Wisconsin Center for Dairy Research

DAIRY PIPELINE

A Technical Resource for Dairy Manufacturers

October 2004, Volume 16 Number 3

Monitoring the Biological Safety of Dairy Plants, Part 2

Designing an environmental sampling program to protect your customers

Produced from a presentation by Dennis Bogart, Randolph Associates at the Wisconsin Association of Food Protection, Education Workshop on June 2, 2004 in Madison, Wisconsin

I am going to begin by telling you a story about a plant I visited. As I was looking around I sensed that this was a place that *Listeria* would like to live. The plant was dirty, it had holes in the floor, and stuff was dripping off the walls. It was also a plant employing environmental sampling. Yet when I looked at the records from the past year and half I could not find one single positive sample. So I asked if I could join the lab technician as she collected her samples the next day. I met up with her and she got her cart and I followed as she went out and put on her gloves, grabbed a spray bottle, used it and wiped a spot on the floor. She finished by writing down its location. Then she went to another area, sprayed the area and wiped it down with a sponge, wrote down where it was. So I said, "Wait a minute, what's in that bottle?" I don't know she told me, something that the QC manager makes up. Well, quat has a distinctive smell! And they never had a positive. The next day the Quality Control manager was looking for a new job.

I'm telling you this to underscore the point that you don't want to hide *Listeria*; you want to find it so you can get rid of it. You want to control it, and it is a difficult task because *Listeria* is almost everywhere. It's on floors, walls, your hands, and under your fingernails. It is everywhere. Your job is to control it and keep it out of our food.

An integral part of controlling *Listeria* in your plant is to set up an environmental sampling program. I recommend looking for all *Listeria* species, not just *L. monocytogenes*. Any place you find any *Listeria*, you can be sure the pathogen types are able to live close by. Thus, consider any *Listeria* as a signal that warrants aggressive control.

Environmental testing is proactive

One reason you should consider environmental testing is because it is a proactive approach. (See sidebar on page 7 for more reasons) Sampling your plant gives you the information you need to control the plant environment, keeping tabs on developing problems and addressing them. You can reduce the potential for contamination because you can take action to prevent contamination of food. In addition, environmental sampling is HACCP friendly. The opposite approach, reacting to a problem in your plant, could mean recalling contaminated product. Testing product is not a very efficient method to find a problem; too often contamination can go undetected. And finally, reacting to problems is inherently anti-HACCP, because it is a food safety system based on prevention.

Setting up a program

The first step towards setting up an environmental sampling program involves establishing a commitment from management. If you don't

continued on page 6

What's Inside:

Monitoring the Biological Safety of Dairy Plants, Part 2 1

Sitting on the shelf—skim vs. 2% vs. whole milk ... 2

Research Update 8

Skimming the Shelf 9

Curd Cinic 10

Sitting on the shelf—skim vs. 2% vs. whole milk

Michelle L. Hanson and W.L. Wendorff, Dept. of Food Science, Univ. of Wisconsin-Madison

Bacterial spoilage is the primary factor limiting the shelf life of fluid milk products. Unpleasant aromas and tastes in milk are the result of bacterial growth (Hayes et al., 2002) primarily caused by psychrotrophic microorganisms. Often the culprits are gram negative bacteria that recontaminate the milk following pasteurization, commonly traced to the processing plant equipment (Dogan and Boor, 2003). Sometimes gram positive bacteria capable of surviving the pasteurization process cause the spoilage (Ternström et al., 1993) and *Bacillus cereus* is the most common offender. This is a gram positive thermoduric psychrotrophic bacteria causing spoilage in milk, particularly sweet curdling in fluid milk (Crielly et al., 1994; Wendorff, 2001).

Several people in the dairy industry have previously reported that skim milk spoils faster than whole milk. Researchers have also indicated differences in spoilage between skim milk and whole milk (Janzen et al., 1982; Pieper & Timms, 1987; Hayes et al., 2002). However, others (Chandler et al., 1990) have reported that there were no differences in spoilage between milks of different fat or protein contents. Many of the studies sampled commercial milk obtained at retail stores, thus the composition and quality of the raw milk was not known.

We attempted to control for that factor in our research study by determining if there is a difference in the spoilage pattern of pasteurized fluid milk products, with different levels of milkfat, processed from the same raw milk supply. Understanding the spoilage pattern of milk products will help fluid milk processors provide high quality products, possibly extending the shelf life.

Collecting and storing milk samples

Samples of skim, 2%, and whole milk, processed by separation from the same lot of raw milk, were collected on the day of processing from the Babcock Dairy Plant in Madison, WI. Approximately 2 liters of raw milk were also collected to determine the initial quality of the fluid milk. Packaged samples, in either half-pint or pint high-density polyethylene bottles, were collected three times between March 2003 and May 2003 approximately 1 month apart. The raw milk and three samples each of skim, 2%, and whole milk were stored at 6ºC until testing. The remaining samples were divided up and stored at two different temperatures (6ºC and 12ºC) for testing on 7, 14, and 21 days after processing. For each milk type, 9 samples were stored at each temperature, two samples for duplicate testing and one for sensory analysis each day.

