

Cleaning Milking Systems Using Electrolyzed Oxidizing Water

Introduction

The purpose of this research is to determine if electrolyzed oxidizing (EO) water is an effective cleaning and sanitizing agent for the 'clean in place' (CIP) cleaning of on-farm pipeline milking systems. EO water is produced from a weak salt (sodium chloride) solution by a combination of electrolysis and membrane separation which separates the sodium and chlorine ions, yielding an alkaline sodium solution and an acidic chlorine solution. EO water would be a safer and perhaps cheaper alternative to the currently accepted cleaning solutions.

Milk production is an important industry in Pennsylvania and across the nation. In Pennsylvania, there are approximately 9,700 dairy farms with ten or more cows. Most of these facilities use some form of mechanized milking system that collects the milk through a series of pipes to a central refrigerated holding tank. A smaller producer may only need to utilize the equipment for a few hours a day, while a larger producer may be milking cows nearly around the clock. Regardless of the size of the producer, the milking equipment must be cleaned and sanitized regularly.

In the United States, the law requires that the microbial activity of raw milk intended for pasteurization must be less than 100,000 standard plate count (SPC) per milliliter. Many milk processors pay premiums for higher quality milk and the Northeast Dairy Practices Council recommends a standard plate count of less than 5,000 as a guideline for producing high quality milk. Good cleaning practices help ensure the production of high quality milk and therefore higher profitability for the producer.

Milking systems are commonly cleaned in a three-step process: A warm water rinse, washing with a highly alkaline solution, and then rinsing with acidic solution. The chlorinated alkaline cleaners contain large

concentrations of either sodium hydroxide or potassium hydroxide. These chemicals are highly caustic and can cause serious burns of the skin and eyes. Additionally, when mixed with acids, these chlorinated cleaning compounds may release poisonous chlorine gas – especially worrisome as an acidic solution is the final step of the cleaning/sanitizing process.

Using EO water to clean milking systems eliminates many of the dangers associated with storing and using the cleaning chemicals. EO water is not harmful to the skin and may even be consumed without serious ill effects. As EO water is produced as both an alkaline solution and an acidic solution, it should fit easily into the accepted three-step washing process.

Personnel

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Methodology Overview

The experimental plan is divided into two distinct phases, as outlined by the attached flow chart. In Phase 1, small pieces of milking systems materials (stainless steel, rubber, polyvinyl chloride, and polysulfone) are contaminated with raw milk. Then the samples are treated with several different treatments (time and temperature) of both acidic and alkaline electrolyzed oxidizing water. The samples are swabbed, diluted, and cultured on plates to enumerate the surviving bacteria. Control pieces are simultaneously treated using only softened tap water.

Phase 2 involves cleaning an actual pipeline-style milking system using electrolyzed oxidizing water. First, a milking system must be constructed in the laboratory. The milking system must be constructed with easily removable joints at various locations in the system to



facilitate swabbing of milk-contact surfaces. Raw milk is circulated through the system for contamination. Some of the trials will simulate severe contamination by allowing the raw milk to rest in the system for an extended time. Then, the milking system is treated with EO water using times and temperatures selected from the results of phase 1. The system is swabbed at various locations and the swabs are rinsed and cultured to enumerate bacteria levels. Finally, the system is contaminated and then cleaned using standard commercial cleaning agents to compare the effectiveness of EO water with the effectiveness of commercial cleaning agents.