical ingredients of the cleaning product
 - b. How the cleaning product is being used or stored?
 - c. Use Ventilation in the area where the cleaning product is used
 - d. Before use equipment you should read the instruction for uses equipment and check cleanliness and functionality

Answer: d

Question 4. Complete in the blank space by following terms cleaning, sanitizing and sanitizing

- a. is the process of killing harmful pathogenic organism or rendering then inert.
- b.is removes soils from surfaces
- c.is process of killing 99.9% of basic germs in place such as food contact surface.

Answer: a) Disinfecting

b) Cleaning

c) Sanitizing

Question 5. Which of the following statements is true or false?

- a. cleaning is process of remove soil and pesticide residues except microorganisms
- b. Cleaning in Place (CIP) is system of cleaning the interior surface of pipelines, vessels, filters, process equipment and associated things with dismantling
- c. Factors affecting cleaning effectiveness are Temperature, Mechanical Actions, Concentration of a product and Time
- d. Wet cleaning method is method of cleaning use water-based solvents while Dry cleaning method is method of cleaning by removal of soil particles from surfaces by mechanical, manual or chemical methods rather than water

Answer:

- a) **False**
- b) **False**
- c) **True**
- d) **True**

Question 6. Arrange the following area from reception room to storage room for pasteurized milk production: receive raw milk, milk pasteurization, milk standardization, Packaging and storage

Answer

Flow chart for pasteurized milk production is: receive raw milk, milk standardization, milk pasteurization, Packaging and storage

Question 7: List the reagents that are commonly used for raw milk alcohol testing

Answer

- ✓ **alcohol**
- ✓ **Distilled water**

Question 6: State the steps of alcohol test as one of methods of testing raw milk for milk pasteurization production.

Answer

To perform the alcohol test:

- A small amount of the sample is mixed with an equal amount of 68% ethanol.
- The mixture is then gently swirled and allowed to stand for several minutes

- If the milk is fresh and of good quality, it should remain smooth and liquid, with no visible clumps or separation.
- If bacterial contamination has occurred, the proteins will begin to coagulate This indicates that the milk is of poor quality or may have been adulterated.

Practical assessment

AZ milk collection center located in Nyabihu district got funds to upgrade its production, the new product to deliver to its customers is pasteurized milk. However, to meet the requirements of that product, qualified worker is needed to perform this task. As a food processing assistant technician qualified in pasteurized milk production, the manager of this milk collection center request you to demonstrate how pasteurized milk production workplace is prepared. Note that all materials, tools and equipment are available in AZ milk collection center.

Task:

1. To select tools and equipment for pasteurized milk production
2. To adjust tools and equipment for pasteurized milk production
3. To clean the work area, tools and equipment for pasteurized milk production
4. To check the quality of raw milk

| Criteria | Indicators | Score | |
|--|--------------------------------|-------|----|
| | | Yes | No |
| Tools and equipment for raw milk testing are properly selected according to their use | Milk sampler is selected | | |
| | Alcohol gun is selected | | |
| | Thermometer is selected | | |
| Tools and equipment for pasteurized milk making are correctly selected according to the protocol | Pasteurizer is selected | | |
| | Cooling tank is selected | | |
| | Tables are selected | | |
| | Cooling tank is selected | | |
| Adjustment of tools and equipment is correctly done according to the manufacturer's instructions | Balance is adjusted | | |
| | Pasteurizer is adjusted | | |
| | Cooling tank is adjusted | | |
| Work area, tools and equipment are cleaned properly according to the procedures | Tools are neatly cleaned | | |
| | Equipment are properly cleaned | | |

| | | | |
|--|-------------------------------------|--|--|
| | Work area is neatly cleaned | | |
| Raw milk quality is checked according to the raw milk specifications | Organoleptic test is correctly done | | |
| | Alcohol test is properly done | | |

