CLEANING THE MILKING UTENSILS AND MILKING MACHINES

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The milk secreted from cow's udder is usually sterile. It invariably becomes contaminated during and after milking by the milker, milking equipment's, utensils, cooling, storage and while processing. Milk is a good medium for bacteria, yeasts and moulds that are the common contaminants. The contamination of milk from improperly cleaned utensils/ cans is about 60%, accounting for highest level of contributor.

Dairy farmers/producers have responsibility of producing milk under clean and hygienic conditions, protected from contamination by dirt at all times, employing appropriate techniques to clean and disinfect the milking equipment, Utensils and storage cans. The ability of raw milk to retain its quality under storage, and the safety of the product for the consumer, can both be directly related to the bacterial content of the milk. Good quality milk is essential for production of good quality dairy products. In most countries, bacterial content is one of the factors considered in determining the payment for milk.

This article will highlight the essential steps that must be taken during cleaning and sanitation of utensils and milking equipment at producers'/farm level to preserve milk.

Selection of Utensils for Milking/Storage

Following general requirements are necessary for selection of the milking vessels/utensils.

1. The pails/ containers/cans made up of mild steel and HDPE/plastic material shall not be used for storage and transportation of milk.
2. The utensils/pails and the storage vessels should be of SS 304 construction and should have smooth surface with minimal joints and free from dents, cracks and crevices.
3. A suitable size lid should always be used to cover the utensils and the vessel.
4. Ensure that the milking utensils are uniform having small mouth so that dirt and flies do not gain easy access.
5. They should be exclusively used for milking and storage.
6. Use separate vessel for washing of udder and teats & for milking.

Procedure for cleaning the milking utensils

1. Pre-rinsing with Water: Pre-rinsing with cold or lukewarm water should always be carried out immediately upon emptying the vessels. Otherwise, the milk residues will dry and stick to the surfaces, making

them harder to clean. If there are dried milk residues on the surface, it may be advantageous to soak the equipment, to soften the dirt and making cleaning more efficient.

2. After rinsing scrub utensils/pails thoroughly with a suitable brush, using hot water and efficient dairy cleaner (Table 1). About 15 g of the mixture will be required for cleaning a utensils of 10 litre capacity.
3. Follow the washing up on scrubbing with hot water. The temperature water should be more than 50°C.
4. Wash the utensil again with enough cold water (tepid water in cold season) to remove traces of detergent.
5. Sanitise the cleaned utensils with acceptable sanitizing agent (iodophors/chlorine solutions (50-200ppm of active compound)) to kill/disinfect the utensils.
6. Properly cleaned vessels should be placed in inverted position for the complete drainage of water, so as to avoid contamination from air, insects, rodents, reptiles etc.
7. Dry cleaned utensils should be stored in dust, dirt and other contamination protected area.
8. Hot water sterilization- the temperature should be as near the boiling point as possible and never below 85°C. The utensils should be immersed for 20 min, but where it is not possible, boiling water should be poured over the milk-contact surfaces till they are too hot to touch.

Choice of detergent/ Sanitizer

Table 1. The detergent mixtures suitable for use in villages

SL No	Ingredients	Quantity of constituents	Remarks
1	Washing soda (commercial hydrated sodium carbonate)	850	General Purpose
	Tri-sodium phosphate	100	
	Sodium metasilicate	50	
2	Washing soda (commercial hydrated sodium carbonate)	850	For general use excluding aluminium utensils.
	Sodium sulphite	50	
	Tri-sodium phosphate	150	
NOTE-For every 1000 g of the detergent mixtures specified in this table, 10 g of a wetting agent, for example, Acinol-N, Idet-10, Teepol, or equivalent compound, should be added.			

Cleaning and Sanitation of Milking Machines

Special care must be exercised in cleaning milking machines. As milking machines become more complex the task of assuring adequate mechanical cleaning action in all parts of the milking machine becomes increasingly complex. The proper cleaning of milking equipment is very much necessary to maintain the quality of raw milk by avoiding contamination from it. The following methods can be employed to get better cleaning efficiency.

