Wisconsin Center for Dairy Research

DAIRY PIPELINE

A Technical Resource for Dairy Manufacturers

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Revisiting Calcium Lactate Crystals in Cheese

by Mark Johnson, senior scientist, Wisconsin Center for Dairy Research

Calcium lactate crystals in cheese are an old problem with a new twist. This review will focus on what we have learned about the formation of crystals and what we are learning from present day permutations. Research done here at the Center for Dairy Research (Johnson et.al 1990) supported earlier observations of Thomas and Crow who linked crystal formation with the transformation of L (+) lactic acid to D (-) lactic acid). Our work also confirmed observations that packaging (gas flush vs vacuum), temperature cycling and temperature of storage play a role in the appearance of crystals. Many researchers have found a correlation between crystals and higher levels of lactic acid in cheese. Despite these helpful leads, we knew the puzzle wasn't solved because we also saw that not all cheese with high acid developed crystals and not all gas flushed cheddar cheese with high acid developed crystals. Although vacuum sealed packages greatly limited calcium lactate crystal production, they did not stop it completely. Now, in the last several years we are seeing crystals forming in young cheese.

Storage temperatures do matter

Our 1987 research on the effect of increasing the temperature (40-65˚F in 5˚F increments) of cheddar cheese during ripening demonstrated the following; cheese ripened at 40˚or 45˚ showed no crystals and no free serum at the surface even after 6 months of storage. Cheeses stored at 50-65˚F had crystals but also had very damp surfaces and much free whey in the package. Even after removing the free serum and cutting off the crystals, free whey and crystals would again appear during storage. Cheese packages were puffy or "opened" since gas was also formed.

Why do storage temperatures matter? It is a solubility issue, calcium lactate is actually less soluble at lower temperatures. Thus cheese stored at low temperatures usually develop calcium lactate crystals more rapidly than cheeses stored at higher temperatures. However, the scenario described above underscores the importance of the movement of free serum in formation of calcium lactate crystals—it is more influential than storage temperature. (See the Dairy Pipeline, Vol. 15 no. 3 for an in depth review.)

Moisture migration makes a difference

Our theory is that moisture movement within the cheese, or to the surface of the cheese, facilitates the movement of calcium lactate to nucleation sites. When calcium lactate reaches a nucleation site a crystal grows and may even expand the openness of a package. An open or puffy package, where the cheese is not in tight contact with the packaging material, also creates or enhances nucleation sites on the cheese surface. Nucleation sites might be uneven or rough surfaces, perhaps created by cutting machines, actual pre-existing small crystals within the serum, or even pressure points from finger prints. This migration is influential. Thus, if the lactic acid content of the cheese is high enough, and if free serum forms inside or at the surface, crystals will form despite the storage temperature.

Free serum is created when the cheese casein network cannot hold the water. It is based on the electrostatic and hydrophobic interactions between casein molecules. (Lucey, 2003) Conditions leading to free serum are low pH (less than ~pH 5.0), high salt, proteolysis

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What's Inside:

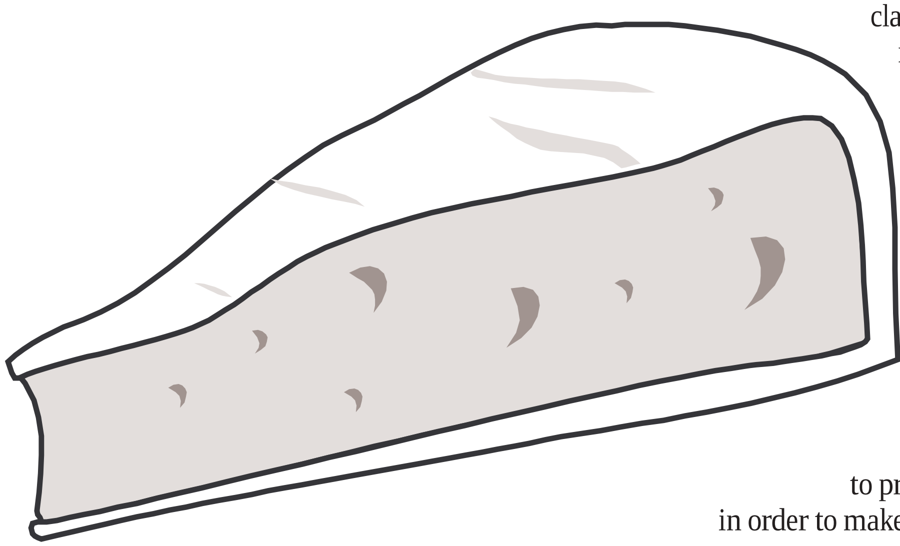
Specialty Cheese in the Southern Hemisphere

When Australian brie tops entries from around the world to win Best of Show you may guess that specialty cheeses in Australia are on the upswing. Jindi Cheese, located in the Victorian dairy farming region of West Gippsland captured Best of Class and then the big prize at the Wisconsin Cheese Makers Association (WCMA) 2002 World Championship Cheese contest. Jindi Cheese followed up in 2004 by taking Best of Class again in the Brie/ Camembert class. Brie and camembert are two of the many specialty cheeses now produced "down under." It is easy to track the expansion in the Australian cheese industry—in the mid 1980's Australia produced more than 50 varieties of cheese however by 1995 the number had grown to 225 varieties of cheese. (Willman 1998)

How did they do it?