END



Further information to the trainer

- Barrett, N. E., Grandison, A. S., & Lewis, M. J. (1999). Contribution of the lactoperoxidase system to the keeping quality of pasteurized milk. *Journal of Dairy Research*, 66(1), 73-80. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/10191475>
- Bille, P., Haradoeb, B., & Shigwedha, N. (2010). Evaluation of chemical and bacteriological quality of raw milk from Neudamm dairy farm in Namibia. *African Journal of Food, Agriculture, Nutrition and Development*, 9(7), 1511-1523. Retrieved 12 20, 2024, from <https://ajol.info/index.php/ajfand/article/view/47682>
- Holmes, D. H. (1950). A comparison of total bacteria counts of raw and pasteurized milk. *Butler University Botanical Studies*, 9(1), 19. Retrieved 12 20, 2024, from <http://digitalcommons.butler.edu/cgi/viewcontent.cgi?article=1179&context=botanical>
- I, K., & I, G. (1977). Coliform bacteria in raw and pasteurized milk. *Veterinarno-meditinski nauki*, 14(10), 46. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/345606>
- Nada, S., Ilija, D., Igor, T., Jelena, M., & Ruzica, G. (2012). Implication of food safety measures on microbiological quality of raw and pasteurized milk. *Food Control*, 25(2), 728-731. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0956713511005639>
- Payne, C., & Wilbey, R. A. (2009). Alkaline phosphatase activity in pasteurized milk: A quantitative comparison of Fluorophos and colourimetric procedures. *International Journal of Dairy Technology*, 62(3), 308-314. Retrieved 12 20, 2024, from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1471-0307.2009.00503.x>
- Raw Milk - Food Safety*. (n.d.). Retrieved 12 20, 2024, from (US) Centers for Disease Control and Prevention: <https://www.cdc.gov/foodsafety/rawmilk/raw-milk-index.html>
- Sepulveda, D., Góngora-Nieto, M., Guerrero, J., & Barbosa-Cánovas, G. V. (2005). Production of extended-shelf life milk by processing pasteurized milk with pulsed electric fields. *Journal of Food Engineering*, 67(1), 81-86. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0260877404003334>
- Stevenson, R. G., Wisdom, G. B., Rowe, M. T., & McConaghy, D. A. (1996). Growth characteristics of post-pasteurization contaminants isolated from pasteurized milk. *Journal of Dairy Research*, 63(4), 585-591. Retrieved 12 20, 2024, from <https://cambridge.org/core/journals/journal-of-dairy-research/article/div->

Learning Outcome 2: Pasteurize the Milk



Indicative contents

2.1 Operating pasteurizer machines

2.2 Monitoring pasteurization

2.3 Cooling pasteurized milk

Key Competencies for Learning Outcome 2: Pasteurize the Milk

| Knowledge | Skills | Attitudes |
|--|---|---|
| <ul style="list-style-type: none"> • Description of pasteurization methods • Description of parameters influencing pasteurization efficiency • Description of the alkaline phosphatase test role and procedure • Explanation of pasteurized milk specifications • Explanation of the purpose of cooling • Description of cooling conditions of pasteurized milk. | <ul style="list-style-type: none"> • Operating the pasteurizer • Performing alkaline phosphatase test on pasteurized milk • Cooling pasteurized milk | <ul style="list-style-type: none"> • Being attentive when using pasteurizer machine • Being careful when using electric connected tools and equipment • Being accuracy when performing alkaline phosphatase test |



Duration: 20 hrs



Learning outcome 2 objectives:

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

1. Operate pasteurizer according to the operating procedure
2. Monitor pasteurization according to the product specification
3. Perform accurately alkaline phosphatase test in pasteurized milk production
4. Characterize correctly pasteurized milk according to pasteurized milk specifications.
5. Cool properly the pasteurized milk to the product quality requirement



Resources

| Equipment | Tools | Materials |
|---|--|--|
| <ul style="list-style-type: none"> • Pasteurizer, • Cooling machine, • Personal protective equipment(PPE), • Tables, • Refrigerator, | <ul style="list-style-type: none"> • Thermometers • Chronometers(timer) • Samplers • Glassware (Beakers, graduated cylinders), • Milk cans, • Measuring cups • Test tubes • Water bath • Pipettes • Register book • Marker pens, • First aid kit | <ul style="list-style-type: none"> • Raw milk, • Distilled water, • Alkaline phosphatase kit, • Pasteurized milk |



Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the raw milk being processed

- Avail the classroom
- Ensure that the workshop is available and well organized
- Avail materials, tools and equipment and make sure that they are in good working conditions
- Verify materials if they are not expired
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuals, protocols)



Indicative content 2.1: Operating pasteurizer machine



Duration: 8 hrs



Practical Activity 2.1.1: Operating pasteurizers



Notes to the trainer

- The trainer is supposed to demonstrate how to operate pasteurizer used in pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for operating pasteurizer
 - ✓ Avail pasteurizer to be operate



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and operate a batch and plate pasteurizers used in pasteurized milk production

Step 2: Explain the task and provide clear work instruction (Task, PPE, Time allocated)

Step 3: Demonstrate how to operate a plate and batch pasteurizers for pasteurized milk production. While demonstrating, explain the procedures of operating pasteurizers.

Step 4: Ask trainees to operate pasteurizers for pasteurized milk production, and monitor the procedures

Step 5: Verify whether pasteurizers are adequately operated and provide feedback where necessary.

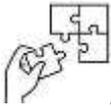
Step 6: Ask trainees to read key reading 2.1.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 2.1



Points to Remember

- During operating pasteurizer, very important step is turn on the heating element and Set the timer for the required pasteurization time and set the temperature to the desired pasteurization temperature.



