Wisconsin Center for Dairy Research

DAIRY PIPELINE

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A closer look at cream cheese

by John Lucey, assistant professor of Food Science, University of Wisconsin—Madison

Cream cheese, whether it is dolled up with walnuts and honey or dispersed in the swirls of a mocha chocolate cheesecake, almost always plays a supporting role. Although rarely the star attraction on a menu or a cheese plate, steady sales and increasing exports suggest that cream cheese may be understated but it is a successful product.

A clue to the popularity of cream cheese can be found in the sales statistics for its steady companion, the dense and chewy roll also known as a bagel. According to the International Dairy Foods Association, the per capita consumption of cream cheese was 1.53 lbs per person in 1988. By 1993, that number increased to 2.07 lbs per person. The American Institute of Baking (AIB) can show a parallel growth curve, bagels climbed from 2.5 lbs per person in 1988 to 3.5 lbs in 1993. Bagels took off from there, increasing from a consumption rate of 14.2 per person per year in 1993 to 26 per person by 1996. Cream cheese was up to 2.7 lbs per person by 1997.

Cream cheese includes several closely related products including single cream cheese, double cream cheese, Neufchatel and bakers' cheese. In the U.S. standards of identity, (cream cheese must contain a minimum of 33% fat and a maximum of 55% moisture. Neufchatel cheese must contain at least 20% but less than 33% fat and a maximum of 65% moisture. Bakers' cheese is produced in the US. and widely used in the bakery and confectionary trades; hence its name. It is made from skim milk and has a soft, dry, pliable curd. Neufchatel cheese is made from milk containing ~5% fat, but otherwise the†procedure is similar to cream cheese. Since it has a lower fat content, Neufchatel has a grainier body and is not as smooth as cream cheese.

What's Inside:

The main processing steps in the manufacture of cream cheese are diagrammed in Figure 1. (See page 9) Cream cheese is typically made from milk with a fat content ranging from 9-14%. Milk is standardized and homogenized (1700-2400psi at 122ºF) and cooled to ~88ºF for a short-set (incubation time, ~ 5 h) or ~ 72ºF for a long-set procedure (incubation time, 12-16 h). Starter is added (e.g., 2%); the level depends on the incubation period and temperature. At the end of incubation, the pH is ~4.7.

To encourage syneresis and efficient separation, the gel is broken using agitators and heated to 104-131ºF as whey is separated from the curd. Traditionally, whey was drained using cloth bags, however you can use a cream cheese separator or ultrafiltration (UF). The UF operating temperature is usually 122-131ºF, which reduces viscosity while concentrating.

Product types diverge

At this point product types diverge into one of two options, cold pack or hot-pack. In the manufacture of cold-pack cream cheese, after whey separation, the cold curd (~ 50-54ºF) is salted, stabilizers are added and the product is packaged. Stabilizers are added to help prevent syneresis that releases free moisture on the surface of the product during storage. Typically, around 0.3% of either one or more stabilizers, such as locust bean gum, guar gum, xanthan gum and carrageenan, are added. In some cream cheese products, whey protein concentrates are also added to stabilize the gel.

During the hot-pack process, the curd is mixed with salt and stabilizers in kettles or scraped-surface heated vats and heated to 149-158ºF. The hot curd (~ 149-158ºF) is then pumped

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This is an edited version of Dr. Jesse's original document, which is located under publications on the following website: http://www.aae.wisc.edu/future/ Also, check out A Primer on Milk Proteins in the September 2002 Dairy Pipeline for a review of milk proteins: http://www.cdr.wisc.edu/

Do Imports of MPC and Casein Reduce U.S. Farm Milk Prices?

by Ed Jesse, Professor and Extension Dairy Marketing Specialist, Department of Agricultural and Applied Economics, University of Wisconsin-Madison/Extension.