Microbiological analysis

Raw milk samples for each sampling time were evaluated for standard plate count (SPC), coliform count, laboratory pasteurized count (LPC), aerobic bacterial spore count, and *Bacillus cereus* count. SPC, coliform count, and *B. cereus* count were also performed on the pasteurized samples along with a rapid psychrotroph count (RPC) at each testing day.

Sensory analysis

For sensory analysis we removed the samples from the incubator on the day of testing and tempered them to 12.8º to 18.3ºC, the temperature range recommended for sensory analysis by Bodyfelt et al. (1988). Each panelist individually scored a maximum of 6 samples in random order; curdled samples were discarded and not evaluated. The milk samples were scored using a suggested scoring guide as described by Bodyfelt et al. (1988), where a score of 10 is assigned to a flavor with no criticism. The flavor criticisms and scoring were based on information provided by Bodyfelt et al. (1988).

Raw milk analysis

The results of the raw milk analysis indicated good quality raw milk. The average standard plate count (SPC) for the three trials ranged from 2,100 to 9,900 CFU/ml. The average lab pasteurized count (LPC) ranged from 61 to 77 CFU/ml, and the average coliform count for the three trials ranged from 76 to 180 CFU/ml.

Spoilage pattern

SPC of the milk samples increased significantly by day 14 at 6ºC and by day 7 at 12ºC as shown in Figures 1. and 2. Storing milk at elevated temperatures not only increased the spoilage, but also

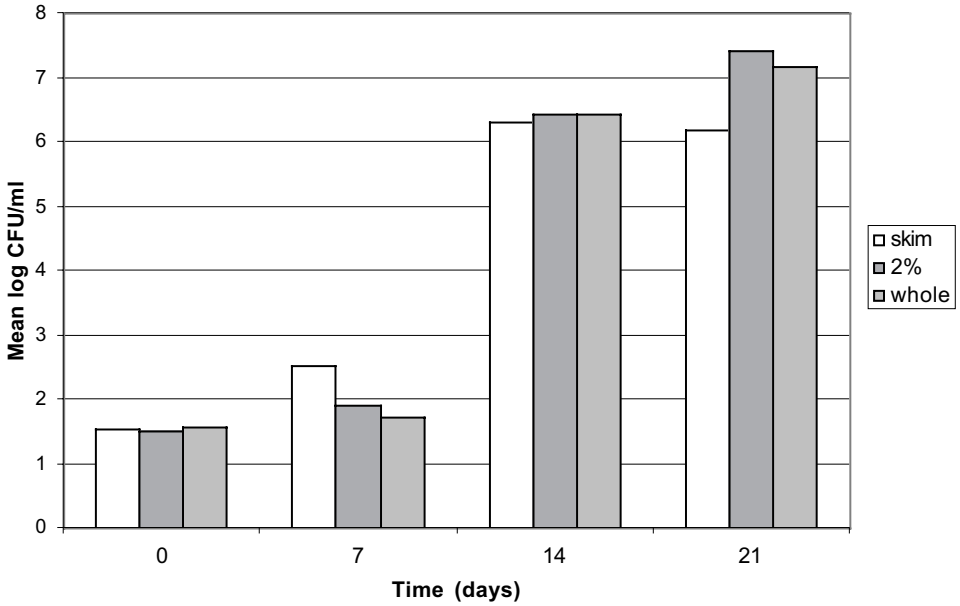


Figure 1. Standard plate count for milk samples stored at 6ºC throughout a 21-day shelf life