Application of learning 2.1.

Organize learner's field to the dairy near school and you request to observe and operate both batch and plate pasteurizers.

Checklist:

| SN | Criteria | Indicator | Score | |
|----|--|---------------------------------------|-------|----|
| | | | Yes | No |
| 1 | Batch Pasteurizer is operated according to the operating procedure | Temperature is correctly set | | |
| | | Time correctly is set | | |
| | | Pressure is accurately regulated | | |
| 2 | Plate heat exchange (continuous) | Temperature is correctly set | | |
| | | Time correctly is set | | |
| | | Pressure is accurately regulated | | |
| 3 | Field study report is well done | company identification is mentioned | | |
| | | key competencies gained are mentioned | | |



Indicative content 2.2: Monitoring pasteurization



Duration: 8 hrs



Practical Activity 2.2.1: Monitor pasteurization process



Notes to the trainer

- The trainer is supposed to demonstrate how to monitor pasteurization process in pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials relate to monitor pasteurization
 - ✓ Avail pasteurizer to be monitored



Key steps:

While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in the pasteurized milk production workshop and monitor the process of pasteurization in pasteurized milk production
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated)
- Step 3:** Demonstrate how to monitor pasteurization process for pasteurized milk production. While demonstrating, explain pasteurization monitoring conditions and procedures.
- Step 4:** Ask trainees to monitor pasteurization process for pasteurized milk production, and monitor the procedures
- Step 5:** Verify whether pasteurization process is adequately monitored and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 2.2.1 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 2.2



Points to Remember

- Monitoring the pasteurization process is crucial for ensuring the safety and quality of pasteurized milk and other liquid food products



Practical Activity 2.2.2: Checking of pasteurization efficiency



Notes to the trainer

- The trainer is supposed to demonstrate how to check of pasteurization efficiency in pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for checking of pasteurization efficiency in pasteurized milk production
 - ✓ Avail pasteurized milk to be checked



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and check pasteurization efficiency in pasteurized milk production.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to check the efficiency of pasteurization for pasteurized milk production by applying alkaline phosphatase test. While demonstrating, explain the procedure to check pasteurization efficiency

Step 4: Ask trainees to check pasteurization efficiency and monitor the procedures.

Step 5: Verify whether pasteurization efficiency is well checked and provide feedback where necessary

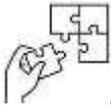
Step 6: Ask trainees to read key reading 2.2.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 2.2



Points to Remember

- The presence of Alkaline phosphatase (ALP) in pasteurized milk can indicate that the milk has been contaminated with raw milk or that the pasteurization process was not adequate.



Application of learning 2.2.

Organize learner's field trip to the dairy near school and you are request learners to monitor pasteurization and check the effectiveness of pasteurization by alkaline phosphatase test.

Solution:

| SN | Criteria | Indicator | Score | |
|----|---|--|-------|----|
| | | | Yes | No |
| 1 | Pasteurization parameters are monitored according to the milk pasteurization conditions | Time is effectively monitored | | |
| | | Temperature is properly monitored | | |
| | | Pressure is correctly monitored | | |
| 2 | efficiency of pasteurization is well checked | Alkaline phosphatase test is properly used | | |
| 3 | Field study report is well done | company identification is mentioned | | |
| | | key competencies gained are mentioned | | |



Indicative content 2.3: Cooling pasteurized milk



Duration: 4 hrs



Practical Activity 2.3.1: Cooling pasteurized milk



Notes to the trainer

- The trainer is supposed to demonstrate how to cool pasteurized milk for pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for cooling pasteurized milk in pasteurized milk production
 - ✓ Avail pasteurized milk to be cooled



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in the pasteurized milk production workshop and cool pasteurized milk.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to cool pasteurized milk. While demonstrating, explain the procedure of cooling pasteurized milk.

Step 4: Ask trainees to cool pasteurized milk, and monitor the procedures.

Step 5: Verify whether pasteurized milk is adequately cooled and provide feedback where necessary.

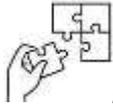
Step 6: Ask trainees to read key reading 2.3.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 2.3



Points to Remember

- After pasteurization, milk is rapidly cooled to below 4°C to slow down the growth of any remaining bacteria that may have survived the heating process



Application of learning 2.3.

KMC dairy located in neighboring schools cool pasteurized milk for the aim of meeting the requirements of pasteurized milk production. In your workshop, ask trainees to cool the milk the same as KMC dairy.

