

Hygienic small-scale milk processing

A training guide for small-scale milk processors in Eastern Africa



TDB
Tanzania Dairy Board



A Programme of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)



ILRI

INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE



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MODULE 5

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It is our desire and hope that the use of this guide in training programmes will contribute to the improvement of milk quality along the marketing chain and provide income generation opportunities for those involved. We look forward to continued collaboration with the above institutions as we strive to strengthen the dairy industry and cross-border trade in the region.



Foreword

As a small-scale milk processor, you know very well how raw milk can get spoilt very quickly if it is not handled and stored properly. Thus, it is important for you to have adequate knowledge and skills that will enable you to practise good hygiene whenever you handle milk before and during processing. This will help to avoid unnecessary losses due to milk spoilage and allow you to increase your profits.

It is with this in mind that this training guide was developed through collaboration between dairy regulatory authorities in Kenya, Rwanda, Tanzania and Uganda; the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) through its Programme for Agricultural Policy Analysis (ECAPAPA) and the International Livestock Research Institute (ILRI). This document will help you acquire basic knowledge and skills in the following areas:

- Hygienic milk production and handling
- Milk quality control and testing
- Milk quality grading and payment systems
- Hygienic milk storage, preservation, transportation and processing / packaging
- Maintenance of milk handling and cooling equipment
- Dairy effluent management systems
- Code of hygienic practice

This is not a detailed manual on processing of specific milk products, rather, it is aimed at helping you to satisfy the basic requirements for hygienic milk processing. The guide is designed to be used for residential training at a suitable institution, on-site training at the processing plant or outreach training by business development service (BDS) providers. After the training, you will



undergo a theory and practical test to evaluate your level of competence in hygienic milk handling and processing. Upon passing the test, you will be awarded a **certificate in basic hygienic milk handling and processing**. You will need to obtain this certificate before you can be licensed by your national dairy board or authority as a small-scale milk processor.

There are similar training modules for farm level workers, milk collection centre operators, transporters and small-scale traders that cover the minimum competencies for hygienic milk handling. A module on basic marketing and dairy business management is not mandatory for licensing of small-scale dairy operatives but is optional for those who desire basic training in this area.

As dairy regulators in Eastern Africa, we recommend this guide for training and certification of small-scale dairy processors.

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HYGIENIC MILK PRODUCTION

It is important for you as a small-scale milk processor to understand that if milk is not handled hygienically at the farm level, its quality can be affected later on and cause it to be unsuitable for processing. For this reason, this section on hygienic milk production has been included to help you understand how some of the factors at the farm can influence milk quality at later stages of the milk supply chain.

Milk from the udder of a healthy cow contains very few bacteria. Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk remains fresh for a longer time, good hygiene must be observed during milking and when handling the milk afterwards.

Important factors that influence milk quality

Feeding

A well-fed and watered animal will produce high quantities of milk of good composition. If cows are fed a diet that is low in forages and high in starch, the butterfat content may fall below 2.5%. Thus, a good balance of forage and concentrates is important. Cows may be given feed supplements but it is important that the proper proportions be observed. Cows should not be fed with silage during milking or shortly before milking, as this will give rise to off-flavours in the milk. It is recommended that silage feed be provided two hours before milking.



Keep your cows well-fed and healthy



Health of the cow

An unhealthy cow will feed less and produce less milk of poor quality. Cows should always be kept healthy and clean because sick animals can transmit diseases like tuberculosis and brucellosis to milk consumers. If a cow is suspected to be sick, a qualified veterinary practitioner should be contacted immediately. Milk from a cow that is being treated with antibiotics should not be sold or consumed until after the specified withdrawal period.

Animal and udder health

Zoonoses

Zoonotic diseases like tuberculosis and brucellosis can be spread to humans through milk. Cows suffering from such diseases should be referred to a qualified veterinary practitioner who will decide on the fate of the animal. Farmers are encouraged to vaccinate their animals against brucellosis. Animals should also be checked periodically for all types of contagious diseases and treated promptly in case of infections.

Mastitis

Mastitis is an inflammation of the mammary glands in the udder caused by infection with disease-causing bacteria. These bacteria can also end up in the milk and result in illness if the milk is consumed. For this reason, milk from cows suffering from mastitis should not be sold or drunk. You can control mastitis by observing general hygiene and proper milking procedures. Hair at the udder should be kept short by trimming. Cows suffering from mastitis should be treated by a qualified veterinary practitioner. Milk from animals that are undergoing antibiotic treatment should not be consumed or sold until the withdrawal period has elapsed because antibiotic residues may cause allergies and drug resistance in consumers.