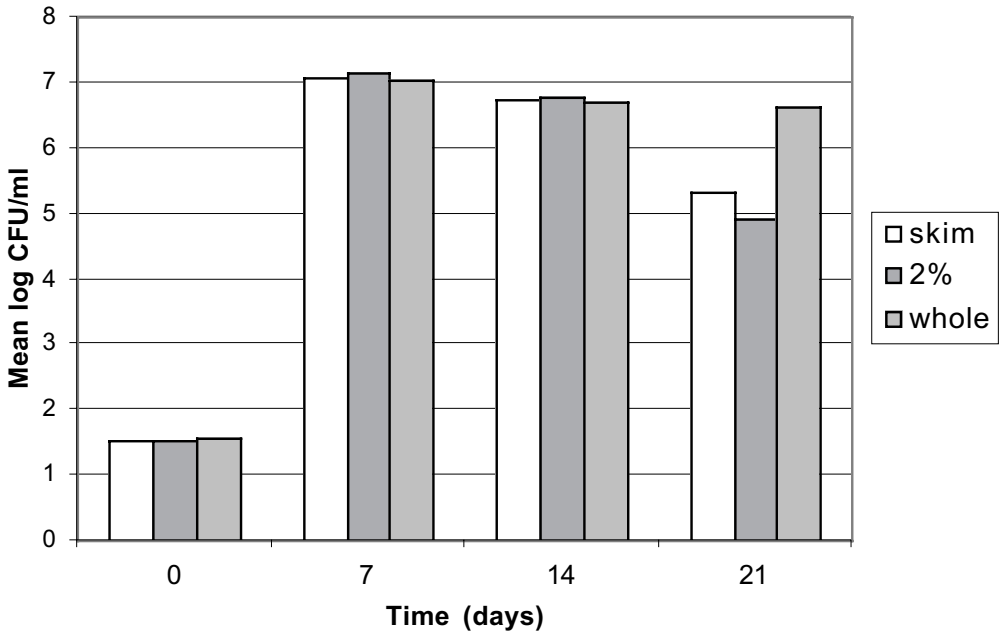


Figure 2. Standard plate count for milk samples stored at 12ºC throughout a 21-day shelf life

significantly decreased the shelf life of the product. This demonstrates how important proper refrigeration temperature is for the keeping quality of fluid milk (Craven and Macauley, 1992). The samples stored at the abuse temperature of 12ºC reached and exceeded the bacterial limit of 20,000 per ml (FDA, 2001) 7 days quicker than the samples stored at 6ºC. On average, the milk samples incubated at 6ºC did not have a shelf life that extended out to 14 days following pasteurization and filling. Over the 21-day period, there was no significant difference in the SPC between the skim, 2%, and whole milk samples. Rapid psychrotrophic count (RPC) showed the same growth trend seen in the SPC, as the psychrotrophs increased significantly after 14 days at 6ºC and after 7 days at 12ºC (Figure 3. and 4.). As with the SPC, over the 21-day period there was no significant difference in the RPC between the skim, 2%, and whole milk samples. For both the SPC and the RPC at 12ºC, there was a slight decline in amount of bacteria present from day 14 to day 21. This decline could possibly be due to the bacteria entering the death phase of the bacterial growth curve.

continued on page 4

continued from page 3

Bacillus cereus isolation

Testing for *Bacillus cereus* showed that *Bacillus* species were isolated from both raw milk as well as pasteurized milk samples. Mesophilic spore-formers were cultured from raw milk. Some of the isolates were characterized as *Bacillus cereus* while others were characterized as *Bacillus mycoides*. *Bacillus* species can survive pasteurization and they can grow at refrigeration temperatures (Eneroth et al., 1998). Due to low numbers of *Bacillus* spp isolated in the initial samples, we used the most probable number (MPN) procedure outlined in Chapter 14 of BAM *Online* (Rhodehamel and Harmon, 2001) for enumerating *Bacillus cereus* in the milk samples. We found *Bacillus cereus* in skim, 2%, and whole milk at both 6ºC and 12ºC. However, there was no difference in the amount of *Bacillus* present in different types of fluid milk. A study by Griffiths and Phillips (1990) also demonstrated that pyschrotrophic *Bacillus* spp. had similar growth patterns in skim and whole milk.

Sensory evaluation

The average score for the samples stored at 6ºC did not decrease significantly as the shelf-life neared 14 days. At 12ºC, the average score of the milk samples at 14 and 21 days post processing were not available because the samples curdled before evaluation. The most common initial flavor defect for each type of milk was a cooked flavor. This defect was found about 50% of the time in the initial milk samples and decreased with age. It is not unusual to detect a cooked flavor in pasteurized milk immediately

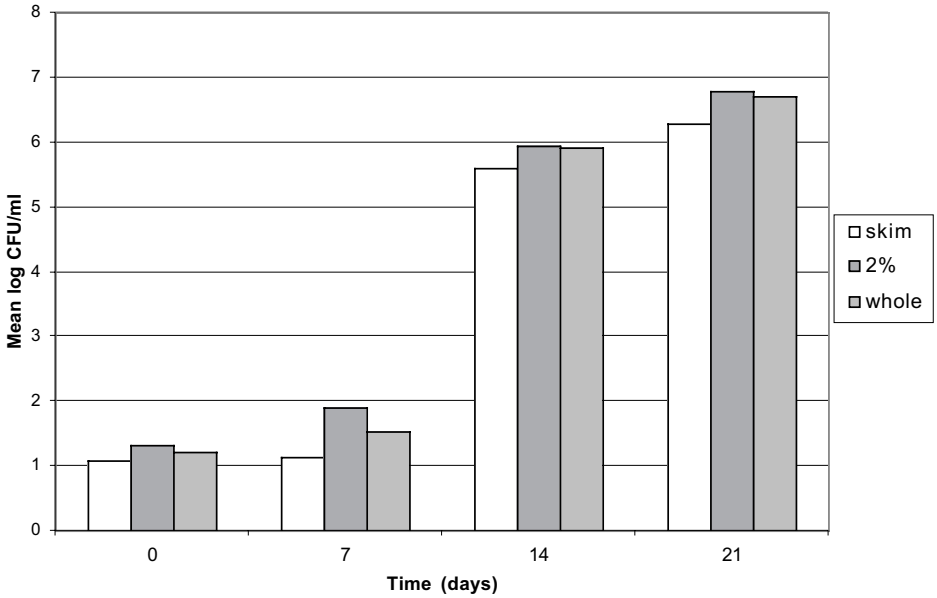


Figure 3. Rapid psychrotroph count for milk samples stored at 6ºC throughout a 21-day shelf life