Checklist:

| SN | Criteria | Indicator | Score | |
|----|--|--|-------|----|
| | | | Yes | No |
| 1 | Pasteurized milk is cooled according to the product quality requirements | Time of cooling is correctly maintained | | |
| | | Temperature of cooling is correctly maintained | | |
| 2 | Reporting is properly done | Report format is considered | | |
| | | key competencies are mentioned | | |



Learning outcome 2 end assessment

Written assessment

Question 1. List types of pasteurizers used in milk pasteurization production

Answer

- a. Batch pasteurizers
- b. Continuous pasteurizers

Question 2. Write **true or false** to the following statements on operating pasteurizers.

- a) When operating a batch pasteurizer, it is important to monitor only the temperature product throughout the pasteurization process.
- b) The first step in operating a plate pasteurizer is to ensure that it is clean and sanitized
- c) The plate pasteurizer should be cleaned and sanitized only after use to prevent contamination.
- d) Purpose of cooling pasteurized milk is preservation

Answer

- a) When operating a batch pasteurizer, it is important to monitor only the temperature product throughout the pasteurization process. **False**
- b) The first step in operating a plate pasteurizer is to ensure that it is clean and sanitized **True**
- c) The plate pasteurizer should be cleaned and sanitized only after use to prevent contamination. **False**
- d) Purpose of cooling pasteurized milk is preservation. **True**

Question 3. Read and underline the right measure corresponding to each parameter.

- I. By using batch pasteurizer, the milk will be heated to a temperature of:
 - e) 70-75°C
 - f) 70-75°F
 - g) 60-65°C
 - h) 60-65°F

- II. When the milk is heated to the pasteurization temperature of 161°F (72°C) holding time is:
 - a) 15 minutes
 - b) 15 seconds.
 - c) 2 seconds
 - d) 2minutes

- III. Pasteurized milk is cooled rapidly to:
 - a. 4°C or below.

- b. 4°C or above
- c. 11°C or below

Answer

- I. using batch pasteurizer, the milk will be heated to a temperature of:
 - a. 70-75°C
 - b. 70-75°F
 - c. **60-65°C**
 - d. 60-65°F

- II. When the milk is heated to the pasteurization temperature of 72°C holding time is:
 - a) 15 minutes
 - b) 15 seconds.**
 - c) 2 seconds
 - d) 2 minutes

- III. Pasteurized milk is cooled rapidly to:
 - a. 4°C or below.**
 - b. 4°C or above
 - c. 11°C or below

Question 4. Differentiate batch pasteurizers to plate pasteurizers in terms of their operating principles and components.

Answer:

Batch pasteurizer

Operating principle

- ✓ Batch pasteurizers heat milk in a vat, holding it at a specific temperature for a set time before cooling.

Components of batch pasteurizers include a jacketed vat/, circulating water or steam and agitator.

Plate pasteurizer

Operating principle

Plate pasteurizers use a heat exchange system with hot water or steam to rapidly heat milk as it passes through plates, then hold it at temperature before cooling.

Components of Plate pasteurizers consist of plate heat section, heat holding section, cooling section/, balance tanks, pumps, valves and control systems

Question 5. Compare the advantages and disadvantages of batch pasteurizers and plate pasteurizers in terms of efficiency, energy consumption, and production capacity.

Answer:

Batch Pasteurizers

Advantages

- ✓ Batch pasteurizers offer simplicity and versatility way during processing (**efficiency**)
- ✓ Batch pasteurizer consumes lower energy during processing (**energy efficiency**)

Disadvantages

- ✓ Batch pasteurizers have longer processing time
- ✓ Lower production overtime.
- ✓ Batch pasteurizers are ideal for small-scale operations (**production capacity**)

Plate pasteurizers

Advantages

- ✓ Plate pasteurizers are faster
- ✓ It is suitable for continuous production (efficiency)

Disadvantages

- ✓ Plate pasteurizers require more energy-efficient (energy consumption)
- ✓ Plate pasteurizers require more complex equipment and maintenance.
- ✓ plate pasteurizers are better suited for larger-scale production with higher output.

Question 6. Describe the procedures for alkaline phosphatase test for pasteurized milk.

Answer

The procedure for testing alkaline phosphatase in milk involves several steps.

Materials:

- ✚ Test tubes
- ✚ Water bath
- ✚ Timer
- ✚ Phenol reagent
- ✚ Buffer solution
- ✚ Milk samples
- ✚ Colour comparator

✓ **Procedures:**

1. Label two test tubes as "**sample**" and "**control**."
2. Add 5 ml of buffer solution to each test tube.

3. Add 1 ml of milk sample to the "**sample**" test tube.
4. Add 1 ml of boiled milk to the "**control**" test tube.
5. Place both test tubes in a water bath at 37°C for 30 minutes.
6. Remove the test tubes from the water bath and add 2 ml of phenol reagent to each tube.
7. Mix the tubes gently and let them stand for 5 minutes.
8. Compare the colour of the "**sample**" test tube to the colour of the "**control**" test tube using a colour comparator.