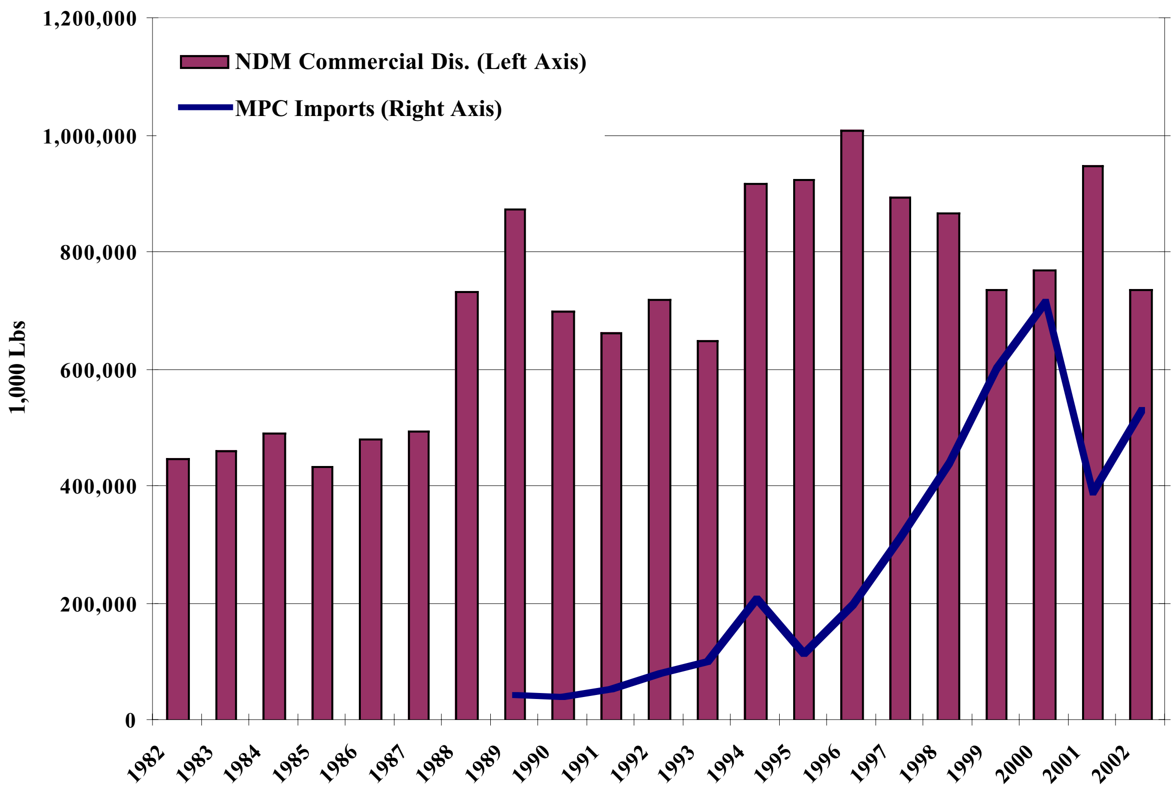
Imported milk protein has, once again, become a hot button in the U.S. dairy industry. The current controversy concerns milk protein concentrate (MPC) a relatively new form of concentrated dairy-based protein. Technically, MPC is made by ultrafiltration of skim milk, which removes water and some lactose and minerals, making it a desirable protein for standardizing cheese milk.

Under the 1994 World Trade Organization (WTO) agreement, imports of casein enter the U.S. duty-free. MPC and caseinates and other casein derivatives are subject to a U.S. tariff of only 0.17 cents ($0.0017) per pound. This very favorable customs treatment of MPC and other milk proteins has led to a sharp rise in imports since1994. MPC showed the largest rate of growth, increasing from just over 10,000 metric tons in 1995 to almost 65,000 metric tons in 2000. Imports of MPC in 2002 totaled about 41,000 metric tons after falling to 35,000 metric tons in 2001. About 60 percent of 2002 MPC imports came from New Zealand.

A popular question in dairy circles is, "What is the effect of milk protein imports on producer milk prices?" There is no shortage of answers, ranging from "absolutely no impact" to "utter devastation." Those holding the former view argue that, at worst, imported milk proteins displace a small amount of nonfat dry milk; an amount much smaller than government purchases. So, if there are any spillover costs, they are being borne by taxpayers, not by dairy farmers.