Neil Willman knows many Australian cheesemakers, and chances are that he met them in the classroom. He is a cheese consultant and senior lecturer at the Gilbert Chandler campus of the University of Melbourne. In his role as cheese educator he teaches a beginning cheesemaking course as well as three different 5-day cheesemaking courses. In addition he travels long distances to teach cheesemaking courses in Australian cheese plants. Willman traveled another long distance recently when he journeyed to Wisconsin to serve as a judge in the 2004 WCMA contest. I had a chance to talk with him about the specialty cheese scene in Australia and learned that, even though Australia and Wisconsin are far in miles, their specialty cheese trends are close.

Not too long ago Australians consumed approximately 14 lbs of cheese per person, mostly cheddar. These days they are consuming about 26 lbs cheese per person annually, including the same 14 lbs of cheddar. The rest is a combination of parmesan, romano, mozzarella, and smaller amounts of washed rind and smear ripened cheeses, a class of cheese that was rarely made in Australia before the late 80's. Willman notes that the explosion in varieties of cheese available in Australia originated from the small and specialty cheesemakers. Much the same as U.S. specialty cheesemakers, the Australians were motivated by the need to produce higher value cheeses in order to make a profit or even survive.



"We have a Specialty Cheesemakers Association, which has evolved over time," says Willman. "In the last five years the focus has shifted to marketing."

Marketing and selling cheese

Like their U.S. counterparts, the specialty cheesemakers in Australia have found the biggest obstacle is marketing and selling their cheese. Willman advises them to start byunderstanding their market. He has seen that the right location makes a big difference, for example if a cheesemaker can capitalize on local tourism then it's a big plus. Comparable to here, Farmers Markets are taking off in Australia and some cheesemakers find success in that niche. Willman has noticed that the successful markets are the regulated ones, those that limit selling to folks who produce the food.

Before cheesemakers get to try their marketing prowess, Willman says that number one, they have to have the technical knowledge of cheesemaking. They need to understand milk, that it is a substance that changes over the season—particularly in a country like Australia that relies on seasonal milking. After the technical mastery comes the artistry part. Successful cheesemakers who make good cheeses are intuitive and use their senses. Willman says, "You have to smell the milk, smell the curd. You have to sense the cheese and become a part of it." And finally, there is the entrepreneurial urge that seems to drive small business owners, perhaps all the way to cheesemaking success.

References

Willman, Neil, The Australian Journal of Dairy Technology 1998, Vol. 53(2)

http://www.cheeselinks.com.au

"...specialty cheesemakers in Australia have found the biggest obstacle is marketing and selling their cheese."

Cheese interests are a family affair for Neil Willman (pictured at right) and his wife, Carole. Together they wrote the leading home cheesemaking book in Australia, "Home Cheesemaking— The Secrets of How to Make Your Own Cheese and Other Dairy Products." Carole Willman stays busy running a small business that sells home cheesemaking supplies as well as leading workshops for home cheesemakers.

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(especially if high salt), and warm temperatures. Warm temperatures also enhance the effect of low pH and high salt, you can see this in high salt, high pH cheeses like queso fresco which will readily form free moisture when warmed just to 45˚F.

Explaining other observations of calcium lactate crystals

Previous research suggested that fast acid development, from using fast starter cultures, is associated with lower incidence of crystals. (Dybing et.al. 1988) However, UW research (1980's) demonstrated that slow acid development (from *Lactococcus lactis subsp. cremoris*) or incomplete acid development (from *Streptococcus thermophilus*) produced cheddar cheese with no calcium lactate crystals. Why is this? I suspect certain strains of *Lactococci* are fast acid producers and tend to ferment all the lactose in cheese. These strains (typically *lactis* subsp.) are less inhibited by salt and acid (pH). They also grow better in cheese than the *cremoris* sub species or *Streptococcus thermophilus*, a species used to speed up acid development during manufacture of cheddar cheese.

Using *Streptocoocus thermophilus* as a starter culture could generate a fast but incomplete lactose fermentation, one that will not ferment all the sugar. Thus, you would produce a less acid cheese that is less likely to grow calcium lactate crystals.