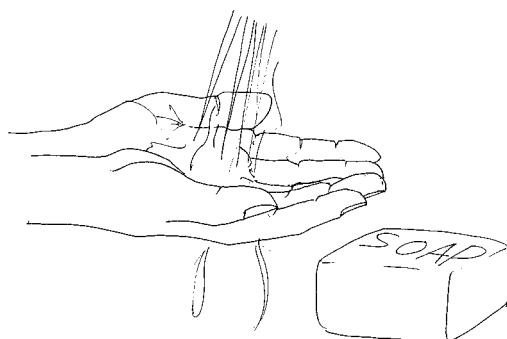
Hygienic milking

Good hygiene and quality control needs to be observed at all stages of milk production, handling and sale. Thus, hygienic practice must begin at the farm level. Good hygiene will ensure that the milk you handle is clean and has low levels of



spoilage bacteria. Below is some advice you can give to the farmers who supply you with milk, in order to ensure good quality:

- Maintain clean and healthy cows.
- Keep a clean milking environment, free of dust and mud.
- Do not milk cows if you are suffering from communicable diseases like diarrhoea or typhoid, but seek medical treatment and resume milking only when you have fully recovered.
- Do not mix colostrum (the milk produced for the first seven days after calving) with normal milk.
- Wash your hands with soap and clean water before milking.
- Wash the udder with a clean cloth and warm water.
- Dry the udder with a clean dry cloth.
- Make the first draw into a strip cup to check for mastitis and throw away from the milking area even if the milk appears clean.
- Use clean containers for milking.
- Cows with mastitis should be milked last and their milk discarded.
- Milk from cows under antibiotic treatment should not be sold until 3 days after last treatment or as advised by the veterinary practitioner.
- After every milking, dip the teats into an “antiseptic dip”.

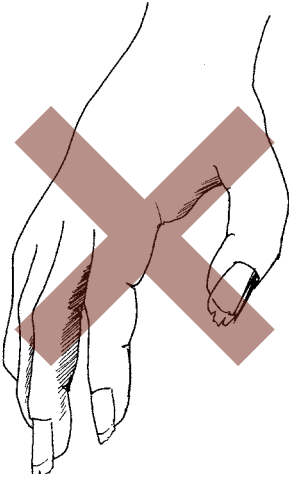


Wash hands with soap and clean water



- During milking, the milker should **not**: (a) have long nails, (b) sneeze, spit or cough, (c) smoke.

During milking, do NOT...



...have long nails

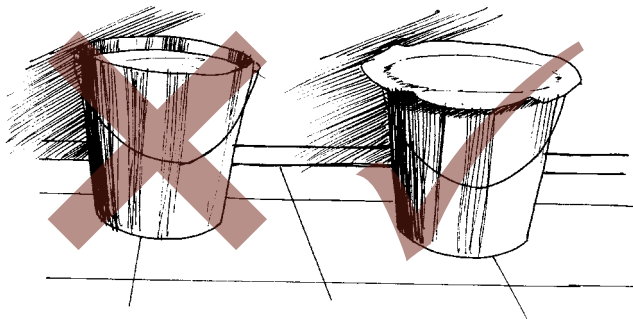


...smoke



...sneeze or cough

- Release the cow from the milking area as soon as milking is finished.
- After milking, sieve the milk through a strainer or muslin cloth to remove solid particles that may have fallen in during milking.
- Cover the milk to avoid contamination.
- Move the milk to a clean and cool area.



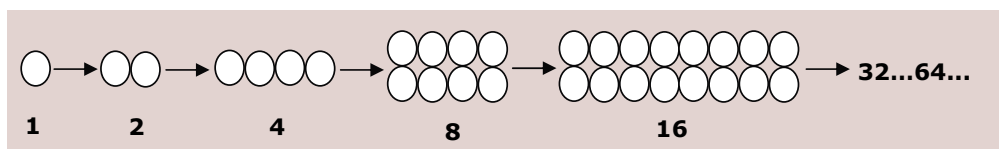
Cover the milk to avoid contamination



HYGIENIC MILK HANDLING

What causes milk spoilage?

It is important for you to know some of the things that can cause milk spoilage so that you can avoid unnecessary losses. Milk is very rich in nutrients. Because of this, the bacteria that cause spoilage can grow very quickly in milk. Bacteria cells grow by dividing into two. If milk is stored at high temperatures for a long time then the bacteria will grow and divide very fast and soon the milk will have a very high number of bacteria and thus get spoilt quickly. Also, if the milk had a high number of bacteria to begin with then it will get spoilt in a very short time.



Bacteria cells grow by dividing into two

Here are some guidelines to follow in order to avoid milk spoilage:

- Always handle milk in clean metal containers.
- When transferring milk between containers, pour the milk instead of scooping. Scooping may introduce spoilage bacteria.
- Do not store milk at high temperatures.
- Do not handle milk if you are sick. Seek medical treatment and resume your work only when the doctor says you are fit to do so.