People who believe milk proteins have a large negative effect on U.S. milk prices argue that nonfat dry milk displacement exceeds government purchases, and that excess cheese supplies augmented by MPC and other milk proteins have depressed the cheese market. Those favoring import restrictions also claim that recent reductions

Figure 1. MPC Imports and Commercial Disappearance of Nonfat Dry Milk



in the government purchase price for nonfat dry milk, which lowered the federal market order prices for certain classes of milk, were attributable to large displacement of domestic nonfat dry milk by imported milk proteins. Some go further in arguing that imported milk proteins are poor-quality products produced under unsanitary conditions, turning off consumers and reducing overall dairy demand in the U.S.

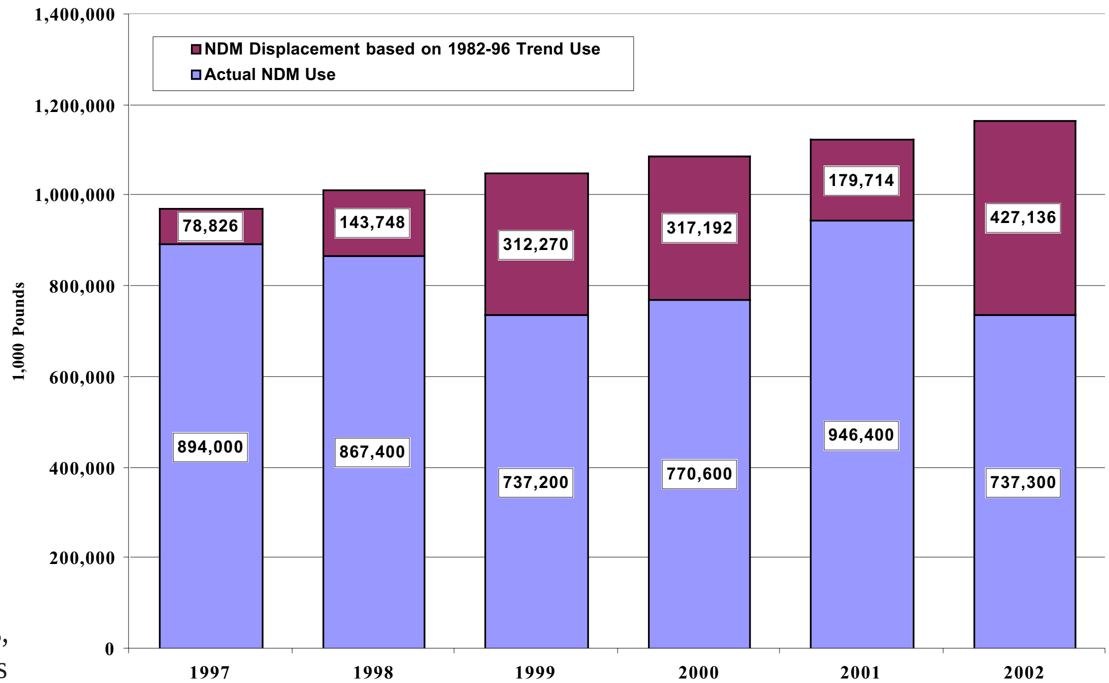


Figure 2. Imputed Nonfat Dry Milk Displacement by MPC, 1997-2002

The correct answer lies somewhere between these extremes. Unfortunately, deriving a precise answer is impossible because we don't have hard information on how imported milk proteins are used. For example, we don't know how much imported milk protein is used in industrial products versus food products for which protein in the form of nonfat dry milk might substitute. And, we don't know how much more cheese is being made than would be if it weren't for imported MPC. We don't know how well nonfat dry milk substitutes for MPC and casein in various applications, so we don't know how much of a price premium for imported milk proteins might be sustainable if tariffs were applied.