I. Manual Cleaning:

Washing by hand is appropriate for bucket milking machines and clusters, and for ancillary equipment's. The daily cleaning routine consists of three stages: a rinse with cold or tepid water (38-55°C), a warm detergent wash and a final rinse with clean water. The cold or tepid water rinses remove residues of milk which would otherwise partially inactivate the disinfectant in the next stage. Tepid water is particularly beneficial for rinsing the clusters, as this is more effective than cold water in removing fat and milk residues.

Procedure:

1. After milking, the outside of the milking unit is cleaned by wiping and rinsing. Each unit should be rinsed by connecting the vacuum tube to a vacuum tap and drawing clean water through the teat cups. If the clusters are not cleaned immediately, they should be left immersed in water.
2. The warm detergent-disinfectant wash, is the most important of the three. Unless the solution reaches all milk-contact surfaces, milk residues may remain which will protect bacteria from the disinfectant. Care must be taken to avoid air-locks in the clusters.
3. Clusters should be washed first by full immersion for two minutes; teat cups, milk tubes and claws are scrubbed, and the cluster is re-assembled and transferred to the rinsing trough.
4. The final clean water rinse, the addition of 50 ppm of hypochlorite significantly improves results. The clusters should be rinsed and hung up to drain.

In case of deposits on the milk-contact surfaces or high bacteriological counts, extra steps are required, as detailed below.

i. De-scaling with acid

Phosphoric acid is used to remove milk stone (milk and hard water residues). After cleaning, the metal components of the milking unit are dismounted and soaked in the de-scaling solution, in accordance with the instructions of the manufacturer. All parts should be brushed with detergent-disinfectant solution and finally rinsed.

ii. Heat Treatment

If detergent-disinfectant solution is unavailable, heat treatment is necessary. The temperature of hot water should be more than 85°C, should be rinsed through the clusters. After treatment, the equipment is hung up to dry.

iii. Wet storage of clusters

Clusters are suspended in a rack in such a way that they can be filled with a suitable detergent-disinfectant solution between milking. If milk has poor microbial quality, immediate attention to be given to following points

1. Old and worn rubber parts should be replaced, together with metal or plastic equipment which is rusty, corroded or has open seams.
2. Metal components should be de-scaled and rubber ware soaked in hot detergent disinfectant solution.
3. Daily cleaning and disinfectant methods should be checked and any faults corrected.

II. In place cleaning

This method used in the milking equipment is connected with the pipelines and cooling tank. This has circulation and acidified boiling water cleaning methods, latter method is less commonly used in cleaning.

a. Circulation cleaning

Circulation cleaning is a three-stage process consisting of a pre-rinse with water, a recirculated hot wash with detergent-disinfectant solutions and a final cold water rinse. The efficiency of circulation cleaning depends on the temperature of the water used for the detergent-disinfectant wash, the optimum initial temperature being at least 85°C. Parlours with large-bore pipeline systems have air-injectors to develop turbulence of the cleaning solution and thus improve surface contact and disinfection efficiency.

Procedures for circulation cleaning are usually indicated by the milking machine manufacturer. Although some differences exist between the various types of milking installations, the generally-accepted procedures are as follows:

1. After milking, rinse the machine thoroughly with warm water, and brush the clusters to remove external dirt.
2. Attach the jetters to the cluster.
3. Check the water temperature (85°C).
4. Drain the milk from the receiver and milk pump.
5. Remove the filter sock (interior) and clean the filter as recommended by the manufacturer.
6. Connect the air pipeline directly to the water heater and set the three-way valve to the washing position so that the hot rinse water is drawn into the machine.
7. Set the releaser milk pump to run continuously and adjust the spreader on the receiver lid to the washing position.
8. Allow hot water to pass through the machine and discharge to waste until the temperature of the water leaving the machine exceeds 50°C.
9. Add approved detergent-disinfectant solution to the measured volume of hot water, in accordance with the specifications of the manufacturer. Set the three-way valve to draw solution from the wash through the installation and continue circulation for 5-10 min. No advantage is gained by prolonging circulation, as the temperature of the solution progressively falls.