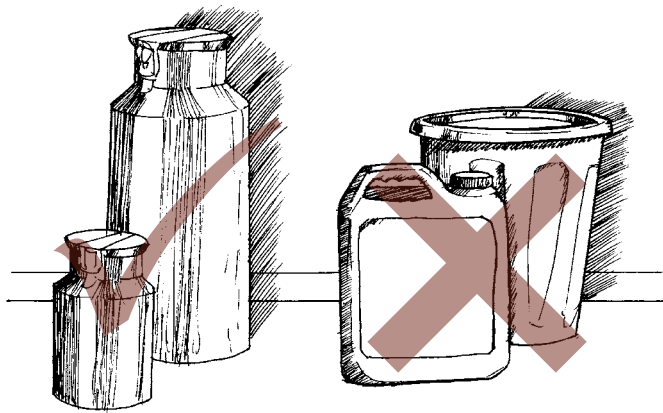
Scooping may introduce spoilage bacteria



Transfer milk between containers by pouring

Equipment for milk handling and storage

- Always use certified foodgrade containers, e.g. aluminium, stainless steel or foodgrade plastic jerry cans designed for single use only. Metal containers are preferable because these are easy to clean and sterilize.
- Do not store milk in plastic jerry cans that previously contained paint, herbicides and other chemicals because traces of these substances can taint your milk.



Store milk in metal containers, NOT plastic jerry cans



Safe use of cleaning and sanitation detergents

There are various types of cleaning and sanitation agents that have been specially designed to clean and disinfect milk-handling equipment. You may also use food-grade liquid soap, which is a good cleaning agent that also destroys bacteria. Always rinse your equipment properly after cleaning to prevent detergent residues from contaminating the milk.

Cleaning agents should be stored properly and handled with care because some of them may be corrosive to the skin. Always follow the manufacturer's instructions for proper use of detergents.

Procedure for cleaning of milk containers

Before re-using the milk container:

- Pre-rinse the container soon after use.
- Thoroughly scrub the container with warm water and detergent or soap (using a stiff bristled hand brush or scouring pad).
- Rinse the container in clean running water.
- Dip-rinse the container in boiling water for at least one minute to kill germs. You may also rinse the container by pouring hot water into it.
- Air-dry the container in inverted position on a clean rack in the open.



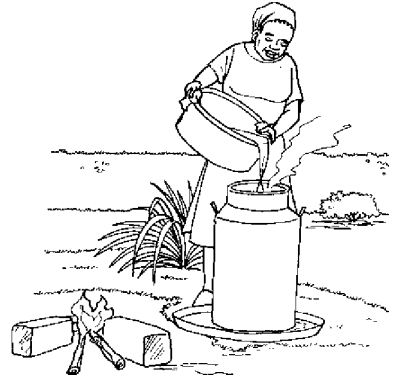
Scrub container with warm water and soap



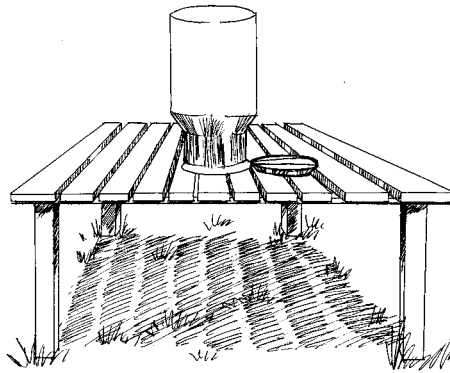


Dip-rinse the container in boiling water for at least one minute to kill germs

OR



Rinse by pouring hot water into container



Air-dry the container in inverted position on a clean rack



BASIC MILK QUALITY TESTS

There are four simple tests for milk quality that you can carry out when you receive raw milk:

- Sight-and-smell (organoleptic) test
- Clot-on-boiling test
- Alcohol test
- Lactometer test

These tests will help you to ensure that only milk of acceptable quality is received. Usually during testing, only a small amount (sample) of milk from each container is assessed. If the sample doesn't pass the test, the milk from that container should not be accepted. Thus, you should advise your suppliers to always handle milk in accordance with good hygienic practice.

Organoleptic test

This test is performed first and involves using the senses to assess the milk with regard to its smell, appearance and colour. This test is quick and cheap to carry out, allowing for segregation of poor quality milk. No equipment is required, but you should have a good sense of sight and smell. Milk that cannot be adequately judged in this way is subjected to tests that are more objective.

Procedure

- Open a can of milk.
- Immediately smell the milk and establish the nature and intensity of smell, if any. Do not accept the milk if it smells slightly sour or has foreign odours like paint or paraffin.
- Observe the colour of milk. Deviation from the normal yellowish-white colour indicates damage to the udder (reddish—blood, or yellow—pus).



- Check for any foreign bodies or physical dirt which may indicate that the milking and handling were not done hygienically.
- Touch the milk container to feel whether it is warm or cold. This indicates how long milk has taken since milking (if not chilled thereafter) and will influence the lactometer test for adulteration (see below).

