Machine cleaning systems

1. Introduction

Udder health, milking system cleanliness, and good milking practices are key factors in the production of quality milk. Machine cleaning systems enhance milk quality by aiming to remove ALL of the milk residues from the plant and destroy any bacteria that may be resident in the milking plant.

2. Interpretation and relevance to Australian conditions

The cleaning of milking machines needs to be done properly to maintain milk quality. Different methods of cleaning milking machines require varying labour inputs and offer varying scope for automation. Milk is a difficult material to clean from surfaces because it has many different components, each requiring different temperatures and chemical environments to aid removal.

Bacteria can build up in the plant and contaminate milk. They affect milk quality by breaking down the components in milk. This reduces the shelf life of milk and milk products, and produces off flavours in cheeses and milk powders.

3. Relationship to CowTime goals

The CowTime project aims to save time and effort in milk harvesting. Reducing the labour time required for machine cleaning, while maintaining the quality of the job, is possible on many farms. Effective machine cleaning helps maintain milk quality and improves returns.

The consistent use of a cleaning routine that is tailored to the milking plant and other available resources (volume and quality of water) will lead to a reduction in the need to manually scrub or BOMB clean the plant.
Automation of the cleaning process provides consistency of operation and eliminates human error while limiting Occupation Health and Safety issues associated with handling strong chemicals and hot water.

4. Features of machine cleaning systems

Bacteria which inhabit the machine come from cows (teat skin and infected udders), the environment (drawn into the cluster) and from bacterial growth and multiplication within the plant. Effective machine cleaning can minimise the bacteria growing and inhabiting the plant. Bacteria require food, moisture and a favourable temperature to multiply. Milk and milk residue provide all of these requirements making the milking machine a desirable place to live. Bacteria multiply so rapidly that a single bacterium can reproduce itself into millions between milkings.

Water is the vehicle that brings all the elements together in the cleaning program. The quality of the water used is very important in achieving a successful clean. Always use the best quality of water possible.

Effective cleaning relies on the four key elements of a cleaning routine to be working effectively.

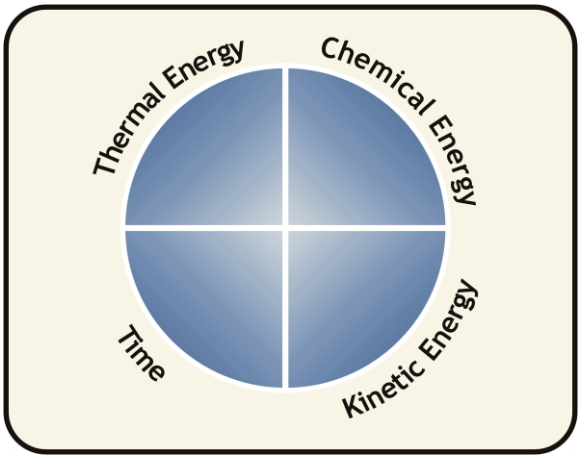

Figure 1:
The essential elements of an effective cleaning routine.

Thermal energy comes from hot water. Modern hot water services provide high volume, low pressure water at 90°C. It is important to keep water below 90°C entering the line (under vacuum) to prevent steam from damaging the vacuum pump. Heat recovery systems are now available that can reduce energy costs. Some washing regimes operate effectively at lower temperatures eg 75°C.

Chemical energy comes from the detergent which should have good wetting properties, be capable of softening water, emulsifying fatty deposits, suspending particles of dirt and rinsing them from the plant. Water quality greatly affects the chemical performance. Because 99.0 - 99.8% of most cleaning solutions is water, the characteristics of the available water supply are the first thing to evaluate when recommending a cleaner or sanitiser.

Kinetic energy from water turbulence is dictated by water volume and flow rate. Air injectors and a reservoir of water at the end of the milkline can greatly enhance slug formation for cleaning. A slug velocity of about 8m/s is recommended for effective scrubbing and cleaning of milklines.