✓ **Interpretation:**

- ✚ If the colour of the "**sample**" test tube is the same as the colour of the "**control**" test tube, the milk has been properly pasteurized.
- ✚ If the colour of the "**sample**" test tube is darker than the colour of the "**control**" test tube, the milk has not been properly pasteurized or has been contaminated with raw milk.

Practical assessment

Gahamanyi owns a dairy in Rutsiro District, when he requested for certification of pasteurized milk produced by his dairy, based on laboratory analysis carried out on the milk, results showed that the milk failed the alkaline phosphatase test, sometimes presenting burnt odors and flavor. As a food processing assistant technician qualified in pasteurized milk production, Gahamanyi requests you to demonstrate how pasteurized milk is produced. Note that all materials and equipment are available to Gahamanyi 's dairy.

Task

1. Operate pasteurizer machines
2. Monitor pasteurization parameters
3. Cool pasteurized milk

checklist

| Criteria | Indicator | Observation | |
|---|---------------------------------------|-------------|----|
| | | Yes | No |
| 1. Pasteurizer is appropriately operated | 1.1 Temperature is set | | |
| | 1.2 Time is set | | |
| | 1.3 Pressure is regulated | | |
| 2. Pasteurization parameters are well monitored | 2.1 Time is monitored | | |
| | 2.2 Temperature is monitored | | |
| | 2.3 Pressure is monitored | | |
| 3. Pasteurized milk is properly cooled | 3.1 Cooling temperature is maintained | | |
| | 3.2 Cooling techniques are applied | | |

END



Further information to the trainer

- Barrett, N. E., Grandison, A. S., & Lewis, M. J. (1999). Contribution of the lactoperoxidase system to the keeping quality of pasteurized milk. *Journal of Dairy Research*, 66(1), 73-80. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/10191475>
- Efigênia, M., Pova, B., & Moraes-Santos, T. (1997). Effect of heat treatment on the nutritional quality of milk proteins. *International Dairy Journal*, 7, 609-612. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0958694697000496>
- Holmes, D. H. (1950). A comparison of total bacteria counts of raw and pasteurized milk. *Butler University Botanical Studies*, 9(1), 19. Retrieved 12 20, 2024, from <http://digitalcommons.butler.edu/cgi/viewcontent.cgi?article=1179&context=botanical>
- I, K., & I, G. (1977). Coliform bacteria in raw and pasteurized milk. *Veterinarno-meditsinski nauki*, 14(10), 46. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/345606>
- Nada, S., Ilija, D., Igor, T., Jelena, M., & Ruzica, G. (2012). Implication of food safety measures on microbiological quality of raw and pasteurized milk. *Food Control*, 25(2), 728-731. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0956713511005639>
- Payne, C., & Wilbey, R. A. (2009). Alkaline phosphatase activity in pasteurized milk: A quantitative comparison of Fluorophos and colourimetric procedures. *International Journal of Dairy Technology*, 62(3), 308-314. Retrieved 12 20, 2024, from <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1471-0307.2009.00503.x>
- Sepulveda, D., Góngora-Nieto, M., Guerrero, J., & Barbosa-Cánovas, G. V. (2005). Production of extended-shelf life milk by processing pasteurized milk with pulsed electric fields. *Journal of Food Engineering*, 67(1), 81-86. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0260877404003334>
- Srujana, G., Reddy, A. R., & Reddy, V. K. (2011). Microbial Quality Of Raw And Pasteurized Milk Samples Collected From Different Places Of Warangal District, (A.P.) India. *International journal of pharma and bio sciences*. Retrieved 12 20, 2024, from <http://ijpbs.net/volume2/issue2/bio/15.pdf>
- Stevenson, R. G., Wisdom, G. B., Rowe, M. T., & McConaghy, D. A. (1996). Growth characteristics of post-pasteurization contaminants isolated from pasteurized milk. *Journal of Dairy Research*, 63(4), 585-591. Retrieved 12 20, 2024, from <https://cambridge.org/core/journals/journal-of-dairy-research/article/div->

Learning Outcome 3: Store Pasteurized Milk



Indicative contents

3.1 Preparation of packaging materials

3.2 Package pasteurized milk

3.3 Monitor storage parameters

Key Competencies for Learning Outcome 3: Store Pasteurized Milk

| Knowledge | Skills | Attitudes |
|---|---|---|
| <ul style="list-style-type: none"> • Description of the types of packaging materials for pasteurized milk • Description of the functions of a packaging material • Explanation of the quality parameters of pasteurized milk • Identification of labeling information of pasteurized milk • Description of the pasteurized milk storage conditions | <ul style="list-style-type: none"> • Packaging pasteurized milk • Sterilizing of the packaging materials for pasteurized milk • Filling and sealing pasteurized milk • Labeling pasteurized milk • Arranging the stock • Monitoring the storage temperature • Recording temperature and time | <ul style="list-style-type: none"> • Being attentive when packaging pasteurized milk • Being careful when labelling pasteurized milk • Being organized • Being collaborative • Being vigilant during filling pasteurized milk • Being self-motivated during packaging |



