Evaluation of Chlorine Stability in a Novel Teat Dip Disinfectant System

A.S. Leaflet R2801

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Summary and Implications

Chlorine concentrations of a novel generated germicidal compound (8000 ppm available chlorine) and pre (500 and 1000 ppm) and post dip (1000 and 2000 pm) made by dilutions with initial separate additive were very stable over 11, 20, and 42 day trials. Using different additives in pre and post dips (trial 2) or just post dips (trial 3) showed reduction in chlorine to 200 ppm within 24 hrs. This novel technology shows excellent chlorine stability over time (base solution) but also the importance of the additives and their potential effects on these concentrations.

Introduction

Today's consumer demands that food be produced at the highest level of quality and safety. The production and processing of safe, nutritional, high quality food products starts right on the farm. As farms get larger, their need to defend against harmful micro-organisms becomes even more critical. The capability to produce safe and effective hygiene and disinfection products on site, in sufficient quantities at a low cost, is a necessity for the farming and food industries, given current economics and input costs.

A hygiene technology that has been in use for more than 30 years in the water treatment industry, but never applied to agriculture, was introduced to the dairy industry earlier this year. The ECAlogix™ System (Zurex PharmAgra LLC) utilizes electro-chemical activation to create large amounts of an extremely efficacious germicidal solution, on-site, at a fraction of the current cost. This base disinfectant solution is blended with a portfolio of proprietary additive formulas to create application-specific products for numerous on-farm applications including animal and premise hygiene and water purification.

The electrochemical activation (ECA) process begins when water is mixed with a purified sodium chloride solution. It moves through an electrolytic cell to generate an active germicidal agent. This concentrate solution is an oxychloride combination that is more effective than common chlorine bleach, yet safe when applied to skin tissue. This system allows farms to focus on sustainability and food safety by creating high quantities of germicidal agents from the concentrate and/or proprietary additives to defend against a wide spectrum of microorganisms. Used for cleaning, sanitizing and disinfection, the system can be applied to pre-milking and post-milking teat hygiene, hoof treatment, cleaning equipment, cleaning walls and calf hutches, CIP cleaning, laundry and water treatment.

The objective of this overall study is to evaluate the stability of the base germicidal product as well as dilutions used for pre and post milking teat dipping, as well as evaluate teat health and integrity when used. The objective of this paper is to present stability results as teat health and integrity data is currently being analyzed.

Materials and Methods

Initial base product: The initial base germicidal stock compound supplied to ISU generated through ECAlogix™ System was designed to have 8000 ppm chlorine.

Cows and procedures: All protocols were approved by the ISU Committee on Animal Care. Two pens (1 each) of 48 animals were used to evaluate pre-dip and post dips only individually (trials 1 and 2) and then both pens were used where both pre and post dips were used together in a half udder design (right side teats dipped with experimental pre and post dips, left teats with control commercial teat dips).

Pre and post dip products: Appropriate dilutions of pre (500 -1000 ppm) and post (1000 – 2000) milking teat dips were made and initially tested. Following a 2 week comparative trial (trial 1), 1000 ppm and 2000 ppm solutions were chosen (pre and post dips, respectively) for a comparison of dip additive formula trial (3 weeks- trial 2) and then a half udder comparative experiment against commercial dip products (trial 3 – 6 weeks). Both pre and post dips had proprietary formulas added to them to facilitate proper teat cleaning (pre dip) as well as skin condition emollients (pre and post dip)

Product chlorine concentrations and stability: A teat dip cup filled with the initial stock germicide solution was placed in the milking parlor and served as a base control over time (never used for dipping). Pre and post milking teat dips were made in 1 gallon quantities that would last ~ 1 week. Chlorine concentrations in all these products were tested every few days by drawing directly from the teat dippers being used or stored in the milking parlor. Testing was done with a chloride titration testing kit and compounds. 10 drops of a 50% Potassium iodide was added to the diluted sample followed by 3 drops of 50% sulfuric acid (yellow color indicated chlorine present). 5 drops of a 1% starch solution were then added (blue color) and the drops (1 at a time) of a thiosulfate titrant solution were added until the sample turned colorless. When the initial solution was diluted 10 fold 3X, each thiosulfate drop equated to 1 ppm total available chlorine.

Results and Discussion

Trial 1: Chlorine stability over an 11 day period for Trial 1 is shown in Figure 1. Pen 11 had right side teat (11 R) pre-dipped with 500 ppm solution while left teats were pre-dipped with 1000 ppm solution (11 L). Pen 10 had right side teat (10 R) post-dipped with 1000 ppm solution while left teats were post-dipped with 2000 ppm solution (11 L). Overall chlorine stability of all pre and post dips and the stock solution were excellent over the 11 day period.