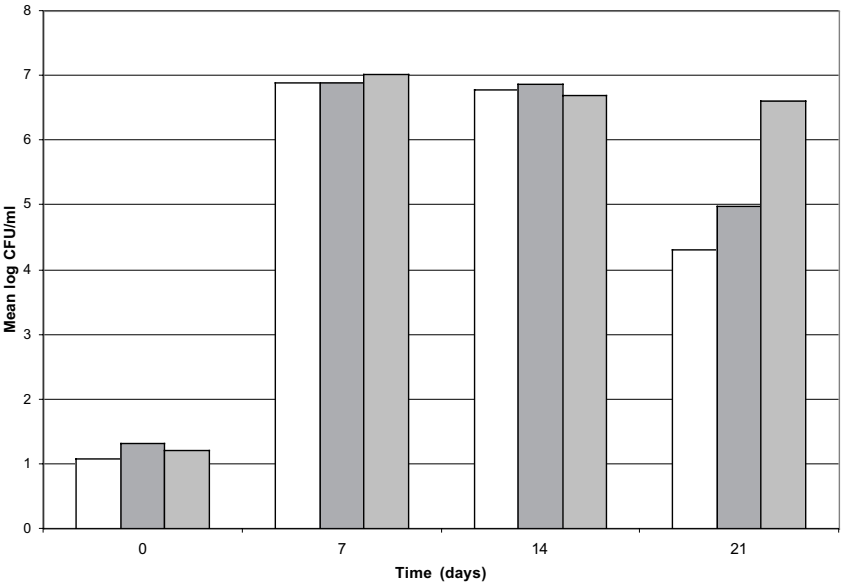


Figure 4. Rapid psychrotroph count for milk samples stored at 12ºC throughout a 21-day shelf life

following processing, but the flavor generally diminishes with storage (Bodyfelt et al, 1988). After 21 days at 6ºC, a stale flavor was the most common defect. It was detected 45.4%, 21.0%, and 31.2% of the time in skim, 2%, and whole milk respectively. Unclean, rancid, and fermented/fruity off-flavors were detected by panelists by day 14 and day 7 in samples at 6ºC and 12ºC respectively. These off-flavors are typically produced by psychrotrophic bacteria through post-pasteurization contamination. (Bodyfelt et al., 1988). We weren't surprised by these flavors given the rapid growth of psychrotrophs from day 0 to day 14 at 6ºC and day 0 to day 7 at 12ºC, as noted in Figures 3. and 4.

Conclusion

We conclude from this study that there is no significant difference in the spoilage pattern of fluid milk with different fat contents. In our study, the skim, 2%, and whole milk were all processed from the same raw milk and all samples had a similar rate and pattern of spoilage. We also found that *Bacillus cereus* was consistently present in fluid milk of all fat levels.

According to Deeth et al. (2002), if differences are noted in the spoilage patterns of skim and whole milk they are not due to the growth rates of psychrotrophic bacteria, but rather to the greater potential for proteolysis in skim milk than in whole milk. Several researchers (Hsu, 1984; Lopez-Fandino et al., 1993) have reported that fat in whole milk protects the milk proteins from proteolysis. Hsu (1984) and Ng (1991) suggest that the milk fat globule membrane may protect the caseins from proteolysis. This protective effect could occur through hydrophobic association of ß- and κ-caseins to fat globules making these caseins less susceptible to proteolysis (Deeth et al., 2002).

Acknowledgements

We would like to thank Ray Michels of the Babcock Hall Dairy Plant for technical assistance in obtaining the necessary samples of fluid milk products. This research was supported in part by the College of Agricultural and Life Sciences, University of Wisconsin - Madison.

References

Bacteriological Analytical Manual *Online*. 2001. U.S. Food and Drug Administration. Center for Food Safety & Applied Nutrition. Available at: http://www.cfsan.fda.gov/~ebam/bam-toc.html. Accessed September 2003.

Bodyfelt, F.W., J. Tobias, and G.M. Trout. 1988. Sensory evaluation of fluid milk and cream products. Pages 107-165 *in* The Sensory Evaluation of Dairy Products. Van Nostrand Reinhold. New York.

Chandler, R.E., S.Y. Ng, and R.R. Hull. 1990. Bacterial spoilage of specialty pasteurized milk products. CSIRO Food Research Quarterly 50: (4) 111-114.