Judgement

Abnormal appearance and smell that may cause milk to be rejected could be due to:

- Type of feed or atmospheric taint
- Cows in late lactation
- Bacterial taints
- Chemical taints or discolouring
- Advanced acidification or souring

Marked separation of fat may be caused by:

- Milk previously chilled and subjected to excessive shaking during transportation
- Adulteration with other solids (may also show as sediments or particles)
- Boiling, if milk fat is hardened

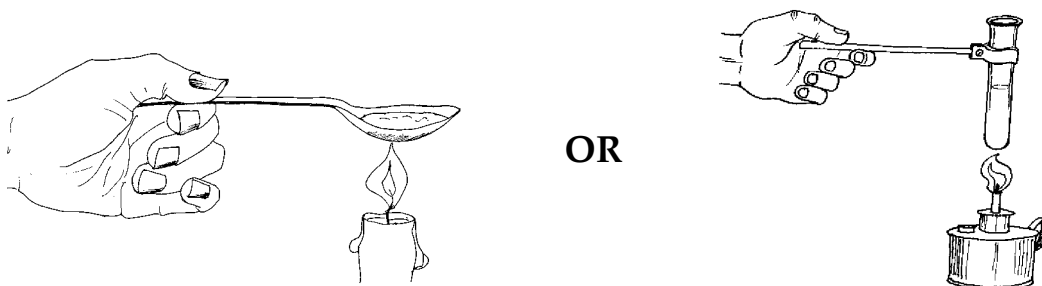
Clot-on-boiling test

This test is quick and simple. It allows for detection of milk that has been kept for too long without cooling and has developed high acidity, or colostrum milk that has a very high percentage of protein. Such milk does not withstand heat treatment hence this test could be positive at a much lower acidity.



Procedure and judgement

- Boil a small amount of milk for a few seconds in a spoon or other suitable container.
- Observe immediately for clotting.
- The milk will be rejected if there is visible clotting, coagulation or precipitation.



Carrying out the clot-on-boiling test

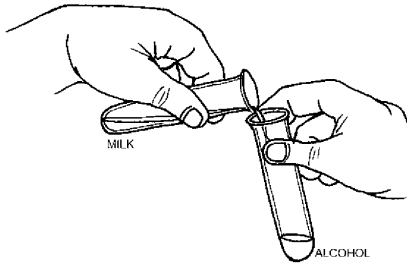
Alcohol test

The test is quick and simple. The specific type of alcohol used is known as “ethanol”. This test is more sensitive to lower levels of acidity and can therefore detect bad milk that may have passed the previous two tests. It also detects milk that has kept for long without cooling, colostrum or milk from a cow with mastitis. Because this test is quite sensitive, milk that passes this test can keep for some hours (at least two hours) before it goes bad.

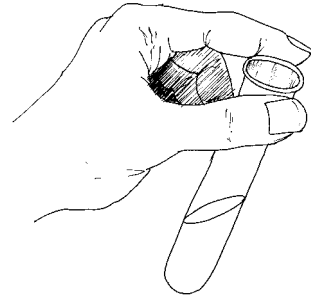
Procedure and judgement

- Use a syringe to draw equal amounts of milk and 70% alcohol solution into a small tube or glass cup (such as those used to administer medicine to children).
- Mix 2 ml milk with 2 ml 70% alcohol and observe for clotting or coagulation.
- If the tested milk sample coagulates, clots or precipitates, the milk will be rejected.



The alcohol test

Mix 2 ml of milk with 2 ml of 70% alcohol



If the milk coagulates, it fails the test

Lactometer test

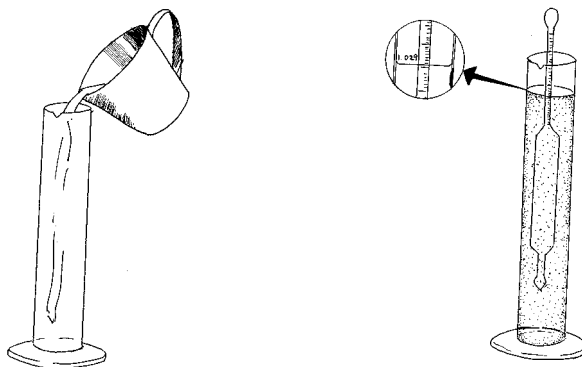
Some unscrupulous milk suppliers adulterate milk with added water to increase the volume or added solids to make it look thicker. Addition of anything to milk can introduce bacteria that will make it spoil quickly. Adulteration of milk is also illegal. The lactometer test is used to determine if the milk has been adulterated with added water or solids.

This test is based on the fact that milk has a heavier weight or density (1.026–1.032 g/ml) compared to water (1.000 g/ml). When milk is adulterated with water or other solids are added, the density either decreases (if water is added) or increases (if solids are added). If milk fat (cream) is added to milk, the density decreases. The equipment used to measure milk density is called a lactometer. Most lactometers are usually marked from “0” (representing density of 1.000 g/ml) to “40” (representing density of 1.040 g/ml).

Procedure

- Leave the milk to cool at room temperature for at least 30 minutes and ensure its temperature is about 20°C.
- Stir the milk sample and pour it gently into a 200 ml measuring cylinder or any container deeper than the length of the lactometer.
- Let the lactometer sink slowly into the milk.
- Take the lactometer reading just above the surface of the milk.