Duration: 10 hrs

**Learning outcome 3 objectives:**

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

1. Prepare packaging materials according to their types
2. Package pasteurized milk according to product requirement
3. Monitor store of pasteurized milk according to storage conditions

**Resources**

| Equipment | Tools | Materials |
|---|---|--|
| <ul style="list-style-type: none"> ✓ Filling machine, ✓ Sealing machine, ✓ Refrigerators, ✓ Cooling tanks, ✓ Cold room | <ul style="list-style-type: none"> ✓ Thermometers ✓ Clock | <ul style="list-style-type: none"> ✓ Jericans, ✓ Register book ✓ Pens ✓ Ruler ✓ Calendar ✓ Stickers ✓ Labels ✓ Glue ✓ Record template |

**Advance Preparation:**

Before delivering this learning outcome, you are recommended to:

- Avail the classroom
- Ensure that the workshop is available and well organized
- Ensure that tools and equipment are available and make sure that they are in good working conditions
- Avail packaging materials
- Prepare teaching aids and didactic materials (manuals/guides, task sheets, photos, audio-visuials, protocols)



Indicative content 3.1: Preparation of packaging materials



Duration: 4hrs



Theoretical Activity 3.1.1: Identification of pasteurized milk packaging materials and their characteristics



Notes to the trainer:

- The trainer may use small groups to describe packaging materials used in pasteurized milk production.
- The use of photos, illustration as didactic materials is required.



Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions:

- Based on your understanding, List types of packaging material used in pasteurized milk packaging
- Give the characteristics of packaging materials given(i).
- Enumerate function of packaging materials given(i).

Step 2: Monitor discussions in groups and ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Asks trainees to discuss on the provided answers and choose the correct ones.

Step 4: Provide the expert view and clarify ideas by using didactic materials.

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 3.1.1 in trainee manual



Points to Remember

- Main functions of Packaging material are used to: enclose, protect, transport, and market goods
- The packaging material used for pasteurized milk is typically made of plastic, paperboard and glass.



Practical Activity 3.1.2: Sterilize packaging materials for pasteurized milk



Notes to the trainer

- The trainer is supposed to demonstrate how to Sterilize packaging materials used pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for Sterilizing packaging materials used pasteurized milk production
 - ✓ Avail packaging materials to be sterilize



Key steps:

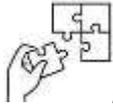
While delivering this activity, pass through the following steps:

- Step 1:** Introduce the activity and ask trainees to go in the pasteurized milk production workshop and sterilize packaging materials for pasteurized milk.
- Step 2:** Explain the task and provide clear work instruction (Task, PPE, Time allocated)
- Step 3:** Demonstrate how to sterilize packaging materials for pasteurized milk. While demonstrating, explain the procedure of packaging materials sterilization.
- Step 4:** Ask trainees to sterilize packaging materials for pasteurized milk, and monitor the procedures.
- Step 5:** Verify whether packaging materials are adequately sterilized and provide feedback where necessary.
- Step 6:** Ask trainees to read key reading 3.1.2 in trainee manual
- Step 7:** Ask trainees to perform the task provided in application of learning 3.1



Points to Remember

- Methods to Sterilize packaging materials for pasteurized milk are: Heat sterilization, Chemical sterilization, Low-temperature sterilization and UV radiation sterilization



Application of learning 3.1.

Organize learner's field trip to the dairy near school that produce pasteurized milk and you are request trainee to prepare packaging materials used pasteurized milk production to ensure the safety of the product.

Checklist:

| S N | Criteria | Indicator | Score | |
|--------|---------------------------------------|---------------------------------------|-------|----|
| | | | Yes | No |
| 1 | Packaging materials are well selected | Plastic bottles are selected | | |
| | | Glass Bottle are selected | | |
| | | Paperboard are selected | | |
| 2 | Packaging materials are well cleaned | Hot water is used | | |
| | | Chemical sterilization is used | | |
| | | Heat sterilization is observed | | |
| | | Steps are followed | | |
| 3 | Field study report is well done | company identification is mentioned | | |
| | | key competencies gained are mentioned | | |



Indicative content 3.2: Package pasteurized milk



Duration: 3hrs



Practical Activity 3.2.1: Filling, sealing and labelling pasteurized milk



Notes to the trainer

- The trainer is supposed to demonstrate how to fill, seal and label pasteurized milk
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for filling, sealing and labelling, pasteurized milk
 - ✓ Avail pasteurized milk to be filled
 - ✓ Avail packaging material and equipment used Filling, sealing and labelling pasteurized milk



Key steps:

While delivering this activity, pass through the following steps:

Step 1:Introduce the activity and ask trainees to go in the pasteurized milk production workshop, fill, seal and label pasteurized milk.