Craven, H.M. and B.J. Macauley. 1992. Microorganisms in pasteurized milk after refrigerated storage 1. identification of types. The Australian Journal of Dairy Technology. 47: 38-45.

Crielly, E.M., N.A. Logan, and A. Anderton. 1994. Studies on the *Bacillus* flora of milk and milk products. Journal of Applied Bacteriology. 77: 256-263.

Deeth, H.C., T. Khusniati, N. Datta, and R.B. Wallace. 2002. Spoilage patterns of skim and whole milks. Journal of Dairy Research. 69: 227-241.

Dogan, B. and K.J. Boor. 2003. Genetic diversity and spoilage potentials among *Pseudomonas* spp. isolated from fluid milk products and dairy processing plants. Applied and Environmental Microbiology. 69 (1): 130-138.

Eneroth, Å., A. Christiansson, J. Brendehaug, and G. Molin. 1998. Critical contamination sites in the production line of pasteurized milk, with reference to the psychrotrophic spoilage flora. Int. Dairy Journal. 8: 829-834.

Food and Drug Administration. 2001. Grade "A" Pasteurized Milk Ordinance. U.S. Department of Health and Human Services, Public Health Service, Washington, D.C.

Griffiths, M.W. and J.D. Phillips. 1990. Incidence, source and some properties of psychrotrophic *Bacillus* spp found in raw and pasteurized milk. Journal of the Society of Dairy Technology. 43(3): 62-66.

Hayes, W., C.H. White, and M.A. Drake. 2002. Sensory aroma characteristics of milk spoilage by *Pseudomonas* species. J. Food Sci. 67(2): 861-867.

Hsu, H.Y. 1984. Methods for measuring the activities of bacterial and native proteinases in milk and study of factors affecting milk protein hydrolysis. Ph.D. Thesis, Cornell Univ., Ithaca, NY.

Janzen, J.J., J.R. Bishop, and A.B. Bodine. 1982. Relationship of protease activity to shelf life of skim and whole milk. J. Dairy Sci. 65: 2237-2240.

continued on page 9

continued from page 1

have that, your program will fail. You can tell what kind of support you have if the person in charge of environmental sampling has the authority to drive the program, is properly trained and has the time and the budget to put a quality program in place.

Training is another key to success. Write the process down and train all your personnel from this Standard Operating Procedure (SOP). Reinforce and review training frequently.

Zone 1
Zone 1 is the area immediately next to the product surface, and for some products it may include the product surface itself. Locate 50 Zone 1 sites if you are choosing 100 total.

Zone 2
Further away, 6 inches to 6 feet. Locate 30 Zone 2 sites if you need 100 total.

Zone 3
Even further, 6 to 8 feet away. Find 20 if you need 100 total sites.

Setting up your sampling zones

Now you are ready to set up a sampling system. Start by establishing three different sampling zones. I should point out that these are somewhat subjective and, in fact, every sampling protocol can be adapted to particular variables in your plant. For example, a small plant needs fewer test sites. You are going to establish three zones, but some are sampled more than others. Zone 1 is the area immediately next to the product surface, and for some products, it may include the product surface itself. Another way to describe Zone 1 is the area that is 6 inches around where that product is going. This is a crucial zone, so you will sample it more often.

Zone 2 is further away, 6 inches to 6 feet. Let's say you have a drain below a piece of equipment, it is within 6 ft of product so it is Zone 2. If it were over in the corner it would be Zone 3. As you can see, the zone concept involves distance. Thus, Zone 3 is even further from contact surfaces and includes environmental surfaces. For example, if we were looking at a warehouse, something farther than 6 to 8 feet away like the hallway would be sampled.

Next, you go through the plant and you establish 100 to 200 potential sites. As I mentioned earlier, you will need more sites in the crucial zones. Thus, if you are locating 100 sites you will pick 50 Zone 1 sites, 30 Zone 2 sites, and 20 Zone 3 sites. As you can see, the process is heavily weighted toward the Zone 1 sites. Locating sampling sites is not hard to do; in a typical plant it will take you a couple hours. The size of your plant and the product you make will influence the number of sample sites you need.

Random selection

Once you have your test sites established, you need a random sampling plan. This is an essential part of the process. Why random? Because your goal is to control *Listeria* and random sampling will remove any conscious or unconscious influence on the process. You can get charts of random numbers from the Internet by plugging in the word random number in a search engine. You will find lists of random numbers and tips on how to use them to make charts for testing. In fact you can develop a chart good for 2 or 3 years of testing because you can go crosswise, up and down, you can do all kinds of things. Just keep track and cross out the series of numbers you used so you don't use the same ones again next month.

Processing samples

I always recommend using sponge kits that you can send overnight to a qualified lab. I strongly discourage the old method of growing your samples in an enrichment broth in your own laboratory. If you don't follow this advice you might find that the healthiest colonies of *Listeria* are growing on the floor, right outside your lab. It is not worth it just to save a few bucks. Also, be careful that you don't contaminate the site while you are sampling. Remember to keep the samples cool. Always mark locations clearly, because if you get a positive you have to go back and treat that area aggressively.

