A New Teat Dip Containing Peracetic Acid Produced In-Situ

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Background

Peracetic or Peroxyacetic acid has been known for years to be a highly effective germicide. It is a powerful oxidizing agent and is, therefore, fast acting and has a broad spectrum of kill. Its byproducts are acetic acid, oxygen and water, so it is friendly to the environment and does not produce residues on the teat. It works well under high organic loads and at a variety of temperatures and water hardness levels. Drawbacks are that it can be hard to handle at high concentrations, it has a pungent odor and it works best at pH's below 7.0. Peracetic acid is produced commercially in concentrations ranging from 4.0% to 15%. It is made by combining acetic acid with hydrogen peroxide in the presence of a sulfuric acid catalyst. This produces an equilibrium quantity of peracetic acid plus water. The stoichiometric relationship is:

$$CH_3C(O)OH + HOOH = CH_3C(O)OOH + H_2O$$

So when the first two components, acetic acid and hydrogen peroxide are combined, an equilibrium is established with the production of peracetic acid and water. As the peracetic acid is used up, more is produced to maintain the equilibrium (1). This phenomenon was the basis for a new teat antiseptic product that combines the components above to produce peracetic acid in-situ. Since only acetic acid and peroxide are necessary in making the product, there is no need to handle peracetic acid during manufacture. The peracetic acid is produced within the product in effectively low enough concentrations to be efficacious while not generating the hazards associated with higher levels. In the present study, germicidal levels, prevention of new intramammary infections (IMI's) and affects on teat condition were assessed. We found that the in-situ-based peroxide product proved to be effective in preventing new IMI's vs. *Staph aureus* and *Strep. agalactiae* in an Experimental Challenge Study. Additionally, there were no differences between treated and control quarters in teat skin and teat end conditions. The product also was proven to be efficacious versus several mastitis pathogens in laboratory assays measuring germicidal efficacy. These results demonstrate that this unique new product is a viable alternative for dairy farmers who would prefer not to use iodine teat dips yet are displeased with issues such as effectiveness or the lack of convenience (such as premixing two part systems) in the use of several other non-iodine teat dips now on the market.

Methods

The Experimental Challenge study was conducted as per NMC guidelines (2). One hundred pastured cows were utilized. All cows were pre-dipped with a 0.5% iodine teat dip, fore-stripped and dried with a paper towel before attachment of milking units. Cow teats were dipped with bacteria suspension and the left front and rear right teats with treatment product,

once per day, five days per week for nine weeks. Milk samples were taken weekly and tested for inoculated bacteria. A new IMI was detected when either a clinical sample or three consecutive, non-clinical samples had 100 cfu/ml or greater or two consecutive, non-clinical samples had 500 cfu/ml or greater. Teat skin and teat end conditions were assessed one week prior the start of the trial. Scores were determined on a scale of from 1 to 5 using the method of Goldberg (3).

Results and Discussion

The data below from the Experimental Challenge indicate that the Peroxyacetic acid teat dip treated quarters had significantly less new IMI's than quarters that were not dipped. A 0.5% iodine teat dip was used as a positive control, which showed no significant reduction in IMI's over this period. The results also show that the peracetic acid had no significant negative effects on the teat skin and teat ends. In fact, these quarters seemed to have less negative effect on the skin condition than either the 0.5% iodine or the undipped controls. These results indicate that the peracetic acid in the product is at high enough levels to be effective in preventing new IMI's but not so high as to cause irritation to the teat skin. A peracetic acid teat dip may therefore be an effective alternative to iodine while providing a greater margin of safety to the environment, animals and people.

Table 1. Experimental Challenge: Efficacy Data versus *Staphylococcus aureus* and *Strep. agalactiae*

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Treatment Formula	Eligible quarters	New IMI'S	Percent Reduction vs. control
Undipped Control	100	13	
Peracetic acid teat dip formula	100	4	69.2% [a]
Undipped Control	100	9	
0.5% iodine teat dip	100	8	11.1%

[a] P > 0.05.

Table 2. Teat Skin and Teat End Condition Scores

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Treatment Formula [a]	Teat Skin	Teat End
Undipped Control-initial	1.20	1.52
Undipped Control-final	1.27	1.75
Peracetic acid formula-initial	1.20	1.53
Peracetic acid formula-final	1.19	1.66
Undipped Control-initial	1.11	1.52
Undipped Control-final	1.26 [a]	1.85 [a]
0.5% iodine-initial	1.13	1.50
0.5% iodine-final	1.22 [a]	1.80 [a]

[a] P > 0.05, final vs. initial

1. FMC Corporation. 2003. VigorOx^{R} Liquid Sanitizer and Disinfectant: Technical Brochure. FMC Corporation, Philadelphia, PA.

2. Hogan JS, DM Galton, RJ Harmon, SC Nickerson, SP Oliver, JW Pankey. 1990. Protocols for Evaluating Efficacy of Post-Milking Teat Dips. J Dairy Sci. 73:2580.

3. Goldberg JJ, PA Murdough, AB Howard, JW Pankey, GA ledbetter, LL Day. 1994. Winter evaluation of postmilking powdered teat dip. J Dairy Sci. 77:748.