Time is required for the actions of the other elements to take place. The time taken for effective cleaning is often independent of the type of cleaning system but greatly influenced by the cleaning operator's routine and the cleaning sequence followed.

Cleaning sequence

The ideal cleaning sequence is as follows:

Post Milking Rinse: The primary purpose of the post milking rinse is to rinse the majority of residual milk from the plant. A warm rinse will remove a very large percentage of the milk residue.

Hot Detergent Wash: The purpose of the hot detergent wash is to remove any adhered non-rinsing milk residue. This process should alternate between acid and alkaline to ensure all residues are removed on a routine basis.

Hot Rinse: The final hot rinse removes chemical residues from the plant and helps kill bacteria. The use of a cold water sanitiser can achieve the same aim and reduce the amount of hot water required.

Types of Cleaning Systems

Jetter (3rd line) cleaning systems

Jetters are fitted to the majority of new installations. They require 30 - 40 litres of water per set of cups per day and a recommended minimum flow rate of 3 L/min through each cluster.

Advantages:

Safe to operate –especially if chemical dosing is automated.
Good contact time and turbulence in cluster.
Improved turbulence for large bore milklines with air injector fitted.
Easy to re-circulate wash water to increase contact time and effectiveness of detergents.
Modern jetters incorporate a non return valve that enables claws to be attached to the jetter while other claws are still milking therefore saving time.
Easy to automate.
Automated systems can eliminate manual handling of chemicals and allow the operator to leave the area while the plant is cleaned.
Automated systems provide consistent operation regardless of operator.
Labour saving.

Disadvantages:

Care should be taken if re-circulating the washing solution, that it does not become too cold, otherwise re-deposition may occur.
High initial capital cost.
Chemical handling/spillage is possible with non automated systems.

Reverse flow cleaning systems

Reverse flow systems were popular with larger dairies and are relatively easy to operate. They require 120 litres per set of cups per day, plus the volume of water to fill the milk system.

Advantages:

Quick to operate, no time needed for attaching jetters and does not cause operator fatigue.
Quick draining of all milking machine parts.

Disadvantages:

Expensive to establish, with larger hot water units and pumps required.
Expensive to run due to high water use and high chemical usage.
Contact wash time very limited, high water use.
Effluent disposal problems.
Difficult to automate.
Difficult to perform heavy duty clean if required.
Because liners are not pulsating, they may not be cleaned properly.

Bucket cleaning systems

Bucket cleaning has been the most common system used in the past but now is only used in smaller dairies. This system requires 30 litres of water per set of cups per day.

Advantages:

Inexpensive to establish.
Very effective results if done properly.

Disadvantages:

High labour cost (if done properly).
Danger due to carrying of hot water in buckets.
Prone to short cuts due to time taken to do the job correctly.
High detergent cost due to a tendency to be "heavy handed".
Difficult to circulate detergent should a heavy duty clean be needed.

Cost / benefit summary of cleaning systems

CRITERIA	JETTER WASHING	REVERSE FLOW	BUCKET WASHING
Establishment Cost	**	**	***
Labour Cost	**	**	*
Chemical Cost	***	*	**
Water Use	**	*	***
Hot Water Cost	**	*	***
Safety	***	*	*
Ability to automate	***	**	N/A
Effectiveness of cleaning	***	*	***

* The more stars the better.
# Comparisons based on the 'ideal' cleaning sequence.

5. Potential challenges with implementation

Effective milking machine cleaning routines require the use of concentrated chemicals and/or large volumes of hot water. Occupational Health and Safety issues arise from this practice. Staff training and emergency response procedures need to be developed for each work site.

Safety Tip: it is very important to wear goggles and gloves when handling chemicals!

6. Robustness of this information

The information is based upon observations compiled from over 3000 farm visits Australia wide by Dasco dairy hygiene specialists. Observations cover a wide range of circumstances including plant size, water source, water volume and water quality.

7. References and further reading

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