Equipment used for determining the milk density

If the temperature of the milk is different from the lactometer calibration temperature (20°C), then use this correction factor:

- For each °C above the calibration temperature, add 0.2 lactometer “degrees” (°L) to the observed lactometer reading.
- For each °C below calibration temperature, subtract 0.2 lactometer “degrees” (°L) from the observed lactometer reading.
- Note: These calculations are done on the lactometer readings (e.g. 29 instead of the true density of 1.029 g/ml).

Examples of how to calculate the true lactometer readings when the milk temperature differs from the calibration temperature of 20°C

Milk temperature °C	Observed lactometer reading °L	Correction °L	True lactometer reading °L	True density g/ml
17	30.6	- 0.6	30.0	1.030
20	30.0	nil	30.0	1.030
23	29.4	+ 0.6	30.0	1.030



Judgement

If the milk is normal, its lactometer reading will be between 26 and 32. If the lactometer reading is below 26 or above 32, the milk will be rejected because it means that it has been adulterated with added water or solids.



MILK QUALITY GRADING AND PAYMENT SYSTEMS

Certain tests can be carried out to grade raw milk and hence determine the payment to be made to the farmer. These tests are done at milk cooling centres and processing plants before the milk is received. Here are the procedures for carrying out two of these tests: the resazurin and butterfat tests.

Resazurin test

The resazurin test is used to determine the quality of raw milk in terms of the amount of bacteria it has. Milk with high amounts of bacteria will not keep for long. Resazurin is a dye indicator that is blue in the presence of oxygen and white when oxygen levels are reduced. The dye is added to the milk and judgement is made based on the colour produced after a specified incubation time. High numbers of bacteria in the milk will remove the oxygen dissolved in the milk much faster so the dye becomes more discoloured than if the milk had only a few bacteria.

Procedure

- To prepare the resazurin solution, add one resazurin tablet to 50 ml of distilled water. Resazurin solution should not be exposed to sunlight or stored for more than 8 hours.
- With a sanitized dipper, transfer 10 ml of milk into a clean test tube.
- Add 1 ml of resazurin solution to the milk sample.
- Stopper the test tube and gently mix the dye into the milk.
- Mark the test tube and place it in a water bath at 37 degrees Celsius for 10 minutes.
- Remove the test tube from the water bath and put it in a Lovibond comparator with a resazurin disc.
- Compare the colour of the sample with a test tube containing 10 ml of milk but without the dye.



Judgement

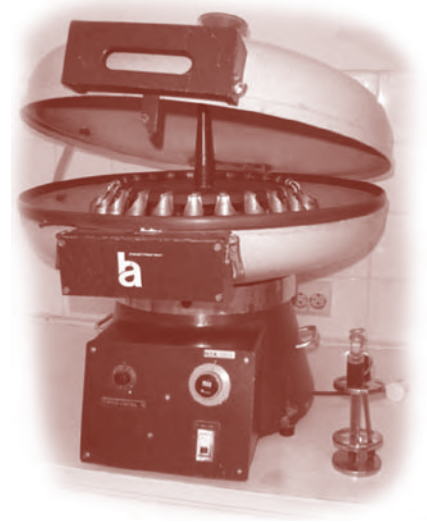
Resazurin disc number	Colour	Grade of milk	Action
6	Blue	Excellent	Accept
5	Light blue	Very good	Accept
4	Purple	Good	Accept
3	Purple-pink	Fair	Separate
2	Light pink	Poor	Separate
1	Pink	Bad	Reject
0	White	Very bad	Reject

Gerber butterfat test

This test determines the fat content of milk. The fat content is then used to determine the price to be paid for milk supplied by the farmer. The test can also show whether the milk has been skimmed.

Procedure

- Add 10 ml of Gerber sulphuric acid into a butyrometer followed by 11 ml of milk and then 1 ml of amyl alcohol.
- Close the butyrometer with a rubber stopper and shake the butyrometer carefully until the curd dissolves and no white particles can be seen.
- Place the butyrometer in a water bath at 65 degrees Celsius for 5 minutes.
- Centrifuge for 5 minutes at 1100 rpm.



Apparatus for carrying out Gerber butterfat test



- Return the butyrometer to the water bath at 65 degrees Celsius for 5 minutes, ensuring the water level is high enough to heat the fat column.
- Read the butterfat percentage off the scale. If necessary, the fat column can be adjusted by regulating the position of the stopper.

Grading of milk

Milk that is received at cooling centres or processing plants is graded based on its quality. Grading helps in deciding whether to accept or reject the milk. The quality aspect may differ from country to country or dairy to dairy, but is generally based on one or a combination of the following:

- Butterfat content
- Bacterial count (microbial quality)
- Physical appearance (colour, smell, presence of dirt particles, etc.)