10. Discharge the detergent-disinfectant solution by deflecting the delivery pipeline.
11. Run clean cold water into the machine. Sodium hypochlorite may be added at a concentration of 50 ppm to avoid risk of contamination from supply lines.
12. Switch off the releaser and vacuum pumps; drain and prepare the machine for milking.

An acid rinse cycle may be performed to remove mineral deposits from water and milk. This may be a cold or warm rinse. The required frequency of acid rinse depends on the quality of the water used for cleaning. If a hypochlorite rinse is given for two minutes immediately before milking, it is not necessary to add hypochlorite to the final rinse.

b. Acidified boiling water cleaning

This method relies on heat for bacterial sanitation. The wash solution makes a single pass through the system and is not circulated. In the first 2-3 min of cleaning, acid (nitric, sulphuric or citric) is added to the water to prevent hard-water salt deposits on internal surfaces. All components should reach 77°C and be kept at this temperature throughout the cleaning process, for approximately 5 min. A recommended routine for acidified boiling water cleaning at the end of each milking (or alternatively once a day or once a week) is as follows:

1. Brush clean the outside of the clusters and jetters with a detergent-disinfectant solution and fit the teat cups into the jetters.
2. Check the water temperature.
3. Remove the milk delivery pipe from the bulk tank.
4. Add the stock acid solution to the acid container.
5. Turn the three-way valve to the wash position and open the wheel valve controlling the flow from the water boiler.
6. Adjust the spreader on the receiver lid to the washing position.
7. Set the releaser milk pump to run continuously, to discharge return water to waste.
8. When water flow ceases, stop the vacuum and releaser pumps and drain the machine.

The total flow time should be 5-6 min. All parts of the machine should reach 77°C after 2-3 min.

c. The procedure for the lye bath is as follows:

Place a rack in the bottom of a pan, put all the rubber parts on the rack, and cover them with water. Add 4 teaspoonsful of lye for each quart of water, bring the lye-water to a boil, then remove the pan from the heat. When the water has cooled, remove the rubber parts from the pan, rinse them thoroughly, and store them in a clean dark place until they are to be used. Sanitize the parts just before they are used. Boiling the rubber parts in a lye solution removes

the milk fat from the pores of the rubber, restores its resiliency, and prolongs its life.

After assembling the machine for the next milking, draw some sanitizing solution by vacuum through the whole machine. Be sure to empty the sanitizer out of the milk pails before milking.

Cleaning assessment methods

a. Visual inspection

Cleaning failures usually result in a visual build up or residual film on some part of the milk harvesting or storage equipment. These residual films having characteristic appearance, which can help to find out the cause of cleaning failure. Films formed by the milk solids viz fat and protein has brownish slimy appearance and mineral deposits caused by using hard water has rough porous texture and are visible when wet. Discoloration may also occur due to corrosion and/or pitting of surfaces. Biofilms can be diagnosed by scrubbing a small area with concentrated acid and/or detergent solutions.

b. Rinse/Swab method

To avoid contamination from the utensils and maintain the quality of raw milk dairy has to create awareness among farmers for clean milk production, good hygiene practices etc., at farm level. It's recommended to verify the cleaning efficiency of utensils used for milking. Rinse method for cans/pails and Swab method shall be used for testing Cleaning efficiency of milking equipment and its accessories.

The following table shows the limit for efficiency of cleaning based on the residual microorganisms in cans/pails.

Standard plate count/litre of holding capacity	
Satisfactory	Not more than 1000
Fairly Satisfactory	Over 1000 up to 5000
Un satisfactory	Over 5000

c. Bioluminescence method

All of these bacterial tests rely on culture media and incubation from two to three days. Recent developments of ATP detection methods using a bioluminescence have been proposed as a rapid method for assessing the effectiveness of sanitation in the dairy industry. ATP bioluminescence is a rapid detection method suited for on-site sampling and takes less than five minutes to perform. Plate count methods also detect the presence of bacterial contamination on equipment surfaces, whereas ATP bioluminescence can detect both bacterial contamination and nonmicrobial contamination such as milk soil. ATP bioluminescence has the potential to be a useful tool to evaluate the effectiveness of cleaning procedures used on the milking machines.

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