The best we can do under the circumstances is provide some general guides. To begin with, it is reasonable to assume that the principal effect of imported concentrated milk proteins is to displace usage of nonfat dry milk, the major domestic source of milk protein. Further, it is clear that MPC and Casein-MPC, among the various forms of imported milk proteins, substitute reasonably well for and therefore displace domestically produced nonfat dry milk. Figure 1 provides persuasive evidence of that displacement.

Note that nonfat dry milk use increased fairly steadily between 1982 and 1996. The annual rate of increase was about 40 million pounds per year, with the spikes generally indicating years during which the U.S. enjoyed unsubsidized exports. Commercial use steadily declined between 1997 and 1999 while MPC imports increased rapidly. When MPC and casein-MPC imports fell 45 percent in 2001, commercial use of nonfat dry milk rose 23 percent to pick up the slack.

How much nonfat dry milk has been displaced by increasing imports of MCP and other milk proteins? One way to answer this is to assume that the observed trend in nonfat dry milk use between 1982 and 1996 would have continued if these increases had not occurred. A continuation of trend growth in the use of nonfat dry milk implies that nonfat dry milk would be the primary ingredient for standardizing an increasing supply of cheese milk. (Or alternatively, that condensed skim milk equivalent in volume to nonfat dry milk was used for standardization and correspondingly reduced production of nonfat dry milk.) Further, it implies that nonfat dry milk would be used instead of imported milk proteins to make products within the growing markets for dietary supplements and energy/sports drinks and foods. The validity of both assumptions is questionable—it is possible that because of the greater functionality of imported specialized MPC, it would be used even if stiff tariff-rate quotas were applied. It is also possible that nondairy proteins would be used in some food applications if imported dairy proteins were not available.

Figure 2 shows actual commercial use of nonfat dry milk from 1997 through 2002 compared with projected displacement by MPC and other imported milk proteins substituting for nonfat dry milk. Displacement is the difference between trend

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use and actual use. For example, commercial use of U.S. nonfat dry milk in 1999 was 737 million pounds. Trend usage was 1.049 billion pounds. So the imputed, or ascribed, displacement of nonfat dry milk by expanded imports of milk proteins was 312 million pounds. With the exception of 2001, imputed nonfat dry milk displacement increases each year, peaking at about 430 million pounds in 2002. Note that this procedure says nothing about how much nonfat dry milk was displaced in 1996 and before. It only estimates how much nonfat dry milk use was reduced by *changes* in milk protein imports since 1996.

