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Milk quality as influenced by cow and machine



Key external stakeholders:

Dairy farmers, dairy processors, IMQCS, detergent product manufacturers, Teagasc advisory, milking machine companies

Practical implications for stakeholders:

The overall objective of this work is to provide guidelines and recommendations for the on-farm milk production process such that, the milk may achieve increasingly stringent hygiene quality standards. The challenges addressed in this study include minimizing the transfer of bacteria (a) from the cow, the milking machine and the environment and (b) from cow to cow.

The outcomes are:

- Clear guidance on choosing a detergent cleaning product is now available to dairy farmers. This study has resulted in better quality cleaning products being available to farmers and should result in better quality milk leaving the farm.
- Management practises such as pre-spraying of teats with disinfectant, use of some bedding materials, cluster flushing, using a sanitizer in the daily wash procedure, using daily acid cleaning will reduce bacterial numbers on teats and on milking equipment and in milk.

Main results:

1. Pre-spraying of teats with disinfectant prior to milking will reduce the levels of bacteria on teats by up to 85%.
2. Flushing of clusters between each individual cow milking, with water and peracetic acid can reduce bacterial numbers on liners by up to 93%.
3. Twenty five percent of detergent/sterilizer products on the market have been reformulated due to the information generated from this study.
4. A cleaning procedure which entails daily acid washing results in effective cleaning of milking equipment.
5. Peracetic acid may be used as a sanitizer and as a replacement for chlorine in the milking machine wash routine.

Opportunity / Benefit:

The results of the evaluation of detergent products and clear guidance on the best use of cleaning products are available on the Teagasc public website. As a consequence, the products available to farmers are of a higher quality and if used correctly should improve the quality of milk leaving the farm gate. This list is now widely used by advisory personnel and farmers when choosing products to clean milking equipment.

Collaborating Institutions:

Madison University Wisconsin

Teagasc project team:

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External collaborators:

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1. Project background:

The Teagasc Statement of Strategy sees its mission as assisting the agriculture and food processing industries in responding profitably to consumer demands and requirements. A specific business objective of Animal & Grassland Research and Innovation Centre is to increase the value of milk. The overall objective of this work is to provide guidelines and recommendations for the on-farm milk production process such that, the milk may achieve increasingly stringent hygiene quality standards. The criteria, specifically thermotolerant and total bacteria (TBC) counts requested by milk processors or by customers of milk processing outlets are becoming more strict and rigorous. The challenges being addressed in this study include minimizing the transfer of bacteria (a) into milk from the cow, the milking machine and the environment and (b) from cow to cow.

2. Questions addressed by the project:

- Could pre-spraying of teats with a disinfectant product and cluster cleaning between individual milkings with a disinfectant reduce bacterial numbers on teats and on liners?
- Can laboratory methods be introduced to Moorepark that could facilitate the accurate bacterial analysis of a larger number of milk samples to allow for undertaking of a range of field studies?
- Could detergent cleaning products containing no chlorine maintain low bacterial counts in milk?
- What equipment cleaning procedures result in residues in milk?
- Will some cubicle bedding materials result in lower bacterial numbers on teats and lower infection rates?
- Does the addition of a sanitizing agent in the rinse water of a cleaning program reduce the bacterial count in bulk milk?
- If a detergent/sterilizer solution was substituted with an acid wash as part of the daily wash routine would this have any negative effects on milk quality or equipment?

3. The experimental studies:

Task 1: Validation of a test method for thermotolerant bacteria: After consultations with a number of companies a 3M Petrifilm plate reader was purchased and compared with the standard agar plate method for a range of milk thermotolerant levels and TBC. A protocol for sampling and subsequent treatment of milk samples for thermotolerant testing was prepared.

Task 2: Minimizing transfer of bacteria from cow to milk: The effect of cubicle bedding materials (3 studies) with both dry and lactating cows, the application of an external teat sealer (Mayo teat sealer) prior to calving, the automated cleaning of clusters between individual milkings using a newly commercially developed auto cleaning system (Dairymaster), on the bacterial count on teats, liners and in milk were evaluated in a series of studies

Task 3: Minimizing bacterial transfer into milk from the milking machine: Three studies were undertaken to establish the effect of different washing procedures on the total bacterial count in milk. 1. Comparison of products containing different levels of sodium hydroxide with and without the addition of a sterilizer agent (chlorine). 2. Comparison of a new cleaning procedure which includes daily acid cleaning. 3. The addition of a number of sanitizers in the final rinse water of a cleaning procedure on bacterial and residue levels in milk.

