Calf Notes.com

Calf Note 144 – Milk pasteurization – more is not always better

Introduction

Bacterial contamination of waste milk (also called hospital milk) is a real threat to the health of young calves. Waste milk is that milk unsuitable for sale and is often contaminated with potential pathogens. Pasteurizing waste milk to reduce the number of bacteria is an important biosecurity step for producers that feed waste milk.

According to the USDA NAHMS study (USDA, 2007), 2.8% of all operations fed pasteurized waste milk, though 28.7% of farms >500 cows fed pasteurized waste milk. This compares to 30.6% of all operations and 27.6% of farms >500 cows that feed unpasteurized waste milk.

Recently, I had the opportunity to visit several dairy farms in the U.S., Mexico and China. On each visit, several farms had waste milk pasteurizers. Generally, farms with 500 or more calves on milk were more likely to have an on-farm pasteurizer. Many were commercial equipment and others were home-made. Some pasteurizers were in excellent shape – clean, well maintained and with some temperature measuring device to monitor temperature during the pasteurization process. Others, however, were poorly maintained and there was significant contamination and lack of cleaning. These pasteurizers were disasters waiting to happen.

On a couple of operations, we discussed pasteurization time and temperature requirements to properly pasteurize waste milk. I was surprised to learn that the calf manager had decided that if a certain temperature was good in killing bacteria, then a higher temperature would be even better. So, they increased the temperature of the pasteurizer to make the milk "better". What they did was to make the milk worse.

Process

There are two types of pasteurization of waste milk – batch and flash pasteurization.

Batch pasteurization occurs when the milk is heated to a specific temperature (usually 63°C or 145°F) and held at temperature for a period of time (usually 30 minutes) to kill off potential pathogens. Pasteurized milk is then cooled to feeding temperature and delivered to calves. Proper agitation of milk during heating is essential to ensure that all milk is heated to the desired temperature.

High temperature, short term (**HTST**) or flash pasteurization is done by raising the temperature of the milk to 72°C (161°F) for 15 seconds. This type of pasteurization uses heated coils and the milk continuously flows through coils to reach pasteurization temperature.

Pasteurization was originally designed for saleable milk. It does NOT sterilize milk, only reduces the number of bacteria. Jorgensen et al. (2006) sampled 31 samples of waste milk and found an average of 8.8 million bacteria colony forming units (cfu) per milliliter of milk prior to pasteurization. On-

farm pasteurization reduced bacteria counts to 0 to 420,000 cfu/ml depending on the quality of equipment and pasteurization process.

Butler and colleagues (Butler et al., 2000) pasteurized waste milk at various temperatures and evaluated survival of various species of mycoplasma. They found that heating waste milk to 65°C for 1 hour effectively eliminated risk of transmission of disease. The species of mycoplasma were killed when milk was heated to 65°C for 10 minutes or more.

Why not more?

If batch pasteurizing to 65°C is good, why not increase the temperature to 80 or 85°C? Won't this reduce the bacteria load even further? Well, increasing temperatures above the those recommended further reduce bacteria, but this increased killing comes at a great cost.

When milk is overheated, the high temperatures can denature (break down) milk proteins, rendering them indigestible to the calf. Indigestible proteins pass through the digestive tract and end up in the feces.

Figure 1 is a photo of feces from a farm that was batch pasteurizing their waste milk. The pasteurizer was originally set up to operate at 63°C for 30 minutes. However, the workers wanted to get done with chores earlier (they had a lot to do!) and so increased the temperature to 80°C and held the milk for 15 minutes. The milk was then cooled and fed.

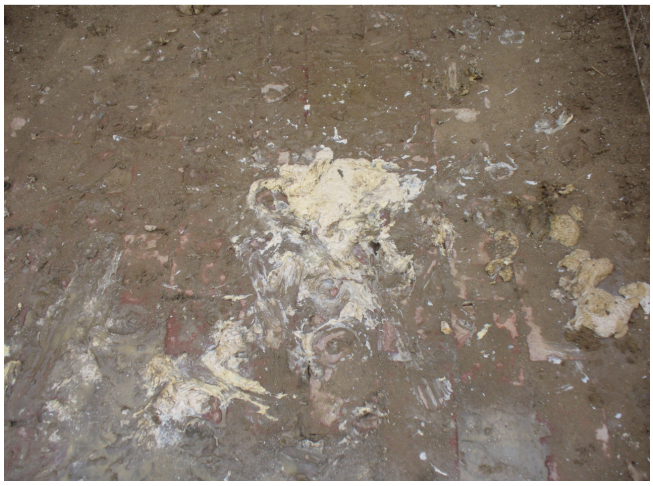

Figure 1. Feces of calves fed waste milk that was protein denatured. Undigested milk protein was evident in the feces.

The high temperature of the process denatured the milk protein, rendering them indigestible. The proteins were subsequently excreted in feces. Calves became protein deficient, even though there was plenty of protein in the milk. Calves looked small and unthrifty with sunken eyes and rough hair coats. They weren't growing the way they should and workers complained of more treatments than normal.

We suggested that the pasteurization temperature be reset to 63°C and held for 30 minutes. Shortly thereafter, the farm reported improved calf health and growth.

Monitoring pasteurizers

When waste milk is pooled, the pathogenic bacteria it contains will be equally distributed throughout the liquid. If pasteurization is not performed correctly or if the equipment is not regularly maintained (clean, sanitized), there is a risk of infecting all calves drinking the milk. It's essential that standard, written protocols be set up for using and maintaining waste milk pasteurizers. Plate counts of pasteurized milk can be evaluated routinely to monitor effectiveness.

Using a thermometer to monitor the temperature of the pasteurizer regularly is essential to monitor the process. Also, make sure that there is proper agitation in batch pasteurizers. Without sufficient agitation, hot spots in the milk can form, causing the same type of protein denaturing seen with excessive temperatures.

Summary

Pasteurization of waste milk is not a trivial task on the farm. It is important. It requires capital. And it requires a process that optimizes bacterial kill without depressing subsequent digestion of nutrients from the milk. It also requires regular maintenance. Without a management plan to clean, sanitize and monitor the performance of your pasteurizer, you're really asking for trouble – which will be manifested by increased disease and death loss.

In the case of pasteurizing waste milk, more is not always better!

Postscript

Several websites contain some useful information on waste milk pasteurization:

1. Univ. of Wisconsin: http://dysci.wisc.edu/uwex/heifmgmt/pubs/pasteurizingwastemilk.pdf
2. Bovine Alliance on Management and Nutrition: www.aphis.usda.gov/vs/ceah/ncahs/.../BAMNFeed_past_milk.pdf
3. Calf Note #35 – risks of using waste milk: www.calfnotes.com/pdffiles/CN035.pdf

References

Butler, J. A., S. A. Sickles, C. J. Johanns, and R. F. Rosenbusch. 2000. Pasteurization of discard mycoplasma mastitic milk used to feed calves: thermal effects on various mycoplasma. J. Dairy Sci. 83:2285–2288.

Jorgensen, M. A., P. C. Hoffman, and A. J. Nytes. 2006. Case Study: A field survey of on-farm milk pasteurization efficacy. Prof. Anim. Sci. 22:472–476.

USDA. 2007. Dairy 2007, Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007. USDA-APHIS-VS, CEAH. Fort Collins, CO.

Written by Dr. Jim Quigley (31 October 2009)

Calf Notes.com (http://www.calfnotes.com)