Step 2:Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3:Demonstrate how to fill, seal and label pasteurized milk. While demonstrating, explain the procedure of filling, sealing and labelling pasteurized milk.

Step 4:Ask trainees to fill, seal and label pasteurized milk, and monitor the procedures.

Step 5:Verify whether pasteurized milk is properly filled, sealed and labelled, and provide feedback where necessary.

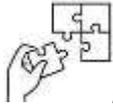
Step 6:Ask trainees to read key reading 3.2.1 in trainee manual

Step 7:Ask trainees to perform the task provided in application of learning 3.2



Points to Remember

- The steps of filling and sealing must be performed in a hygienic manner to prevent contamination of the milk



Application of learning 3.2.

BDC dairy located in neighbouring schools fill, seal and label pasteurized milk for the aim to ensure proper handling and milk safety standard. In your workshop, ask trainees fill, seal and label pasteurized milk as BDC dairy Ltd.

Checklist:

| SN | Criteria | Indicator | Score | |
|----|--------------------------------------|------------------------------------|-------|----|
| | | | Yes | No |
| 1 | Pasteurized milk are properly filled | Packaging materials are sterilized | | |
| | | Headspace is respected | | |
| | | Product quantity of is respected | | |
| | | Steps are followed | | |
| 2 | Pasteurized milk are properly sealed | Seals are sterilized | | |
| | | Sealing machine is used | | |
| | | Steps are followed | | |
| 3 | Reporting is properly done | Report format is considered | | |
| | | key competencies are mentioned | | |



Indicative content 3.3: Monitor Storage parameters



Duration: 3hrs



Practical Activity 3.3.1: Arrange store, monitor and record the time and temperature for pasteurized milk storage



Notes to the trainer

- The trainer is supposed to demonstrate how to arrange store, monitor and record in pasteurized milk production
- For the effective delivery; it is recommended to:
 - ✓ Avail videos as didactic materials for arrange, monitor and record in pasteurized milk production
 - ✓ Avail cold room for storing pasteurized milk



Key steps:

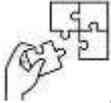
While delivering this activity, pass through the following steps:

- Step 1:**Introduce the activity and ask trainees to go in the pasteurized milk production workshop and store pasteurized milk.
- Step 2:**Explain the task and provide clear work instruction (Task, PPE, Time allocated)
- Step 3:**Demonstrate how to store pasteurized milk. While demonstrating, explain the conditions, techniques and procedure of storing pasteurized milk.
- Step 4:**Ask trainees to store pasteurized milk, and monitor the procedures.
- Step 5:**Verify whether pasteurized milk is properly stored and provide feedback where necessary.
- Step 6:**Ask trainees to read key reading 3.3.1 in trainee manual
- Step 7:**Ask trainees to perform the task provided in application of learning 3.3



Points to Remember

Storage conditions Pasteurized milk is refrigerator at 4⁰C or less for 10 to 21 days



Application of learning 3.3.

Organize learner's field visit to the dairy near school that produce pasteurized milk and you are requested trainee to arrange, set, and monitor storage conditions of pasteurized milk to ensure the quality of the product.

Checklist:

| SN | Criteria | Indicator | Score | |
|----|---|---------------------------------------|-------|----|
| | | | Yes | No |
| 1 | Storage techniques are properly applied | Cold room is used | | |
| | | Refrigerator is used | | |
| | | Steps are followed | | |
| 2 | Storage conditions are properly monitored | Time is respected | | |
| | | Temperature is respected | | |
| 3 | Field study report is well done | company identification is mentioned | | |
| | | key competencies gained are mentioned | | |



Learning outcome 3 end assessment

Written assessment

1. Fill the sentence below with given appropriate term (packaging, packaging material, filling, sealing, labelling)
 - a.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.

Answer: packaging

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

Answer: packaging material

- c.is a process of pouring product into packaging material.

Answer: filling

- d. is the process of tight and perfect closure of packaging material against gas or any other product in or out?

Answer: sealing

2. Read careful the following statement and choose the correct answer:

- i. What is the primary purpose of packaging of pasteurized milk?
 - 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. Which of the following criteria is not mentioned for the selection of packaging material for pasteurized milk?
 - a) Resistance to UV light
 - b) High oxygen barrier properties
 - c) Not imparting a strong flavour to the product

d) Mechanical properties

iii. What is the purpose of sterilizing packaging materials before filling pasteurized milk?