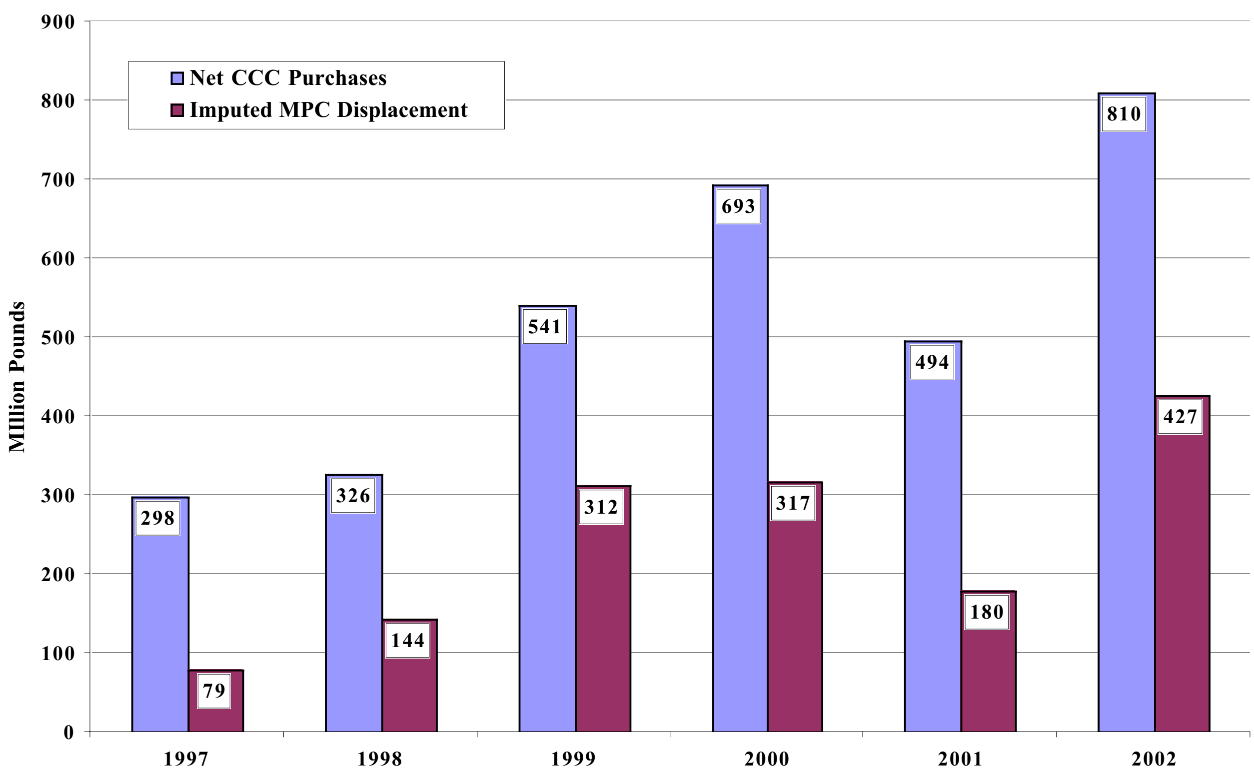
Figure 3 compares government purchases of nonfat dry milk under the dairy price support program to the amount of U.S.-produced nonfat dry milk that imported milk proteins may have displaced. With the exception of 2001, nonfat dry milk purchases have increased each year since 1997, with 2002 purchases estimated at over 810 million pounds. The government purchased more nonfat dry milk than was imputed, or ascribed, to MPC displacement each year. The gap between government removals and imputed displacement has grown from about 200 million pounds to nearly 400 million pounds.

The displacement estimates derived in this fashion very likely err on the high side. But even if displacement is as large as indicated, production of nonfat dry milk is expanding more rapidly than the amount that is displaced by MPC and other milk protein imports. Government nonfat dry milk purchases increased by 500 million pounds between 1997 and 2002. They still would have increased, but only by about 200 million pounds, if imports of concentrated milk proteins had remained at 1996 levels.

This raises an important question related to the effect of milk protein imports on price. Under the dairy price support program, the U.S. Secretary of Agriculture reduced the purchase price for nonfat dry milk and raised the butter purchase price twice in the last two years. These relative price changes are called butter-powder "tilts." The question is, "What if government purchases of nonfat dry milk had been smaller? What if they were decreased by the amount displaced by imported milk proteins? Would USDA have implemented the butter-powder tilts in 2001 and 2002?"

There is no question that the two tilts reduced average farm milk prices. Federal orders were amended in January 2000 to adopt a new Class I price "mover." The mover is the higher of an advanced formula price for Class III skim milk (used for cheese and whey) or Class IV skim milk (used for nonfat dry milk). Class IV skim milk prices have served as the Class I mover most of time since adoption of the "higher of" mover.

Figure 3. Nonfat Dry Milk: Government purchases compared to imputed MPC



The Class IV skim milk formula price varies solely with the price of nonfat dry milk, and the commercial price of nonfat dry milk is tied closely to the government purchase price. When the purchase price for nonfat dry milk was reduced by the tilts, the market price moved down almost in lock step. So whenever Class IV was the mover, the Class I price was correspondingly lower because of the lower government purchase price.

Had the tilts not occurred, the Class I price (at 3.5 percent butterfat) from July 2001 through February 2003 would have averaged an estimated $0.66 per hundredweight higher. The tilts also affected monthly Class II and Class IV skim milk prices, which are tied exclusively to the price of nonfat dry milk. The estimated average monthly impact of the tilts on Class II and Class IV prices (at 3.5 percent butterfat) since the May 2001 tilt is about $0.80 per hundredweight.