Task 4: Investigation of the use of new pre-milking products and procedures to reduce bacterial levels in milk: A number of pre-milking teat preparation procedures including teat wipes and disinfection dip products containing different formulations were applied to cow's teats. Teats were swabbed for bacterial counts (*Staphylococcal*, *Streptococcal*, Coliform) before and after the procedure was applied.

4. Main results:

Over 90 detergent products used for the cleaning of milking equipment in Ireland have been evaluated for chemical content and regulatory status. The investigation into the chemical content of products has resulted in the reformulation of 25% of detergent/sterilizer products and the removal of some of the inferior products from the marketplace. The list of products is updated monthly on the Teagasc website (teagasc/research&innovation/dairy) together with guidelines on the effective use of these products. As a consequence the products available to farmers are of a higher quality and if used correctly should improve the quality of milk leaving the farm gate. This list is now widely used by advisory personnel and farmers when choosing products to clean milking equipment.

The 3M Petrifilm plate reader is now used in the Teagasc microbiology laboratory and has been adapted by some processors for the measurement of TBC and thermotolerant bacteria in milk samples. Pre-spraying of teats with disinfectant followed by drying with a paper towel will eliminate up to 85% of *Staphylococcal* and *Streptococcal* bacteria on teats prior to milking. Ninety percent of teats not disinfected, will contain *Staphylococcal* bacteria and 35% will harbour *Streptococcal* bacteria. The automatic flushing of clusters between each individual cow milking with 1 litre of water and 0.2% peracetic acid will eliminate 93% and 66% of *Staphylococcal* and *Streptococcal* bacteria, respectively, from liner, thus minimizing the possibility of cross infection and the amount of bacteria entering the bulk tank. The use of hydrated lime as a bedding material will minimize bacterial numbers on teats compared to the standard ground limestone material. The percentage of teats with no *Staphylococcal* (59%) and *Streptococcal* (68%) bacteria present was lower with hydrated lime compared to the percentage of teats with *Staphylococcal* (25%) and *Streptococcal* (27%) bacteria with Ground limestone. The dipping of teats using the Mayo teat sealer on teats of 1st lactation cows for a five week period prior to calving did not result in lower CMT or somatic cell count at calving compared to teats not dipped.

5. Opportunity/Benefit:

The effectiveness of a range of washing procedures, cluster disinfection methods, teat disinfection products, cubicle bedding materials in reducing bacterial numbers on equipment, teats and in milk have been evaluated and the results published in popular articles and through the Irish dairy Board.

The standard of detergent products sold to Irish farmers has been greatly improved by this research. Many inferior products or products that would increase the likelihood of chemical residues have been withdrawn from the marketplace. Teagasc provide a monthly updated list of products on the Teagasc website.

6. Dissemination:

List of detergent products evaluated and advice notes on the effective use of these products is available on the Teagasc public website (research/innovation/dairy). Dissemination of information from this study was distributed through a series of technical publications at conferences (Milk Quality Forums, IGAPA, IMQCS, Moorepark Open days, Advisory staff meetings, Food Research UCC, International conferences), as a contribution to the Moorepark Milk Quality Handbook and Teagasc Dairy Manual and popular articles in the Irish Farmers Journal, TResearch, IDB news letters.

Main publications:

Gleeson, D., O'Brien, B., Flynn, J., O'Callaghan, E.J. and Galli, F. (2009). Effect of pre-milking teat preparation procedure on the microbial count on teats prior to cluster application. *Irish Veterinary Journal* 62 (7) 461-467.

Gleeson, D., O'Brien, B., Flynn, J. and Jordan, K.N. (2011). Bacterial contamination on milk contact surfaces of different component materials following different cleaning procedures. In: 40th Annual UCC Food Research Conference, UCC, Cork, 31-Mar-2011, p. 17.

Gleeson, D., O'Callaghan, E.J. and O'Brien, B. (2010). Effect of individual cluster flushing between milkings on the bacterial count on liners. In: Mastitis Research into Practice: Proceedings of the 5th IDF Mastitis Conference, Christchurch, New Zealand, 21-Mar-2010, p.719.

Popular publications:

Gleeson, D. and O'Brien, B. (2011). Chemical analysis of cleaning products and guidelines for the effective use of those products for cleaning milking equipment. IMQCS. Teagasc IE Article on the Web site.

Gleeson, D. (2010). Cleaning products for milking equipment. TResearch Vol 5 (3). 28-29.

Gleeson, D. (2010). Are you cleaning your milking machine correctly? Irish Farmers Journal p. 18-19.

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