- 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. Which labelling technique involves printing all information directly on the packaging ?

- a) Applied labelling
- b) Direct labelling**
- c) Transparent labelling
- d) Indirect labelling

3. State any ten labelling information that should be indicated on label of pasteurized milk ?

Answer:

Product name

Quantity of product / Net quantity

List of ingredients in descending order

Company location/ producer location

Shelf life information: including production date, expiration date or best before date.

Company/ produce address

Batch number

Nutritional information

Instruction of use.

Storage conditions

Lot number or batch number, Bar code.

Direction for use

Nutritional information

Practical assessment

Tworore cooperative located in Bugesera district, produces pasteurized milk in their dairy. Based on customer appraisal survey, results showed that their pasteurized milk is prone to fermentation before the expected shelf life. However, the pasteurized milk passed the alkaline phosphatase test. As a food processing assistant technician, the manager of Tworore cooperative requests you to demonstrate how pasteurized milk should be stored. Note that all materials, tools and equipment are available at Tworore cooperative.

Task:

1. To sterilize packaging materials for pasteurized milk production
2. To package pasteurized milk
3. To monitor pasteurized milk storage parameters

| Criteria | Indicators | Observation | |
|--|--|-------------|----|
| | | Yes | No |
| 1. Packaging materials are well prepared | 1.1 packaging materials are selected | | |
| | 1.2 packaging materials are sterilized | | |
| 2. Pasteurized milk is properly packaged | 2.1 Product quantity is respected | | |
| | 2.2 sealing is respected | | |
| | 2.3 labelling is respected | | |
| 3. Storage parameters are well monitored | 3.1 Storage conditions are monitored | | |
| | 3.2 Stock is arranged | | |
| | 3.3 Storage temperature monitored | | |

END



Further information to the trainer

- (Abubakar), A., (Triyantini), T., Sunarlim, R., Setiyanto, H., & Nurjannah. (2001). Effect of temperature and time of pasteurization on the milk quality during storage. *Indonesian Journal of Animal and Veterinary Sciences*, 6(1), 45-50. Retrieved 12 20, 2024, from <http://medpub.litbang.pertanian.go.id/index.php/jitv/article/view/218>
- Al-Attabi, Z., D'Arcy, B. R., & Deeth, H. C. (2014). Volatile sulfur compounds in pasteurised and UHT milk during storage. *Dairy Science & Technology*, 94(3), 241-253. Retrieved 12 20, 2024, from <https://link.springer.com/article/10.1007/s13594-013-0157-y>
- Janzen, J., Bishop, J., Bodine, A., & Caldwell, C. (1982). Shelf-Life of Pasteurized Fluid Milk as Affected by Age of Raw Milk. *Journal of Dairy Science*, 65(12), 2233-2236. Retrieved 12 20, 2024, from [https://journalofdairyscience.org/article/s0022-0302\(82\)82491-0/abstract](https://journalofdairyscience.org/article/s0022-0302(82)82491-0/abstract)
- Lynch, J., Lock, A. L., Dwyer, D., Noorbakhsh, R., Barbano, D. M., & Bauman, D. E. (2005). Flavor and Stability of Pasteurized Milk with Elevated Levels of Conjugated Linoleic Acid and Vaccenic Acid. *Journal of Dairy Science*, 88(2), 489-498. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/15653514>
- Martin, N., Ranieri, M., Wiedmann, M., & Boor, K. J. (2012). Reduction of pasteurization temperature leads to lower bacterial outgrowth in pasteurized fluid milk during refrigerated storage: A case study. *Journal of Dairy Science*, 95(1), 471-475. Retrieved 12 20, 2024, from <https://ncbi.nlm.nih.gov/pubmed/22192227>
- Papachristou, C., Badeka, A., Chouliara, I., Kondyli, E., Kourtis, L., & Kontominas, M. G. (2006). Evaluation of polyethylene terephthalate as a packaging material for premium quality whole pasteurized milk in Greece. *European Food Research and Technology*, 224(2), 237-247. Retrieved 12 20, 2024, from <https://link.springer.com/article/10.1007/s00217-006-0398-6>
- Ranieri, M., Huck, J., Sonnen, M., Barbano, D. M., & Boor, K. J. (2009). High temperature, short time pasteurization temperatures inversely affect bacterial numbers during refrigerated storage of pasteurized fluid milk. *Journal of Dairy Science*, 92(10), 4823-4832. Retrieved 12 20, 2024, from <https://sciencedirect.com/science/article/pii/S0022030209708112>



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