HYGIENIC MILK STORAGE, PRESERVATION, TRANSPORTATION AND PROCESSING/ PACKAGING

Here are some points you should follow in order to ensure that you maintain the good quality of your milk during storage and transportation:

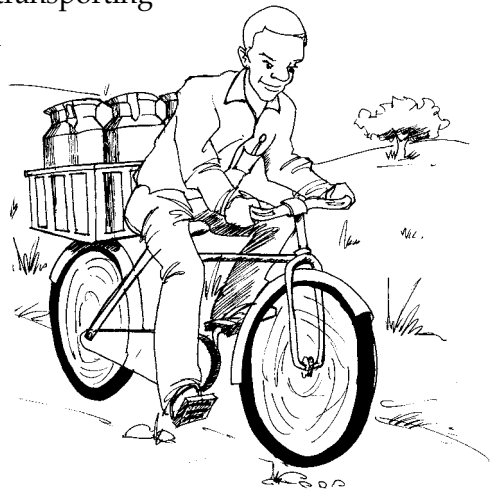
Appropriate milk storage vessels

- All containers used for storing milk should be clean and made of food-grade material like stainless steel or aluminium. These are also easy to clean and disinfect.
- The premises used for storing milk should be clean, pest-free, well-ventilated with adequate lighting, and protected from dust, rain and direct sunlight.
- Milk should not be stored in the same room with agricultural produce (e.g. onions) or chemicals like paint or paraffin, which can taint the milk with off-odours.

Appropriate milk transportation equipment

As a small-scale trader, the ideal equipment for transporting milk would be metal milk containers made from stainless steel or aluminium. Such containers are made from approved food-grade material and are also durable, easy to clean and sanitise. The milk container should have a lockable lid to prevent spillage.

Traders handling larger quantities of milk often use insulated bulk milk tankers. These are more expensive and require special additional equipment like pumps which should also be thoroughly cleaned by the “cleaning-in-place” (CIP) method.



You should use approved food-grade containers to transport your milk



Cleaning and sanitation of milk handling, transportation and processing/packaging equipment

- All equipment used for transporting and processing milk should be properly cleaned and sanitized because milk provides an ideal medium for growth of bacteria.
- Select detergents and sanitizers that will not corrode the material from which the equipment is made.
- Cleaning and sanitizing are complementary processes; either of them alone will not achieve the desired result, which is to leave the surfaces of the equipment as free as possible from milk residues.
- For details of how to properly clean milk handling equipment, refer to “*Procedure for cleaning of milk containers*” in an earlier section of this guide.

Appropriate milk preservation methods

- Milk spoils easily if it is left at high temperatures for long periods so it needs to be cooled. If you do not have a refrigerator or cooler you can store milk in a cold water bath or wrap the milk can with a wet sack, but ensure that the milk container is well-covered to prevent dirt from entering the milk.
- Milk may also be boiled to destroy spoilage bacteria but it must be quickly cooled thereafter so that it remains fresh.



MAINTENANCE OF MILK HANDLING AND COOLING EQUIPMENT

Maintenance of milk coolers

For best use of milk cooling equipment, it is important to adhere to the following:

- Avoid opening the milk cooler unnecessarily to prevent warm air from entering it.
- Ensure that the evaporator is well ventilated so that the cooler functions properly.
- Ensure that the cooler always has enough refrigerant in the system.
- Connect the cooler to a voltage stabiliser to provide for a constant supply of electricity.
- Set up schedules for cleaning and preventive maintenance and ensure that they are followed. Any mechanical repairs should be carried out by a trained technician.
- Have a standby generator in case of power failure.

Characteristics and maintenance of milk handling and processing equipment

All equipment should be maintained by proper handling and adherence to regular cleaning and sanitation schedules. Cleaning, sanitizing and rinsing of bulk tankers and accessories like pumps should be done immediately after emptying the milk. The valves, hose connections and lid of the tanker should be covered to prevent the milk from being contaminated with dirt.

Importance of carrier maintenance

Milk transport vehicles often get dented during loading and offloading. Milk cans are designed with rims at the bottom to resist deformation during rough handling. To protect the carrier vehicle during loading, you can use a set of loading conveyors. It



is also advisable to partition pick-up trucks with double deckers for greater stability of the loaded vehicle. The carrier vehicle should be serviced regularly and undergo preventive maintenance.

Legal requirements for milk transportation vessels and carriers

The legal requirements for milk transportation are likely to vary from country to country. However, you can contact your national dairy regulatory agency to find out the specific licences, certificates and permits that you will need. Documents must be valid and are likely to include:

- Certificate of registration with the national dairy board or dairy authority
- Certificate from the national transport licensing board
- Public health certificate
- Driving licence
- Road licence
- Motor vehicle insurance certificate

You should also follow the code of hygienic practice and any other laws that relate to milk hygiene, e.g. approved milk containers, use of chemical preservatives, medical examinations for milk handlers, environmental management and waste disposal, etc.

Tips on maintaining milk quality during transportation

In order to ensure that good milk quality is maintained during transportation, here are some points you need follow:

- All personnel involved in milk transport (drivers, turn boys and porters) should observe good personal hygiene and wear clean protective clothing whenever they handle milk.
- Use only the recommended food-grade metal containers to ferry the milk.