Follow up

Get information to key people and take action on the positive samples. Let me say that again, take action on the positive samples. Listeria can be controlled if we take this control as a very serious issue. No one needs to get food poisoning.

> "Get information to key people and take action on the positive samples."

Effective *Listeria* control

What does it mean when we continue to detect *L. monocytogenes* in a variety of food? According to R. B. Tomkin, writing in the Journal of Food Protection, it means that the "Existence of a resident population of *L. monocytogenes* in food-processing establishments is more common than previously thought."

Tomkin continues by advising that commercial experience suggests environmental testing is a better and more cost effective measure for assessing control of *Listeria* in your plant than product testing. Environmental sampling programs are based on similar programs, used for over forty years, to control other pathogens, like *Salmonella*, and various spoilage bacteria.

Both the design of your environmental testing program and your response to positive samples are key ingredients that determine the success of *Listeria* control program.

Tomkin suggests that an effective *Listeria* control program includes:

- Prevent the establishment and growth of *Listeria* in niches or other sites
- Implement a sampling program
- Respond rapidly to each positive sample
- Verify that the source has been detected and corrected
- Conduct ongoing short-term and long-term assessments

Reference
Tomkin, R.B., 2002 Control of *Listeria monocytogenes* in the Food Processing Environment. Journal of Food Protection, Vol. 65, No. 4

Editor

Research Update

Van Slyke yield formula—You can use it for sheep's milk cheese

Although raising dairy sheep in the United States is an emerging enterprise many people expect it to continue growing. The Wisconsin Sheep Dairy Cooperative charted the increase in the milk they marketed from 1996 to 2003 and the trend only goes up—an impressive rise from 96,000 lbs to 450,000 lbs. According to Bill Wendorff, Chair of the University of Wisconsin—Madison Food Science Department, the availability of sheep's milk offers great opportunity for making mixed milk cheeses as well as sheep's milk cheese.

Wendorff and John Jaeggi, Wisconsin CDR, recently attended the 10th annual Great Lakes Dairy Sheep Symposium in Hudson, Wisconsin to present their research on sheep milk composition and cheese yield. Most of the sheep milk in the US is produced during the early spring to fall lactation cycle. Seasonal changes in milk composition varied during this season, reflecting lactation and nutritional influence. Their research project confirmed that despite the variation in milk composition, fat and protein recoveries in the cheese did not vary significantly. Thus, using the retention factors developed by the scientists, cheese makers can use the Van Slyke cheese yield formula to predict cheese yield.

To read the report (or to look over Proceedings of previous symposia) check out Dave Thomas's website at the Animal Science Dept: http://www.uwex.edu/ces/animalscience/sheep/Publications_and_Proceedings/res.html

Or you can watch for a full research report in upcoming issues of the Journal of Dairy Science.

Labeling the trans fat in dairy products

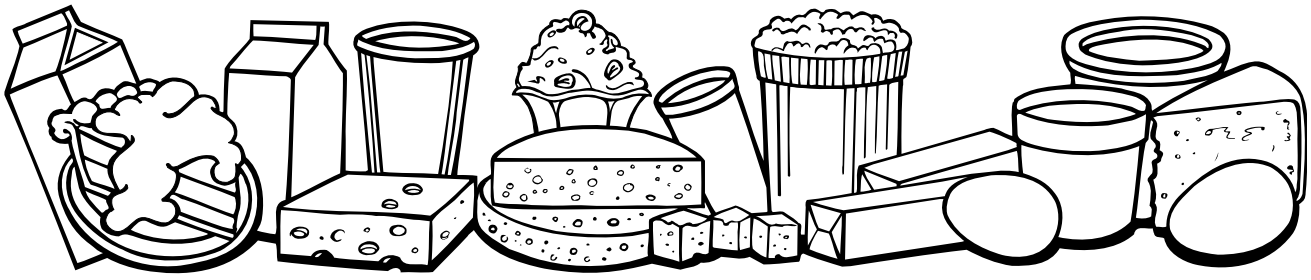
Although most food manufacturers realize that January 2006 is the deadline for listing trans fatty acids (TFA) on food labels many are still collecting the data they need to put accurate numbers on those labels.

That is the case for many in the dairy industry, however preliminary results from the International Dairy Foods Association (IDFA) suggest that labeling the trans fat in dairy products may be relatively painless. IDFA collected 37 raw milk samples from around the US and shipped them to Silliker labs for analysis. The result: raw milk contains approximately 0.13 grams of trans fatty acids per 100 grams of milk. Expressed as a proportion of milkfat, trans fats make up 3.56% of the fat content of milk. Or, 0.0356 grams of trans fats are in each gram of milkfat. Trans fats have to reach a threshold in order to be listed, which means anything under 0.5 trans fat grams/serving is listed at zero. Using a 95% confidence level in the measurement of TFA in milk suggests that the level of TFA in milk would be zero until you get to 10 grams of fat per serving. A real life example is seen in the nutrient content of one serving of reduced fat milk, which is one cup. The 5 grams of milkfat already listed on the label means it contains 0.178 grams of trans fat (5 x 0.0356) and thus can be labeled as zero grams of trans fat.