In the UW study, pH at drain was ~6.2 and the pH at mill was ~ 5.4. Because of that study, we recommended that a lower drain and a lower mill pH should be used, but this advice alone is misleading. An important factor was that the strains we used also produced less acid in the cheese. Remember that the final pH of the cheese was ~5.1. Cheeses with a higher pH (cheese where pH did not drop below 5.0) tend to develop crystals slower than cheeses with a lower pH. This is due to lactic acid content. You can not have a low pH with low acid content. In our study lactose fermentation may not have been complete i.e the total lactic acid level in the cheese was only 1.2-1.3%. It is also possible that there was less lactose remaining in the curd.

It is our restrospective conclusion that the speed of the starter culture is not the most important variable. Instead, you should pay attention to the extent of acid development and the moisture level in the cheese because it influences the solubility of calcium lactate. These are the culprits that promote crystal formation. To put it bluntly, too much calcium lactate in too little serum = calcium lactate crystals.

More evidence

UW Research (1990, Johnson, M.,Journal of Dairy Science) conducted with a commercial manufacturer demonstrated that using faster starters and higher drain and mill pH resulted in higher lactic acid levels in cheddar cheese (1.4-1.6%). Coupled with the earlier UW research and observations of colby cheese (using fast cultures but with a wash to limit acid in curd) we concluded that total acid produced in the cheese rather than rate of acid development is the key to controlling calcium lactate crystals. In commercial production, where fast acid production is sometimes desired to increase through put, the drain and often the salt pH are much higher than when slow acid producers are used. But, fast acid producers "carry through" and ferment all the sugar while slow starters may leave lactose in the cheese to produce less acid and thus lessen the incidence of crystal formation.

Chemical reactions producing calcium lactate

Lactic acid^{-} + Ca^{++} = Calcium lactate
Lactic acid is extremely soluble in water, calcium lactate is not.

Commercial production	In cheese
Fermentation of sugars by selected bacteria = lactic acid, then add $CaCO_3$ = calcium lactate	Starters produce lactic acid + ionic calcium in serum = calcium lactate The source of ionic calcium is already present in serum since the calcium is derived from casein. As lactic acid is developed and as the cheese ages, casein bound calcium is released into the serum and can combine with lactic acid. Assumption: At high acid content (low pH) when crystals are most often seen, there will be enough available ionic calcium for the formation of crystals.

Slow acid producing *Lactococci* (typically *cremoris* subsp.) tend to be more sensitive to salt and pH. Also, they break down protein for growth slower since they do not survive as well in cheese. As a consequence, they may not ferment all the lactose in cheese, producing less acid in the cheese. Other bacteria could step in and ferment this available lactose and then you may see undesirable consequences like gas or off-flavors.

Limiting lactose

If you use cultures that will ferment all the lactose, the proven method to reduce the incidence of calcium lactate crystals is to limit lactose in milk or cheese. You can do this by washing the cheese or by using ultrafiltered (UF) milk. However, in order to reduce the lactose in the milk via UF, water must be added during the UF processing either by a process called diafiltration, or added water while blending of the UF milk with the cheese makers own milk supply.

Lower drain pH or a lower pH when most of the whey is removed may also slightly reduce the amount of lactose and lactic acid remaining in the curd. In addition, lower drain pH will lower the calcium level in the curd. Connecting the reduction of calcium levels in cheese to slower crystal development has, unfortunately, remained a very provocative but interesting theory.

Recent developments

In 1998, cheesemakers brought to our attention a new development in the calcium lactate crystal epic. Crystals are now seen in very young cheddar cheese with very few numbers of *Lactobacilli* (less than 10,000/ gram of cheese) present and no D(-) lactic acid in the cheese, only the L (+) isomer. This is different and not typical of past experience where all crystals were a mixture of both L and D lactic acids. The D isomer was the direct result of the metabolism of *Lactobacilli* in cheese, often influenced by very high numbers—one million to 100,000,000/ gram.

Both types of crystals are found in cheddar and colby cheese, but the L (+) calcium lactate crystals we see now are linked with high acid cheeses (> 1.5 % total acid) produced by cheesemakers using fast starters. Even though the colby curd was washed, apparently the wash treatment was not enough to significantly reduce lactic acid values. High acid content in cheese is most likely to occur when condensed milk or NDM is added, thereby increasing the lactose in the serum phase of the milk. Lactic acid in the serum phase of the cheese typically exceeds 4.0%.

The big question

How much lactic acid and calcium are needed to produce enough calcium lactate to precipitate as calcium lactate crystals? (See Table 1.) Most cheddar cheese is above the solubility limit in terms of lactic acid, but not all the lactic acid in cheese is calcium lactate. It's likely there are competing reactions for calcium or lactic acid.

Preventing calcium lactate crystals

The key is to preventing calcium lactate crystals is to limit the lactic acid content in cheese serum. (< 3.5% lactic acid in serum phase) To do this, consider reducing the lactose in serum of milk; if you are using RO or NDM add water. Reduce the lactic acid in cheese by rinsing the curd, a lower pH at rinse will be more effective. If you use UF milk, add water back to minimize lactose content.