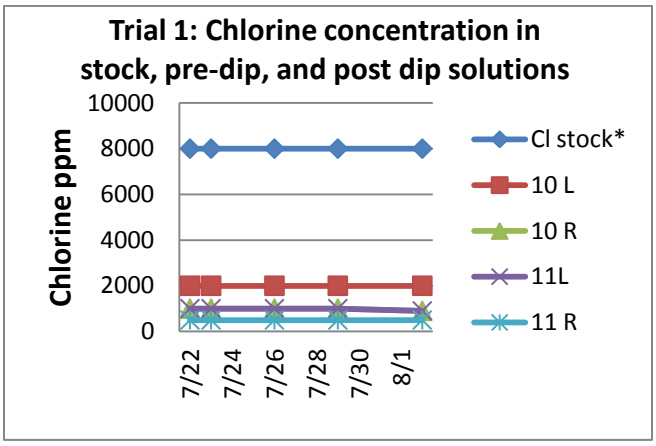

Figure 1. Chlorine concentrations for stock solution, pre (11 L and 11R), and post (10L and 10R) milking teat dips over an 11 day period.

Trial 2: Chlorine stability over a 20 day period for Trial 2 is shown in Figure 2. Pen 11 had right side teat (11 R) pre-dipped with 1000 ppm solution with a new additive (in both pre and post dip) while left teats were pre-dipped with initial 1000 ppm pre-dip solution (11 L). Pen 10 had right side teat (10 R) post-dipped with 2000 ppm solution with a new additive (in both pre and post dip) while left teats were post-dipped with 2000 ppm initial post dip solution (11 L).

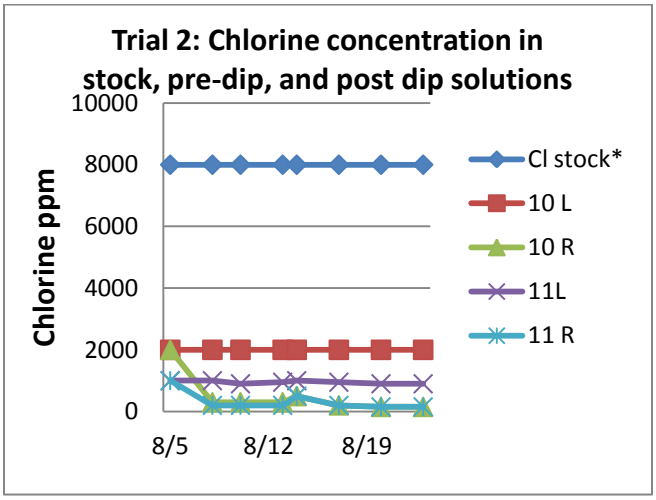

Figure 2. Chlorine concentrations for stock solution, pre (11 L and 11R), and post (10L and 10R) milking teat dips over a 21 day period.

Overall chlorine stability of stock solution and initial pre and post dips (11L and 10 L)with original separate additives were stable across the 3 weeks. Pre and post dips at 1000 ppm and 2000 ppm (11R and 10R), respectively at the start that used new additives saw reduced chlorine concentrations within 24 hrs (down to 200 ppm).

Trial 3: Chlorine stability over a 6 week period for Trial 3 is shown in Figure 3. Post milking teat dips were initially 2000 ppm solutions while pre-dips were 1000 ppm. New dip solutions were made on 8/26, 9/27, and 10/7. Predip additives were same as original trial 1 in all dips. Postdip made on 8/26 had original post dip additive while dips made on 9/27 and 10 7 had a new post dip additive. Overall chlorine stability of stock solution and pre and post milking teat dips with the original additives were stable and excellent over time. Using a new post dip additive resulted in lower chlorine (200 ppm) within 24 hours post dip mixing at 2 separate new batches

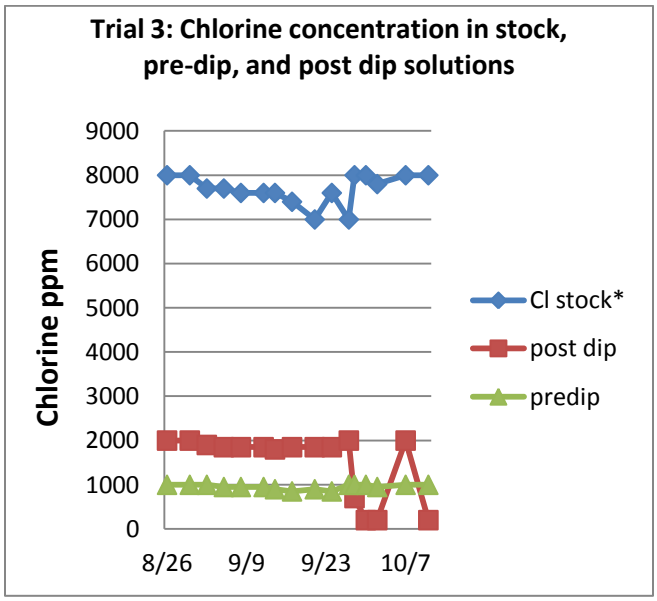

Figure 3. Chlorine concentrations for stock solution, pre and post milking teat dips over a 42 day period.

Summary

Chlorine concentrations of a novel generated germicidal compound (8000 ppm available chlorine) and pre (500 and 1000 ppm) and post dip (1000 and 2000 pm) made by dilutions with initial separate additive were very stable over 11, 20, and 42 day trials. Using different additives in pre and post dips (trial 2) or just post dips (trial 3) showed reduction in chlorine to 200 ppm within 24 hrs. This novel technology shows excellent chlorine stability over time (base solution) but also the importance of the additives and their potential effects on these concentrations.