Does further processing influence these values? To answer this question 15 cheese samples were tested and the results match those from milk. According to Matt Mathison of the Wisconsin Milk Marketing Board, "If you know the original milkfat amount you will be able to predict the trans fat in cheese." Further testing of cheese is ongoing and when it is finished IDFA will have a database that manufacturers can use to label their dairy products. Right now it looks like cheese is a food that is naturally low in trans fat, a fact that might be used to promote dairy products. For more information check out the following websites:

http://www.fda.gov/oc/initiatives/transfat/backgrounder.html
http://www.idfa.org

For more information about trans fat, see the Dairy Pipeline, Vol. 15, Number 4.



Skimming the Shelf—

What's New in Print?

Every cheese maker knows that high quality milk makes high quality cheese. But what are the characteristics of that high quality milk? How does Wisconsin milk rate? How does the protein and fat content compare to California's milk? Or perhaps you have read that Wisconsin's cheese makers face a "protein deficit" but you aren't really sure what that means. You will find the answers to questions like these in a document entitled "Can We Make the Milk that Cheese Makers Need?" written by Professors George Shook, Randy Shaver, Pam Ruegg and Bill Wendorff of the University of Wisconsin—Madison.

The authors define and describe the ideal milk for making cheese, relating this description to Wisconsin's milk output. Then they lead readers through a discussion of how we can improve our current situation, covering dietary protein, genetic changes and selective breeding. The short version is concise and easy to read while the complete text is also available for those who prefer an in-depth, detailed report.

The information is available in a condensed 8 page version as Number 7 in a series of reports entitled" Rethinking Dairyland, Background for Decisions about Wisconsin's Dairy Industry." Or you can dive into Paper No. 78E2, Milk Composition, Quality and Production Efficiency: Where does Wisconsin stand? and study the thirty three page version complete with tables and graphs. Both are available at:
http://www.aae.wisc.edu/www/pub/dairyland/

If you don't have Internet access you can also get a copy from Linda Davis at the Department of Agricultural and Applied Economics, (608) 262-9488.

Shelf-life *continued from page 5*

Lopez-Fandino, R., A. Glano, N. Corzo and M. Ramos. 1993. Proteolysis during storage of UHT milk: differences between whole and skim milk. J. Dairy Res. 60: 339-347.

Ng, S.Y. 1991. Improved shelf life and quality of liquid milk products. M.A.S. Thesis, MIT, Melbourne.

Pieper, G., and L.L. Timms. 1987. Effect of storage temperature and fat content on keeping quality of skim milk and whole milk. J. Dairy Sci. 70 (Suppl. 1): 92.

Rhodehamel, E.J. and S.M. Harmon. 2001. Bacteriological Analytical Manual *Online*. *Bacillus cereus*. Available at: http://www.cfsan.fda.gov/~ebam/bam-14.html.

Ternström, A., A.-M. Lindberg, and G. Molin. 1993. Classification of the spoilage flora of raw and pasteurized bovine milk, with special reference to *Pseudomonas* and *Bacillus*. Journal of Applied Bacteriology. 75: 25-34.

Wendorff, William. 2001. *A White Paper on* psychrotrophic *Bacillus* in raw and pasteurized milk. Department of Food Science. University of Wisconsin-Madison.

Curd Clinic

Curd Clinic doctor for this issue is Bob Bradley, Emeritus Professor, Dept of Food Science, University of Wisconsin—Madison

Q. An article in the July issue of the Dairy Pipeline discussed the role of sanitizers in the context of monitoring the biological safety of dairy plants. I have always been a little nervous about using a product like quat in my plant. Is there a problem with using quat as an environmental sanitizer in a cheese plant?

A. I always emphasize using caution if you are using a quaternary ammonium compound, or "quat" as an environmental sanitizer in a plant manufacturing cultured dairy products. Because quat will inactivate many bacterial species you must understand the consequences of quat contamination in dairy foods. For example, as little as 20 ppm in milk can measurably slow acid development from a bacterial culture.

Read the label

In addition it is important to know exactly what you are using for a sanitizer. Identify the chemical used when trade names are involved; quat fits the general formula of alkyl (C_8-C_{14}) dimethyl benzyl ammonium chloride. The key element to easy identification is "ammonium" in the formula. Read the label!

Develop an environmental sanitation program that restricts random scatter of sanitizer. Apply only after cleaning walls, floors, and drains. Use 400 to 1000 ppm quat. After application have your quality assurance personnel swab processing equipment that is exposed, then use a test kit to determine if quat is on product contact surfaces. If the result is positive then modify your application to minimize the scatter of spray. You might also want to consider adjusting the pressure in the spray tank.