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Summary: What you need to develop calcium lactate crystals

- ♦ You need enough lactic acid and ionic calcium (i.e. ca lactate) in the serum of cheese to exceed solubility. This is the only requirement. All other observations are about controlling the expression or nucleation of the crystal.
- ♦ Nucleation of the calcium lactate crystal is an essential factor. Lactic acid moves with serum of cheese, if the serum moves to the cheese surface or at sites within the cheese there will be a steady "feed" of calcium lactate. Nucleation may be a slow process but it is enhanced by the isomer of lactic acid, surface moisture, temperature fluctuation, and rough surfaces (even finger prints and cutting blades).
- ♦ The isomer of lactic acid is important because a mixture of D and L calcium lactate is less soluble than a solution of just L calcium lactate.

Table 1. Minimum lactic acid (LA) content of crystals exceeding solubility of calcium lactate

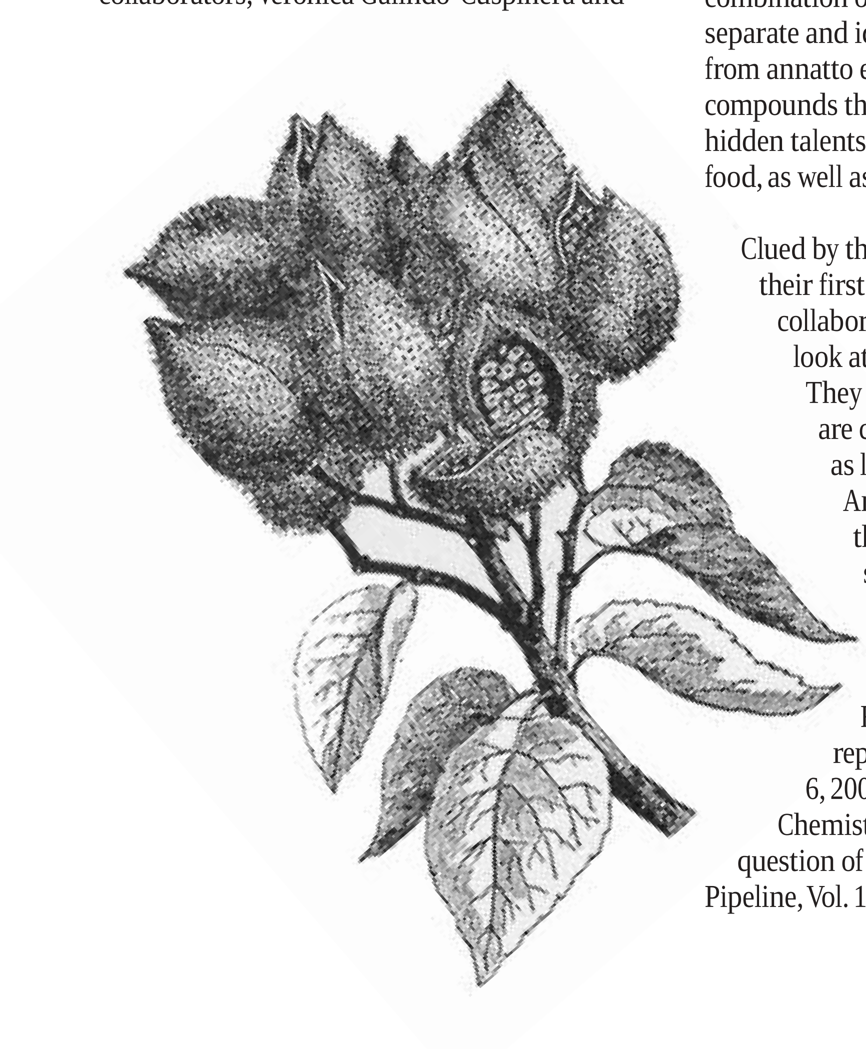
Cao et.al. 2001 Korean J. Chem Eng Lactic acid in DL (±) calcium lactate	
39˚F	1.77g/100 ml water = .67 % LA in 38 % moisture
50˚F	1.83g/100 ml water = .69 % LA in 38 % moisture
Kubantseva, Hartel, Swearingen 2004 J. Dairy Sci. Lactic acid in L (+) calcium lactate	
39˚ F	2.76g /100 ml water = 1.05 % LA at 38 % moisture
50˚ F	3.38g /100 ml water = 1.28 % La at 38 % moisture

Research Update
Does annatto have an antibacterial effect?

Although no specific reports are available in scientific journals, most people assume that annatto in cheese only influences the color of cheese. But is that assumption true? Cheesemakers are familiar with annatto extract, when they add it to cheese milk it provides the typical golden color of cheddar cheese. However, annatto fills a novel niche in other parts of the world. For example, people in some African and Latin American countries use annatto for medicinal purposes. In the West Indies an oil suspension of annatto is used to treat diabetes and South Americans use annatto on skin infections and to promote healing in burns and wounds.