- Keep the milk containers and transport vehicle clean at all times.
- Keep milk out of direct sunlight and avoid storing it for long periods at high temperatures.
- Ensure the transport vehicle is well covered so as to protect milk containers from rain and dust.
- Deliver milk to the cooling centre or processing plant as quickly as possible, ideally within three hours after milking.
- If using a bulk tanker, maintain the temperature of the milk at less than 10 degrees Centigrade.
- Avoid excessive shaking of the milk during transport. You can achieve this if you minimize the head space when filling the containers.
- Avoid formation of foam (air) when filling the milk containers because air can cause milk spoilage due to oxidation.
- Do not carry animals and passengers on the transport vehicle while it is being used to ferry milk.
- Always keep the milk transport vehicle clean and well maintained.



DAIRY EFFLUENT MANAGEMENT SYSTEMS

There are practical and economic reasons for paying close attention to effluent management:

- Dairy effluent contains valuable water and nutrient resources that can be used to promote crop or pasture growth, and potentially reduce inorganic fertilizer and irrigation water requirements.
- Effluent may be harmful to the quality of underground and surface water resources, and to the chemical and physical characteristics of the soil if it is not managed appropriately.

Types of dairy waste

- Solid waste
- Liquid waste

Dairy effluent disposal systems, recycling and utilization

Continuous management systems

These systems are not designed to treat effluent and have limited storage capacity. Thus, effluent must be collected regularly, usually twice a day following each processing. The effluent is generally collected in a concrete sump before regular emptying. The main types of continuous effluent application systems are:

- Sump and gravity flow (generally through a moveable hose)
- Sump, pump and moveable sprinkler
- Sump and effluent tanker



Treatment and storage systems

These systems use one or two ponds to treat the daily inflow of effluent from the processing plant and to store both the liquid effluent and solids (sludge) that settle out of the effluent. Pond systems can also collect, treat and store runoff from concrete and earth yards, and in some cases, feed pads and regularly used laneways. A number of effluent ponds may be constructed in series to treat and store dairy effluent. The first pond in such a series is generally referred to as the primary pond and the second pond as the secondary pond. Sludge accumulates in the primary pond and is removed at regular intervals. Primary ponds are commonly designed to store between one and ten years' accumulated sludge. The sludge storage capacity generally depends on the intended method of sludge removal. Sludge removal can be done with an excavator or vacuum tanker.

Municipal regulations on management of dairy industry waste

The specific regulations governing management of dairy industry waste may vary in different countries. However, it is likely that the environmental laws in your country stipulate the approved sites and methods of waste disposal, under the supervision of an environmental inspector.



CODE OF HYGIENIC PRACTICE

Dairy premises siting and location

Premises	<ul style="list-style-type: none"> ■ Dairy premises should be sited in open, well-drained and hygienic surroundings at least 50 metres away from major roads or garbage dumping sites. ■ Design of the premises should provide sufficient space to allow for hygienic processing operations. Plant layout should be set up in such a way as to prevent cross-contamination of raw and processed products. ■ Set-up of plant and storage of raw materials and finished goods should not impede movement of personnel. ■ Materials used in construction shall be of brick, plaster, cement, concrete, tiles or any other non-toxic material that can be easily cleaned. ■ The materials should be water-proof and non-decomposable under the work environment (this excludes polythene lining).
Walls and ceiling	Should have smooth, white-coloured, non-absorbent surfaces for ease of cleaning. The height of the ceiling should give enough clearance for activities in the work room.
Floor	The floor should be made of impervious material (concrete, terrazzo or tiled), easy to wash and drain, and resistant to weak acids, alkalis and steam.
Drainage	Drainage systems should be kept clean and drain openings should have detachable screen traps to prevent clogging from solid matter and entry of vermin.
Lighting	There should be adequate bright white light, either natural (solar) or artificial (electricity). Lighting fixtures should be protected so as to eliminate chances of contamination. Conduits should be water-proof to prevent electrical fires and shocks during cleaning.
Ventilation	Proper ventilation should be maintained to prevent condensation. Exhaust fans should be provided where necessary. Ventilators and windows should be positioned away from toilets and suspected contaminated air.
Water supply	Adequate potable water should be supplied for processing, cleaning and sanitation.
Waste disposal	Effluent should be treated before being discharged into the municipal waste disposal system.



Liquid waste disposal	Drainage should be adequate and sufficient for disposal of waste water and other liquids to the main drainage channel and/or soak pits.
Solid waste disposal	Adequate and suitable bins should be provided in which to collect solid waste generated during production. The bins should be located such that there is no risk of contamination of milk and milk products.
Sanitary facilities	Adequate sanitary facilities (wash basins, toilets and shower rooms) must be provided and suitably sited so as not to act as a source of contamination. A foot bath with proper drainage should be located at the entrance to the processing area.
Changing room	A suitable room should be provided for personnel to change and store their protective clothing.