Using all-market average annual average producer milk utilization by class for 2001, the monthly average price reductions attributable to the tilts are estimated at about $0.40 per hundredweight across all markets. For the Upper Midwest order, which has relatively high Class III use, the estimated average monthly price reduction is 17 cents per hundredweight. For the Florida order, with high Class I utilization, the comparable value is 66 cents.†In some markets, larger over-order premiums for Class I and Class II milk probably offset some or all of the reduction in minimum federal order prices. Consequently, the price reductions noted are larger than what actually occurred.

Butter powder tilts cut farm-level milk prices

There is a major issue regarding the economic and political wisdom of using the dairy price support program to prop Class I prices (see Jesse and Cropp). Regardless of one's position on that issue, it is clear that butter powder tilts cut farm-level milk prices. But the larger question is whether these tilts would have occurred if milk protein imports had been curtailed.

It's not possible to definitively answer that question. On one hand, the Secretary of Agriculture is bound by law to adjust butter and nonfat dry milk prices as often as twice per year in order to minimize the cost of the dairy price support program. Adhering to this legal commitment means that the Secretary would have been obligated to reduce the nonfat dry milk purchase price (and raise the butter purchase price) even if milk protein imports had remained at 1996 levels. Nonfat dry milk purchases would still have been significant and butter purchases nil.

On the other hand, legal commitments of the Secretary often seem to be interpreted in light of political pragmatism. Sufficient political pressure may have been mounted to prevent the tilts if nonfat dry milk purchases and stocks had not increased as much as they did.

How serious is the threat to U.S. dairy farmers? Imported milk protein concentrate has shown robust growth, partly in response to the absence of border protection by the U.S.—a post-WTO agreement "push" factor. The growth in MPC imports has also occurred because MPC is cheaper than domestic sources of milk protein, because it is a very functional ingredient in a rapidly growing market consisting of high-energy foods and beverages, and because it increases the efficiency of cheesemaking— "pull" factors.

Making a case for comparable treatment

Some of these explanations behind the growth of imported MPC underlie legitimate concerns of U.S. dairy farmers. For example, it makes little sense to apply restrictive tariffs on nonfat dry milk imports and simultaneously allow unlimited imports of a reasonably close substitute, MPC, essentially duty-free. There is a strong case to be made for comparable customs treatment of nonfat dry milk and MPC imports. At the same time, there are real questions about whether it is realistic or even possible to increase border protection in the middle of new WTO negotiations.

Other reasons reflect more of a protectionist attitude than a legitimate concern. In particular, foreign suppliers of MPC have been quick to heed the call of U.S. food manufacturers for tailored milk proteins. Primarily because of artificial price signals coming from the dairy price support program, potential U.S. suppliers of specialized milk proteins have found it more profitable to manufacture a generic substitute—nonfat dry milk—that does not meet the specifications of these manufacturers. Consequently, U.S. producers have not enjoyed the benefits of this expanding market. The same argument applies to cheese milk standardization. Besides being cheaper to purchase, MPC increases efficiency in the cheese plant. It is illogical to expect cheesemakers to voluntarily use nonfat dry milk instead of a more functional source of protein that is also less expensive.

At least for now, the price effect of MPC imports seems minimal. MPC does displace large volumes of nonfat dry milk. But the production of nonfat dry milk in the U.S. substantially exceeds what would be purchased commercially even if imports of MPC and other milk protein had not increased

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Wisconsin Master Cheeser

Bob Wills, Cedar Grove Cheese
Plain, Wisconsin

The five cheesemakers who make up the 2003 class of Wisconsin Master Cheesemakers™ are enthusiastic about their work and modest about their accomplishments. They have all produced award winning cheeses, but that isn't what they talk about when you ask them about cheesemaking. Instead, they'll tell you about the people who taught them to make cheese, fathers who instilled a drive for quality, fathers-in-law they worked alongside, and mentors who "know more from smelling the plant than I'll ever know."