> "...most people assume that annatto in cheese only influences the color of cheese. But is that assumption true? "

Scott Rankin, of the Food Science Department at University of Wisconsin—Madison, and his collaborators, Veronica Galindo-Cuspinera and Meryl Lubran from the University of Maryland are very well acquainted with annatto, or *Bix orellana L*. They used a combination of mass spectroscopy and gas chromatography to separate and identify 107 compounds in oil and water extracts from annatto extracts designated for food colorants. The array of compounds they identified suggests that annatto plant has some hidden talents, including the ability to influence the aroma of food, as well as antimicrobial and antioxidant properties.



Clued by the medicinal uses of annatto and encouraged by their first study the researchers, along with another collaborator, Dennis Westhoff, decided to take a closer look at the antimicrobial power of annatto in cheese. They set up their study to determine if annatto extracts are capable of influencing the growth of yeast as well as lactic, spoilage, or pathogenic microorganisms. Annatto may not be as inactive in cheese as we thought. According to the researchers this study suggests that "annatto may have some ability to influence microflora of significance to dairy foods, namely certain Gram positive species."

For more information check out the full research report in the Journal of Food Protection, Vol. 66, No. 6, 2003 and The Journal of Agricultural and Food Chemistry, Vol 50, No. 7. Also, Dr. Rankin addressed the question of annatto and flavor in a Curd Clinic column in the Pipeline, Vol. 14, No. 3.

Turning sweet whey into high quality whey powder

Under ideal conditions spray drying produces a high quality whey powder that is fine and free flowing. However, when the process goes awry whey powder can turn into a sticky, caked agglomeration that gums up equipment. Scientists have been working on this problem for years and they have made progress, but it is still an issue even as more whey is processed every year.

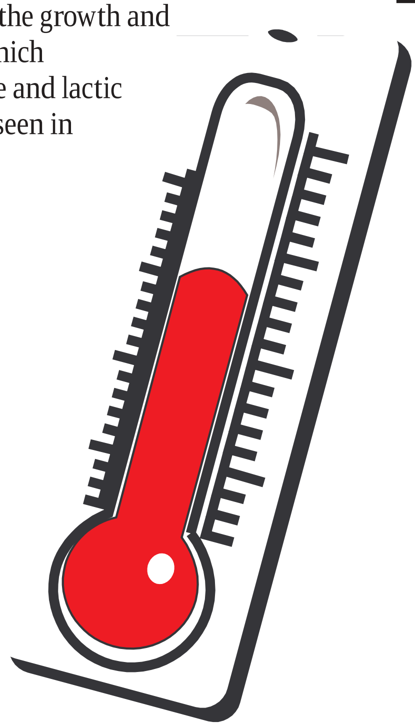
Rao, Wendorff, and Smith published the results of their whey research recently in the Journal of Food Protection, Vol. 67, No. 2, 2004. Their project, "Changes in galactose and lactic acid content of sweet whey during storage," measured changes in several types of whey during storage at different temperatures. The researchers built on results from many earlier studies that implicated galactose and lactic acid in the sticky whey powder problem.

High levels of galactose and lactic acid may indicate problems

Approximately 70% of the solids portion of whey is lactose, a portion of this breaks down into galactose and glucose. Although lactic acid only makes up around 3% of whey solids, it also influences the stickiness of whey powder. If these components are accumulating in whey you will see increasing problems with stickiness in the whey powder. Thus, high levels of galactose and lactic acid in whey may indicate problems ahead.

What influences the accumulation of these indicators? The study by Rao et al looked at the effects of storage temperature, cheese type (mozzarella vs cheddar), and the starter culture used in cheesemaking. They found that storing whey at elevated temperatures (37.8°C) promoted the growth and metabolism of starter cultures, which increased the amount of galactose and lactic acid. No significant increase was seen in refrigerated (4°C) samples.

The scientists also found that the galactose content was higher in mozzarella cheese whey when compared to cheddar whey. They suggest that the presence of the starter culture *S. salivarius ssp. thermophilus* in mozzarella whey might explain the difference. Rao et al concluded that storing whey at refrigeration temperatures, along with starter culture selection can help processors control the quality of spray dried whey powder.