> "It's important to know the parameters of treatment areas..."

It's important to know the parameters of treatment areas because the spray will dry rapidly and remain active for at least 30 days if it is not washed away. Realize that sanitizer application is not a responsibility that should be delegated to a novice. Anyone taking on this duty should be aware of the consequences of quat contamination and the expense incurred when overspray is a problem.

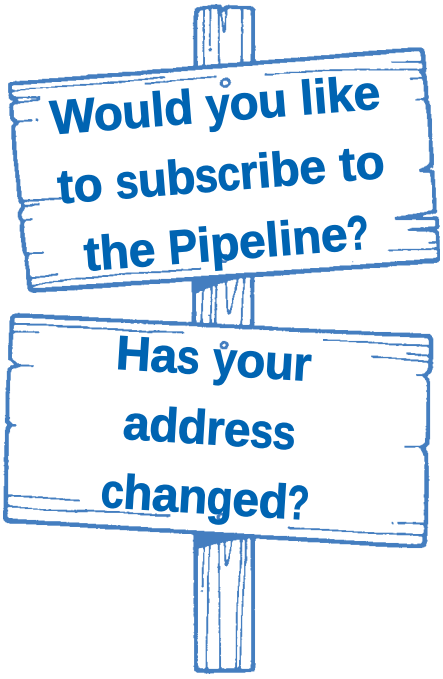
Three critical caveats

In summary, I'll leave you with three critical caveats:

- Apply environment sanitizer after cleaning and, ideally, with no other work in progress.

- Remember that water in floor drain traps and dilutes sanitizer effectiveness.

- Last, but most important, after applying environmental sanitizer, be sure you rinse all product contact surfaces before use in order to retain full culture activity.



Please help us keep our mailing list current! Simply phone, fax or e-mail the information requested below to:

The Dairy Pipeline
Center for Dairy Research
1605 Linden Dr.
Madison, WI 53706
phone: 608/262-8015
fax: 608/262-1578

You can also choose to forgo a mailed copy and get on our e-mail subscription list which will remind you to read the Pipeline on the web. E-mail this request to hogensen@cdr.wisc.edu

Name _____

Company _____

Street Address _____

City _____

State _____

Zip _____

Country _____

(and mailing code)

☐ CHANGE ☐ ADD ☐ REMOVE

Dairy Pipeline

The Dairy Pipeline
Center for Dairy Research
1605 Linden Dr.
Madison, WI 53706-1565
phone: 608/262-5970
fax: 608/262-1578

Karen Paulus, Editor

Technical Reviewers:
Mark Johnson, CDR
Norm Olson, Dept. of Food Science
Jim Path, CDR
Marianne Smukowski, CDR
Tom Szalkucki, CDR
Karen Smith, CDR
Bill Wendorff, Dept. of Food Science

The *Dairy Pipeline* is published by the Center for Dairy Research and funded by the Wisconsin Milk Marketing Board.

To subscribe to the Pipeline simply phone, fax, or e-mail your request to CDR. (Form on page 11) We welcome your questions and comments. Send them to:

Karen Paulus, Editor
e-mail: Paulus@cdr.wisc.edu
phone: 608/262-8015

You can also find the Dairy Pipeline on our website: www.cdr.wisc.edu

Calendar

Dec. 2-4 **Premium Ice Cream Short Course.** Madison, WI. Call Scott Rankin at (608) 263-2008.

Jan. 4-5 **Milk Pasteurization and Process Control School.** Madison, WI. Call Scott Rankin at (608) 263-2008 for information.

Jan. 13-14 **Producing Safe Dairy Products.** River Falls, WI. Call Ranee May at (715) 425-3704 for information.

Feb. 8-9 **Quality Milk Conference (WI Dairy Field Reps).** Madison, WI. Call Scott Rankin at (608) 263-2008.

Feb. 22-23 **Wisconsin Process Cheese Short Course.** Madison, WI. Call Jim Path at (608) 262-2253 or Bill Wendorff at (608) 263-2015 for more details.

Mar. 28-Apr. 1 **Wisconsin Cheese Technology Short Course**, Madison, WI Call Bill Wendorff at (608) 263-2015.

Apr. 20-21 **Wisconsin Cheese Industry Conference**, Madison, WI. For information, call Judy Keller at (608) 828-4550.

May 3-5 **Cultured Dairy Products Short Course**, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 10 **Wisconsin CIP Workshop**, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 11 **Dairy HACCP Workshop**, Madison, WI. Call Marianne Smukowski at (608) 265-6346.

May 17-18 **Applied Dairy Chemistry Short Course**, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 24-25 **Cheese Packaging Short Course**, Madison, WI. Call Bill Wendorff at (608) 263-2015.

***Wisconsin* Center for Dairy Research**
University of Wisconsin-Madison
1605 Linden Drive
Madison, Wisconsin 53706-1565