

Evaluation of Teat Cup Disinfection with Hot Water in a *Staphylococcus Aureus* Mastitis Model

Mastitis pathogens can be transmitted from cow to cow through teat cup liners that contain remnants of milk of infected cows. This transmission can be reduced by removing or killing the bacteria from the liners by rinsing them with hot water or ultimately with a disinfectant in between milkings. Information on the effect of rinsing liners, however, is scarce and outdated. Smith *et. al* (1985) showed that teat cup disinfection with an iodine solution reduced 99% of the mastitis pathogens. Neave (1971) evaluated several hot water baths and their effect on the percentage of liners that remained infected with *Staphylococcus aureus*. Although a lot of books on milking machines refer to this work, the study lacks relevant details.

- 90°C water from a boiling water device, during 5 seconds (90°C or 194°F/5sec)
- 75°C water from a hot water tap, during 5 seconds (75°C or 167°F/5sec), and
- 75°C water from a hot water tap, during 30 seconds (75°C or 167°F/30sec).

Each liner was sampled with a sterile swab immediately after a cow was milked, and after the hot water bath treatment. As such, 144 paired swabs were collected for each scenario. Each swab was placed in a one ml transportation fluid of which, after arrival in the laboratory, 100µl was plated on a sheep-blood agar plate. The total number of bacteria (TBC) and the number of cfu of *S. aureus* were counted after 2 x 24 h of incubation at 37°C. Data collection, processing and analysis was done by trained and competent technicians.

Aim

To evaluate the effect of dipping teat cup liners in hot water baths at different temperatures and durations on the total bacterial count and the number of *S. aureus* colony forming units (cfu) in liners after milking cows that were experimentally, intramammary infected with *S. aureus*.

Materials and Methods

Eight cows were inoculated with *S. aureus* Newbold 305 in three quarters, while the fourth quarter remained uninfected. Cows were milked twice daily in our experimental milking facility with two quarter milker units. Quarters were post-dipped after completion of the milking procedures. Three hot water bath scenarios were evaluated:

Main Results

All inoculations with *S. aureus* resulted in an intramammary infection with comparable patterns of bacterial growth and elevated SCC (Figure 1 and Figure 2). None of the cows showed systemic signs of mastitis, although quarter milk production decreased after inoculation (Figure 3). The multiple quarter infection model with *S. aureus* performed well under the given experimental conditions. The number of swabs with >0 cfu/ml of TBC before the water bath was 77.1% for 90°C/5sec, 71.7% for 75°C/5sec and 59.1% for 75°C/30sec. The number of swabs with >0 cfu/ml of *S. aureus* after the water bath was 61.5% for 90°C/5sec, 44.4% for 75°C/5sec and 30.8% for 75°C/30sec. Rinsing liners in warm water bath resulted for all three temperatures in a significant ($P<.05$) reductions of

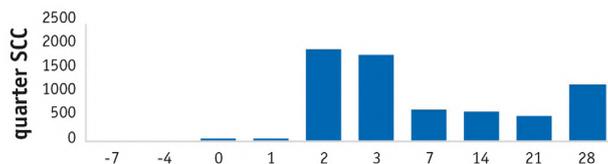


Figure 1. Mean SCC in milk samples of inoculated quarters of 8 cows taken on different days post inoculation

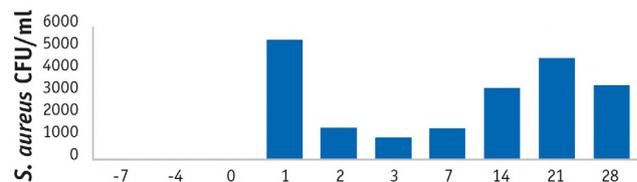


Figure 2. Mean number of *S. Aureus* in milk samples of inoculated quarters of 8 cows taken on different days post inoculation

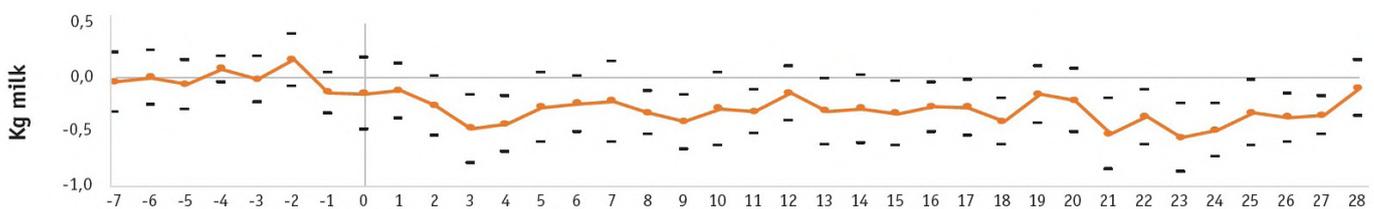


Figure 3. Average quarter milk production of inoculated quarters of 8 cows minus the average milk production in the period -7 to 0 days before inoculation

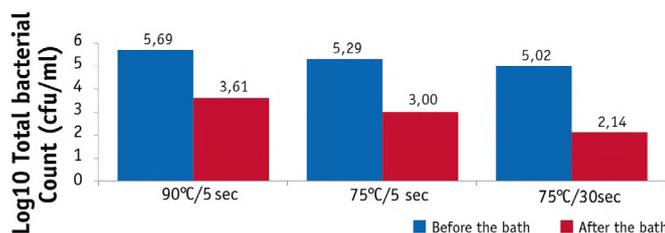


Figure 4. Average Total Bacterial Count of swabs taken from liners after milking an inoculated *S. aureus* quarters and after a warm water bath

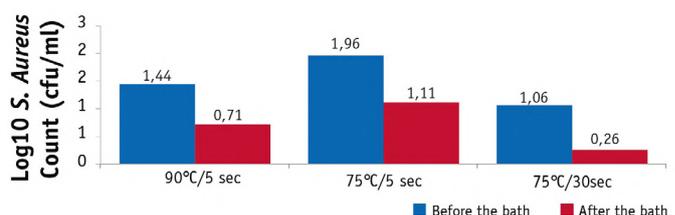


Figure 5. Average count of *S. aureus* of swabs taken from liners after milking an inoculated *S. aureus* quarters and after a warm water bath

>99% in counts of TBC and *S. aureus* (Figure 4 and Figure 5). Numerically, the treatment at 75°C/30sec showed the largest reduction in total bacteria counts and *S. aureus* counts. However, no statistically significant difference in reduction of TBC or *S. aureus* between the three scenarios were found. Liners with a high TBC (≥ 5.2 cfu/ml) immediately after milking had a significant higher TBC reduction with the 75°C/30sec bath treatment, than in the other two scenarios.

Conclusions

Our quarter *S. aureus* challenge model performed very well: all quarters were reliably subclinically infected. All three types of hot water baths reduced TBC and the number of cfu of *S. aureus* in liners after milking a *S. aureus* infected cow. For liners with TBC ≥ 5.2 Log₁₀ cfu/ml a 75°C/30sec bath reduces TBC more than the other warm water baths. From these data it may be observed that a longer exposure to temperatures of at least 75°C may result in a larger reduction of TBC and *S. aureus* bacteria.

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