The list below is a summary of current CDR administered research projects, funded by the Wisconsin Milk Marketing Board (WMMB)or Dairy Management Inc. (DMI)

Developing pH-sensitive biodegradable smart hydrogels using whey protein concentrate

Control of annatto cheese colors in whey products

Nutraceutical protein recovery from acid whey

Phase/state transitions that affect drying of whey products

Identification and control of off-flavors in commercially produced GMP products

Review and comparison of nutritional and functional properties of dairy proteins relative to other market protein sources

Characterization of pigments and conditions responsible for browning in whey powders

Improving WPI functionality for beverage applications

Curd Clinic

Curd Clinic doctors for this issue are John Jaeggi, cheese applications coordinator and Dean Sommer, cheese and food technologist at the Wisconsin Center for Dairy Research

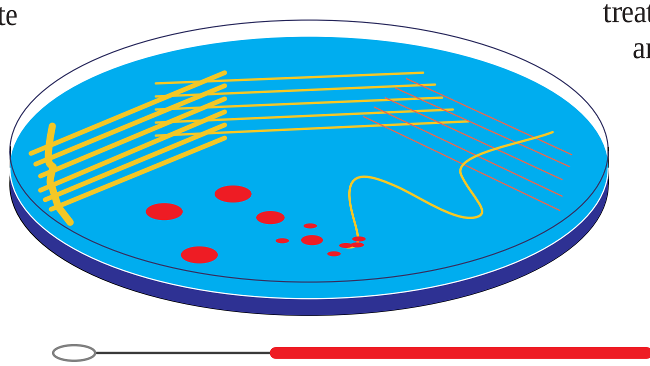
Q I have been having problems with small chunks in my mozzarella cheese, which seems to produce a stale off flavor in my cheese. I think this is related to standardizing with nonfat dry milk. Any ideas about the cause or the solution?

A. Thanks for bringing up an important and timely issue. Since the current milk supply is short and cheese prices are high, standardizing cheese milk is more important than ever. Thus, it's a good time to review quality issues you should consider when using nonfat dry milk (NDM).

We'll start with your question. We suspect that you are having some problems with rehydrating the NDM you are using to standardize your cheese milk. Actually, this particular problem of undissolved powder in cheese has decreased as the technology has improved. Many cheese plants use an improved mixing system which helps to rehydrate NDM completely. Additional research by Shuffleberger and Wendorff examined holding times and temperatures that promote the process of rehydration. (See side bar)

How long can you store it?

Another question we get about NDM is how long can you store the powder, or in other words, when it is too old? This a tough call, because storage temperature and humidity are just as important as the length of time you are storing NDM. Assess the storage conditions of your dry milk, what is the humidity level? An ideal level is less than 50%. Generally, after a year of storage you can expect some oxidation with resulting off-flavors. Remember to rotate your stock as you use it so you won't the have the problem of out of date stock piling up in the back of the storeroom.



As long as we are looking at timing, let's talk about the rehydrated slurry and how long you can hold it. Some people seem to think you can hold it forever, but that is not true; this is a vulnerable mixture that can support microbial growth. Wisconsin state regulations call for washing the tank or silo every 72 hours.

Any discussion of NDM quality issues needs to consider the influence of lactose. NDM has a rather high percentage of the milk sugar lactose, around 51%. When you add all this sugar to your cheese excessive acid will be produced—unless you use some sort of wash technique. It is almost better to make a rehydrated slurry, between 9 and 30% solids is a window to shoot for, depending on the cheese variety and the amount of lactose and the composition of your cheese milk. Figure out where you want your pH to be, and where you can add water in the cheesemaking process to compensate for the increase in lactose. Remember that cheese variety makes a big difference, the problem and the solution are different for cheddar cheese compared to jack or colby.

It is important to have a good supplier of NDM, with a consistent manufacturer, because your casein to total protein or true protein ratios can and do vary. One source of change is the well-documented seasonal fluctuation in milk components, milk powder from the fall and early winter months of October and November has a better balance of protein and minerals, with a higher percentage of protein.

Heat treatment history

A common variable that is hidden in NDM is its heat treatment history. When it changes, from lot to lot for example, your cheese moistures will vary and you'll see inconsistencies in your product, both in body and texture. Scorched particles in NDFM from high heat treatment can cause problems, too. The particles come through in the cheese producing a surprisingly speckled mozzarella. So when it comes to buying NDM for cheesemaking you want to make sure it is a low heat treatment powder, as low as possible and as consistent as possible.

Flavor issues are another aspect to monitor when adding NDM to standardize cheese milk, particularly in Hispanic style cheeses. You want a milky, fresh taste in these cheeses and since some cheesemakers don't use starter cultures and the cheese pH is high you are particularly vulnerable to stale flavors coming through. For this reason, it is important to taste and evaluate the flavor of your NDM.

There is another flavor issue that is occasionally noticed by the plants adding NDM right to the cheese milk. This particular approach can agitate the milk excessively, causing lipolysis and breakdown of fats. The result could be rancid flavors developing in your cheese.

Foaming is another potential issue when rehydrating NDM powders. You can use defoaming agents to control the foaming you see during rehydration, but you need to know that you might be solving one problem while causing another. Our whey specialist, Karen Smith, recommends against using a defoaming agent if you are going to use membrane technology down the line to separate whey proteins.

Remove those artifacts

Sifting your NDM powder before rehydration will also prevent problems by removing pieces of paper and plastic from the multiwall bags used to store the powder. Or, you can run the rehydrated fluid through a strainer of some sort, perhaps a filter or a stainless mesh filter. It's very difficult to detect metal in a 50 lb bag so when you start collecting plastic, braided wire, and other artifacts on your filter, you will be glad you added this reliable step.

