Volume 32 September 28, 2012 Number 36

CHEESE MARKET NEWS®

The Weekly Newspaper Of The Nation's Cheese And Dairy/Deli Business

Microbial research looks at shelf life, pasteurization

By Aaron Martin

MADISON, Wis. — A recent study on spore-forming bacteria microbes could help extend the shelf life of milk and change the way dairy processors view pasteurization, according to researchers at Cornell University.

Researchers in Cornell University's Milk Quality Improvement Program spent years researching and identifying predominant spore-forming bacteria in milk. By studying the enzyme activity of bacteria microbes, and what causes spore formations, researchers say they have found that the quality of fluid milk can be improved and spoilage can be averted after more than three weeks in the refrigerator by lowering the pasteurization temperature to 76-79 degrees Celsius (about 168-174 degrees Fahrenheit).

Turn to RESEARCH, page 10 ⇨

RESEARCH

Continued from page 1

The study has identified *Paenibacillus* bacteria as the predominant strains of spore-forming bacteria that cause milk and other foods to spoil. *Paenibacillus* are ubiquitous in nature and can cause off-flavors in a variety of foods and curdling in dairy products. The spores survive in dormant form despite modern sanitation, processing and packaging procedures. The bacteria also are suited to not only survive pasteurization, but they benefit from the "heat shock," which causes them to germinate. *Paenibacillus* also can reproduce in refrigerated dairy products at temperatures that would stop the growth of other types of bacteria.

Nicole Martin, a research support specialist at Cornell, says the findings are the result of more than 15 years of research.

"We've been isolating these bacteria in fluid milk — raw and pasteurized — and looking at the comparison of organisms we've found over the years to identify which ones are responsible for spoilage," Martin says.

Researchers studied 1,288 bacterial isolates found in milk and in the dairy farm environment. They found that only a handful of the strains accounted for 80 percent of the spore-formers present in milk.

"They grow well in milk — and possibly other foods — at temperatures as low as 43 (degrees) Fahrenheit," says Martin Wiedmann, Cornell food science professor and study co-author.

Lowering the pasteurization temperature to 76-79 degrees Celsius — still well above the standard 72 degree Celsius minimum — can prevent the formation of *Paenibacillus*, researchers found.

"A lot of spore-forming bacteria need to have a heat shock to germinate. That's one of the mechanisms contributing: The higher temperature shocks them into germinating," says Martin.

Turn to BACTERIA, page 11 ⇨

BACTERIA

Continued from page 10

Another factor, Martin adds, is that a natural enzyme in milk that helps to control bacterial growth is deactivated when milk is pasteurized at higher temperatures. When reduced to the lower 76-79 degree Celsius threshold, there is residual activity of that enzyme, which helps prevent bacteria formation.

"(Lowering pasteurization temperatures) is somewhat counter-intuitive, but it has been well received by the industry," Martin says. "I definitely think that it's something that is catching on. We've had a lot of interaction with processors in the Northeast, and across the country as well. This information has gone out to many co-ops, and this has the capacity to be a very instrumental tool for the industry to use. We don't have a way of eliminating spore formers, but optimizing conditions to control their growth is one of our best options."

Dean Sommer, a cheese and food technologist at the University of Wisconsin-Madison Center for Dairy Research, says cheesemakers already pasteurize milk for cheesemaking at low temperatures due to numerous added benefits.

"In cheesemaking, virtually across the board, cheesemakers pasteurize milk at as low a temperature as they can to meet the minimum pasteurization requirement of about 161 degrees Fahrenheit," Sommer says. "When you do it that way, you get a better coagulum, there is better retention of protein and it helps the maturation process during aging."

While research has shown that lowering pasteurization temperatures can help extend the shelf life of milk, Martin adds that the method offers the benefit of energy conservation as well.

"I don't see any drawbacks to lowering the pasteurization temp," she says."Lowering the temperature just a little bit had a significant impact on spore formation because it's not shocking these organisms into growth. At the same time, you have the added benefit of lower energy costs. It's a win-win situation."

Cornell researchers will next focus their research on preventing these spore-forming strains of bacteria from entering the milk supply.

Upstate Niagara Cooperative, which has more than 360 dairy producer members in western New York, has begun working with Cornell researchers to identify bacterial entry points in its facility. Milk samples that contain spore-forming bacteria are analyzed using DNA fingerprinting, which identifies the types of organisms present and where they originate. Martin says she hopes the project could become a model for approaching spore-forming bacteria in individual dairy processing plants across the country.

"We're looking at identifying the entry points for these organisms on the farm, identifying where they're coming in and what practices can be used to control them," Martin says. "Still, there isn't a one-size-fits-all solution because processors have their own systems and practices in place. With individual processors, like Upstate Niagara Cooperative, we go into their facility and do targeted trouble shooting because they are progressive enough to know what these organisms are."

Researchers say their work with *Paenibacillus* could have an industry-wide impact and help improve milk's foothold in an increasing cluttered beverage market.

"There's a lot of competitiveness in the beverage industry in general, so doing everything we can to get milk in consumers' hands that is not expiring in 7-10 days is very important. We want to make it as positive of an experience as possible for customers," Martin says. "Another thing we're dealing with in the dairy industry is longer shipping times for milk, which this could definitely play a role in."

Issues related to shipping and the shelf life of milk are especially prevalent in developing markets abroad, where some see the dairy industry's biggest growth potential.

"Control of food spoilage is critical in a world that needs to fee 7 billion people," says Wiedmann. "Approximately 25 percent of post-harvest food is spoiled by microbes before it is consumed."

The recently-released Tetra Pak Dairy Index identifies 2.7 billion low-income people living in developing countries, sometimes in remote regions. These people have an increasing awareness for nutritious foods and will have increasing financial means to purchase them, according to the Dairy Index.

"They represent a golden opportunity for dairy processors and packaging companies because today's low-income consumers are tomorrow's middle class," says Dennis Jönsson, present and CEO of Tetra Pak Group in the Dairy Index. "However, reaching these consumers will require new and innovative ways of working ... We are convinced that innovation, partnership and commitment hold the key to success in this market. We must develop products differently, distribute them differently and sell them differently to extend the availability of good nutrition in developing countries." CMN