

Chlorine-free cleaning protocols for milking equipment

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Summary

- It is increasingly difficult to achieve dairy product specifications with regard to Trichloromethane (TCM) and Chlorate residues, when chlorine-based cleaning products are used in milking equipment cleaning routines
- Chlorine-free cleaning of milking equipment will be required on farms by January 2021
- Milking equipment **cleaning protocols on farms need to change** when chlorine is removed
- Chlorine-free cleaning protocols require increased usage of hot water, acid detergents and higher working solutions of caustic

Introduction

There are increased food safety concerns regarding the use of chlorine for cleaning milking equipment, due to residues of TCM and Chlorate. The removal of chlorine from cleaning routines would significantly reduce the risk of these residues in milk and consequently, in final products, such as lactic butter and milk powder. The adoption of chlorine-free cleaning of milking equipment is currently an on-going process. Some milk processors have already requested their milk suppliers not to use cleaning products that contain chlorine. Others are focussing initially on removal of chlorine products from the bulk milk tank cleaning routines.

Necessary steps associated with changing to chlorine-free cleaning:

Re-calibration of the automatic detergent dosing systems for both milking machine and bulk milk tank: This will ensure correct uptake rates of the different detergent products; uptake rates may be lower for some chlorine-free products and those that have slightly higher caustic content than products previously used. Higher working solutions of caustic (1%) are now applied particularly when cold water is being used.

Hot water for daily cleaning: When chlorine-free liquid based cleaning protocols (as opposed to powder products) are used, regular hot washes (75/80°C) are necessary, with temperatures remaining $\geq 50^{\circ}\text{C}$ on completion of the wash cycle. A suggested routine may involve hot and cold circulation cleaning to be operated after AM and PM milking, respectively. On many farms the wash cycle (detergent wash) time is far too long (15/20 min), a wash cycle time of 8/10 minutes is more than sufficient to maintain plant hygiene and reducing the wash cycle time may give the required temperature at the end of the wash cycle.

Peracetic acid: a replacement for chlorine: Peracetic acid has similar antimicrobial properties to sodium hypochlorite and is effective against a broad spectrum of bacteria, spores, yeasts, moulds and viruses. Post milking wash routines can include an additional rinse involving peracetic acid. But the caustic detergent solution of the main wash circulation should be rinsed thoroughly from the plant before the additional rinse containing peracetic acid is applied. This is important both for safety concerns and effectiveness; otherwise, the caustic could neutralize the acid, making the peracetic acid ineffective.

Chlorine-free cleaning protocols:

Using caustic powder products (sodium hydroxide only): a number of potential options can be considered when using powder products depending on the availability of hot water:

- (i) Include 6 hot powder washes and 1 hot acid wash (phosphoric acid) per week
- (ii) Include 1 hot caustic wash and 2 hot acid washes (phosphoric acid) per week
- (iii) Include 1 hot acid wash and 1 hot caustic wash per week and include peracetic acid in an additional rinse twice daily

Using caustic liquid and acid: Combinations of caustic and acid based products can be selected for use in weekly milking machine wash protocols:

- (i) A caustic liquid product (21/29%) used with hot water (75/80°C) 4 times weekly after AM milking and used with cold water 7 times weekly after PM milking. Acid (phosphoric) is used with hot water 3 times weekly after AM milking (Option 3 at end of this document)
- (ii) Alternatively, a caustic liquid product (21/29%) used with hot water 7 times weekly after AM milking and used with cold water 7 times weekly after PM milking may be put in place. An additional rinse containing peracetic acid should be carried out after the completed detergent rinse cycles at both AM and PM milking.
- (iii) A third cleaning protocol requires the use of hot water (75/80°C) after both AM and PM milking. In this situation a caustic liquid product (21/29%) is used on 13 occasions and an acid (phosphoric) is used on at least 1 occasion per week. More acid washes may be required if water hardness is an issue.

Using acid as the main cleaning agent: 'One for all' acid based cleaning products (chlorine-free) have been developed. This simplifies the cleaning protocol as one product is multi-functional; it removes organic materials and also sterilizes the stainless steel surfaces. While 'one for all' products are stand-alone products, it is advised to include a caustic chlorine-free product once or twice weekly to the milking machine wash routine to maximize cleaning efficiency.

Chlorine-free cleaning of the bulk milk tank: Various options can be used for fully automatic wash systems:

- (i) Dosing unit can be programmed to use caustic detergent (21/29%) after each of two collections and an acid detergent (phosphoric/nitric) after the third collection, using hot water (60/75°C) at each collection (check most suitable temperature with bulk tank supplier)
- (ii) Alternatively, the caustic detergent could be used after each collection with hot water (60/75°C) and the second pump could be used to add peracetic acid to an additional final rinse
- (iii) If an acid based 'one for all product' is used, then no other product is required. In this situation both detergent suck up tubes are added to the one drum.

Advice on storing and handling cleaning products

- (i) Do not stockpile cleaning products (chlorate levels increase in stored products)
- (ii) Store products out of direct sunlight and protected from frost- store on pallets
- (iii) Store cleaning product drums separately to teat disinfectants drums-products have been used incorrectly on farms with serious consequences

- (iv) Use protective gloves and goggles when handling cleaning products
- (v) Display wash routines and identify cleaning products in the dairy
- (vi) Rinse out detergent 'suck up' tubes if changing chemicals

Conclusion

Chlorine has been recognized as a good cleaning and sterilizing agent and must be replaced with combinations of increased usage of: hot water, acid detergents, higher working solutions of caustic and peracetic acid.

There are 5 chlorine-free cleaning protocols recommended for milking machines and 3 cleaning options recommended for bulk milk tanks. Which option to choose depends on the plant size, if automatic wash is in place, availability of hot water, if additional equipment like milk meters are in-place and the level of water hardness.

Example of a chlorine-free wash routine:



OPTION 3: Chlorine free cleaning based on liquid detergent (sodium hydroxide) and an acid (phosphoric/nitric)

After each AM milking

1. Wash outside of clusters and jettors. Attach jettors to clusters
2. Remove or replace the milk filter sock
3. Rinse plant with 14 litres (3 gals) of warm or cold water per unit
4. Add an approved **liquid detergent** (sodium hydroxide) on 4 occasions per week and an **acid** product on 3 separate occasions per week (Monday, Wednesday, Friday) at the recommended use rate in hot water at 70-80°C, allowing about 9 litres (2 gals) of solution per unit
 - Circulate the solution for 8-10 min, having allowed the first 5 litres to run to waste
5. Rinse the plant with a minimum of 14 litres (3 gals) of water per unit immediately after the wash cycle

After each PM milking

1. Wash outside of clusters and jettors. Attach jettors to clusters
2. Remove or replace the milk filter sock
3. Rinse plant with 14 litres (3 gals) of warm or cold water per unit
4. Add an approved **liquid detergent** (sodium hydroxide) at the recommended use rate in cold water, allowing about 9 litres (2 gals) of solution per unit
 - Circulate the solution for 8-10 min having allowed the first 5 litres to run to waste
5. Rinse the plant with a minimum of 14 litres (3 gals) of water per unit immediately after the wash cycle

Option of including peracetic acid in an **additional** cold water rinse twice daily.

Visit the Teagasc milk quality webpage to get more information on chlorine-free cleaning of milking equipment: <https://www.teagasc.ie/media/website/animals/dairy/joint-programmes/Chlorine-free-Wash-Routines.pdf>