In summary, since the quality of NDM added to your cheese vat will indeed affect the quality of your cheese you should continuously analyze and assess what you can do to monitor and maintain quality. For larger plants this might mean more testing, many smaller plants accomplish this by staying with a supplier who can consistently deliver a quality product.

Resources

http://www.usda.gov/standards/standair.htm
http://www.adpi.org/product_drymilk.asp

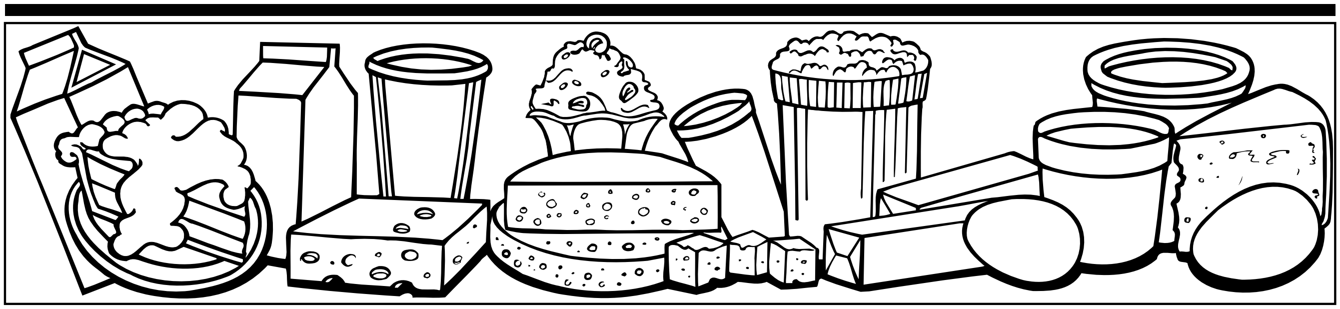
Optimal conditions for rehydrating NDM

Back in 1996 Bill Wendorff stepped up to the podium at the Wisconsin Cheese Makers Assoc. LaCrosse Cheese Show and presented the results from his studies on the effects of standardizing mozzarella cheese using NDM. Wendorff noted that there didn't seem to be any limit to the amount of condensed skim milk that could be added to cheesemilk, no significant problems were seen. In contrast, only 15 to 20% of the solids in cheese milk could be supplied by NDM. Any higher and you would start to see defects like weak body and poor stretch in the cheese. Both condensed skim milk and NDM had most characteristics in common; for example they received the same basic heat treatment. What caused the difference in the cheese?

A two year study to answer the question focused on NDM, both the spray drying process and rehydration. Several combinations of reconstitution times and temperatures were used to make cheese and the experimental cheeses were then evaluated for shreddability, browning and composition. Based on the results of this study, Wendorff recommended reconstituting NDM at 32˚+C for 2 hours before blending it with whole milk and pasteurizing. Following this protocol allows cheesemakers to use NDM to make up 40% of the total solids without affecting the cheese quality.

Reference

Effect of standardization on characteristics of mozzarella cheese. Wendorrf, Bill. In Maximizing Cheese Yield, produced by the Wisconsin Center for Dairy Research



News from CDR

UW Food Science professors honored

In January 2004, Dr. Elmer Marth, professor emeritus of the University of Wisconsin–Madison, was awarded the highest honor bestowed by the National Cheese Institute, the NCI Laureate Award. This award recognizes individuals who have made significant contributions to the development and growth of the industry, and Dr. Marth's achievements are many. Not only did he distinguish himself as a teacher, but Marth also conducted critical research on foodborne pathogens and authored hundreds of research papers and several books. Congratulations Dr. Marth.

Rich Hartel will be awarded the 2004 IFT Research and Development Award at the IFT (Institute of Food Technologists) meeting in Las Vegas in July 2004. This award recognizes an IFT member who has made a recent, significant research and development contribution to the understanding of food science, food technology, or nutrition. Congratulations to Rich!

Master Cheesemaker Richard Glick, Swiss Valley Farms

Ten year anniversary of Wisconsin Master Cheesemaker® Program

Back in 1994 Jim Path announced the beginning of the Wisconsin Master Cheesemaker ® Program by putting out a call for applications at the annual International Cheese Technology Exposition (ICTE). Three years later, in 1997, the first Masters graduated at the ICTE awards banquet and now, including this year's graduate, we have 40 Wisconsin Master Cheesemakers. If you are considering the program the application deadline is coming up, contact Jim Path and sign up before May 15th.

Latest Master Cheesemaker graduates

Making cheese for 40 years is already a claim to fame but now Richard Glick built on those 40 years of experience and also completed the requirements to earn the title of Master Cheesemaker. Glick, who makes both blue cheese and gorgonzola for Swiss Valley Farms, will be certified in both cheeses. Although he has made many varieties of cheese over the years he is particularly proud of his Mindoro blue, and Glick's goal is for people to think of Mindoro blue when they think of blue cheese.