Personal hygiene

Here are some guidelines for personal hygiene for workers employed in dairy processing units:

- All personnel involved in production, handling and distribution of milk and milk products should be medically examined by an authorized medical practitioner every six months. A record of such examination shall be maintained.
- Any employee suffering from vomiting, diarrhoea or any notifiable disease should not handle milk but should seek medical treatment immediately.
- Fingernails should be short and clean. Employees should wash their hands with soap and water before commencing work and especially after using sanitary conveniences. Preferably elbow or leg operated taps should be provided at hand-washing facilities.
- Protective clothing should be kept clean and should not be worn outside the factory.



Good Manufacturing Practices

- Accept only good quality raw milk for processing. This will provide assurance of good quality processed products, if all processing conditions are followed.
- Handle milk and processing ingredients hygienically so as to avoid bacterial contamination.
- Maintain high standards of cleanliness and sanitation of the work area and all processing equipment.
- Personnel should always adhere to the code of hygienic practice.
- Package finished products in sanitized packaging material to prevent contamination.
- Store products in accordance with the recommended conditions, e.g. chilled or frozen.



HYGIENIC PROCESSING OF DAIRY PRODUCTS

All dairy products should be manufactured in accordance with good hygienic practices (GHP) as well as good manufacturing practices. The methods used should employ approved processes and procedures so as to ensure food safety and preserve product nutritional quality.

Packaging should avoid recontamination and exposure to light and environmental contaminants. The trainer will guide you through these approved processes and procedures for each product.



APPENDIX

Curriculum and minimum competencies for small-scale milk processors

Target Group	Course Title	Type of course & location		Course units (sessions)			
Small-scale milk processors	Hygienic small-scale milk processing	On-site		Milk production			
Subunits	Objectives (Competency sought)	Course content	Duration		Training method/materials	Evaluation	Award
			Theory	Practical			
1. Hygienic milk production	Small-scale milk processors knowledgeable and on factors influencing quality of milk at farm level	Factors influencing milk quality - Feeding - Animal health - Milking practices	1 hour		Lectures Discussions Questions & answers Participatory adult learning techniques	End of course theoretical written or oral test End of course practical test	Pass or fail
		Animal and udder health - zoonoses - mastitis	45 min				
		Hygienic milking	45 min	2 hours			
2. Hygienic milk handling	Small-scale milk processors knowledgeable and skilled in hygienic milk handling	Factors contributing to milk spoilage	½ hour		Lectures Discussions Questions & answers Participatory adult learning techniques		
		Types of milk handling & storage equipment	½ hour				
		Cleaning and sanitation agents	½ hour				
		Cleaning & sanitation of equipment	½ hour	1 hour			
3. Milk quality control and testing	Small-scale milk processors knowledgeable and skilled in milk quality control and testing	- Sight and smell (organoleptic) - Alcohol - Clot on boiling - Lactometer	1 hour	3 hours	Lecture Discussion Demonstration Hands-on testing		
4. Milk quality grading and payment systems	Small-scale milk processors knowledgeable and skilled in milk quality grading and payment	- Resazurin test - Methylene blue dye reduction test - Butterfat test	1 hour	3 hours	Lecture Discussion Demonstration Hands-on testing		
5. Hygienic milk storage, preservation and transportation	Small-scale milk processors knowledgeable on various hygienic milk storage, preservation and transportation methods	Appropriate milk storage vessels	½ hour		Lecture Discussion Demonstration Overhead projector Flip chart Chalkboard Felt pens		
		Appropriate milk transportation equipment	½ hour				
		Cleaning and sanitation of milk handling and processing equipment	½ hour				
		Appropriate milk preservation methods	½ hour				



Subunits	Objectives (Competency sought)	Course content	Duration		Training method/ materials	Evaluation	Award
			Theory	Practical			
6. Maintenance of milk handling and cooling equipment	Small-scale milk processors knowledgeable on maintenance of milk coolers, milk handling equipment, transportation carriers and processing equipment	Maintenance of milk coolers	½ hour				
		Characteristics and maintenance of milk handling/ processing equipment	½ hour				
		Importance of milk carrier maintenance	½ hour				
		Legal requirements for milk transportation vessels and carriers	½ hour				
7. Dairy effluent management systems	Small-scale milk processors knowledgeable and skilled in environmental sanitation and dairy waste management	Types of dairy waste	½ hour		Lectures Discussions		
		Dairy effluent disposal systems, recycling and utilisation	½ hour				
		Municipal regulations on food industry waste management	½ hour				
8. Code of hygienic practices	Small-scale milk processors knowledgeable about code of hygienic practices and Good Manufacturing Practices (GMP)	Dairy premises, siting and location	½ hour		Lecture Discussion		
		Personnel hygiene	½ hour				
		Good Manufacturing Practices (GMP)	½ hour				
9. Hygienic processing of dairy products	Small-scale milk processors knowledgeable on hygienic production of specific dairy products	Theory of procedure for production of specific dairy product	1 hour				
		Practical production of specific dairy product		4 hours			
			14.5 hr	13 hr	End of course theoretical (½ hr) and practical (1 hr) test	Certificate in basic hygienic milk handling and processing	