Scott Erickson earned Master Cheesemaker status back in 1998, but this year he is coming back to be certified as a Master in Chevre, the first Master to complete the program 3 times. Scott is proud of his Master Cheesemaker status and encourages Wisconsin cheesemakers to consider the program.

Calendar, continued from back page

June 22-25 American Dairy Science Association Annual Meeting, sponsored by American Dairy Science Assn. St. Louis, MO. For more information call ADSA, (217) 356-5146.

Aug. 17-18 Milk Pasteurization and Process Control School. Madison, WI. Call Scott Rankin at (608) 263-2008 for information, or the CALS Outreach Services (608) 263-1672 to register.

Sept. 28-Oct. 2 World Dairy Expo, Madison, WI. For information see www.world-dairy-expo.com.

Oct. 4-8 Cheese Technology Short Course, Madison, WI. Call Bill Wendorff at (608) 263-2015.

Oct. 19-20 Membrane Processing Short Course, Madison, WI. Call Bill Wendorff at (608) 263-2015 or Karen Smith at (608) 265-9605.

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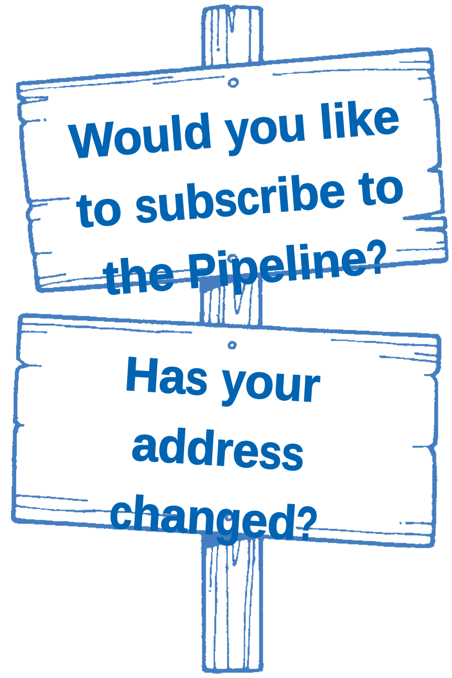
UF milk by itself does not change lactose in serum phase of milk, but adding water does.

Use cultures that do not ferment all the lactose. Remember that this must be done along with using pasteurized milk or gassy cheese could result. In addition, to prevent L/D calcium lactate crystals keep *Lactobacilli* levels less than 100,000/g to slow racemization. Again, it is important to pasteurize, and to use proper plant hygiene with cool storage temperatures (45˚F or less). Match your cheese with the desired end-use. For example, use properly washed cheese when mild cheese will do, especially if it is used as cubes, and slices or in opened packages.

Conclusion

The issue of calcium lactate crystals is a complex one, and for this reason there are no magic solutions that fit all observations. We know what enhances the potential for problems: open packages, temperature cycling, moisture migration within and to the surface of the cheese enhanced by high acid content, and formation of D(-) calcium lactate crystals. However, whether or not calcium lactate crystals develop is ultimately determined by calcium lactate content in the serum phase of the cheese. Once this level is exceeded, crystals can form.

There are proven methods to reduce the level of lactic acid in cheese and therefore decrease the incidence of calcium lactate crystal formation. What we need to know more about are the factors that influence and initiate the nucleation of calcium lactate crystals.



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Calendar

May 4-6 Cultured Dairy Products Short Course , Madison, WI. Call Bill Wendorff at (608) 263-2015 or John Jaeggi at (608) 262-2264.

May 11-12 Applied Dairy Chemistry Short Course, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 18 Wisconsin CIP Workshop, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 19 Dairy HACCP Workshop, Madison, WI. Call Marianne Smukowski at (608) 265-6346.

May 25-26 Cheese Packaging Short Course, Madison, WI. Call Bill Wendorff at (608) 263-2015 or Mary Thompson at (608) 262-2217.

June 2 Developing a Listeria Action Plan for Regulatory Compliance and Consumer Safety, Madison, WI. Sponsored by WI Assn. for Food Protection. For further information, call Neil Vassau at (608) 833-6181.

June 8-9 Wisconsin Cheese Grading Short Course, Madison, WI. Call Scott Rankin at (608) 263-2008 or Marianne Smukowski at (608) 265-6346.

June 27-29 WDPA and Marschall Cheese & Dairy Seminar, Spring Green, WI. Sponsored by WI Dairy Products Assn. For further information, contact WDPA at (608) 836-3336.

July 12-16 IFT Annual Meeting, Las Vegas, NV. For information see www.am-fe.ift.org.

July 21-25 American Cheese Society Annual Meeting. Milwaukee, WI.. For info, call (502) 583-3783.

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