Bob Biddle grew up in a cheese plant, he remembers watching his father make cheese from the vantage point of an unused 10,000 lb open vat that also served as a playpen. Cheesemaking has always been part of his life and to this day Bob still calls his Dad for advice. He notes that his Dad "is one of the best cheesemakers I ever knew, I think he forgot more about making cheese than I know."

Randy LaGrander's history is similar, as far back as he can remember he's been working in a cheese plant. His father, Dan, always joked that the way he was brought up he should have whey running in his veins instead of blood. Randy had his cheesemakers license by the time he was 15, even before his drivers license. Even though Randy has taken over the business, his Dad's retirement job is—you guessed it—working around the plant.

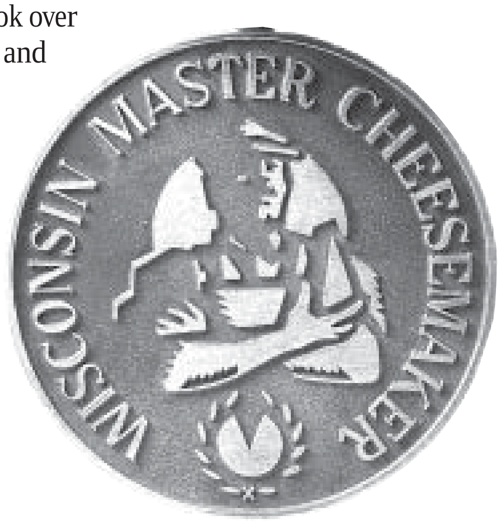
Randy La Grander,
LaGrander's Hillside Dairy, Inc.
Stanley, WI

And then there's the legend—Roger Krohn. You'll have to talk to Terry Lensmire to get the details of this story, but that's the label pinned on Roger by a customer when Randy took a trip to New York city. Roger is a third generation cheesemaker who started working in the plant after school and summers when he was 14. After graduating from high school he went fulltime, making minimum wage in the packing area. Roger enjoyed his Master classes but he says, "You can learn a lot from books and classes but there is nothing like first hand experience. Working side by side with my Dad was invaluable." Readily acknowledging his enjoyment making cheese, Roger always looks past the daily cheesemaking to the end product that will reach the customer. He wants them to be pleased with their decision to buy his cheese.

Jim Mieves and Bob Wills both had interests in dairy science and agriculture but their lives took different directions when they married into cheesemaking. Jim Mieves was a Dairy Science major at the University of Wisconsin when he took a year off to make cheese, he never did go back. In 1978 Jim started working for his future father in law, Billy Lehner and in 1985 Jim began making cheese at Chula Vista, where he is today.

makers, Class of 2003

When Bob Wills fled academia he was teaching Ag Economics and doing research. He began to dread a common question from his students, "Is this going to be on the exam?" Bob became a student himself, learning about cheesemaking from his customers, his father in law, Ferdie Nachreiner, and cheesemaker Dan Hetzel. Bob took over the factory in 1989 and he continues to appreciate the fact that cheesemaking is such a "wonderful combination of science and art" that allows him to just keep learning.



Jim Mieves, Chula Vista Cheese Co.
Browntown, Wisconsin

Roger Krohn, Trega Foods
Luxemburg, Wisconsin

Bob Biddle, Swiss Valley Farms
Platteville, Wisconsin

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since 1996. Whether the displaced nonfat dry milk that ultimately ended up in government storage induced butter-powder tilts and associated lower producer milk prices is an open question.

It seems unlikely that imported MPC is stimulating excess natural cheese production. Given normal price relationships between butter and cheese, cheesemakers strive to use as much butterfat in their milk supply as possible by adding milk protein. MPC possesses desirable characteristics for standardizing cheese milk, but nonfat dry milk that is currently displaced would be used if MPC were not available. Hence, the same volume of natural cheese would likely be made, albeit at a higher cost. MPC and other milk proteins may be adding to the supply of process cheese, but again, in the absence of MPC, manufacturers would likely turn to nonfat dry milk as an alternative source of protein and supply the same volume of process cheese. Simply put, it is hard to argue that MPC is lowering farm milk prices as long as the U.S. government is purchasing more nonfat dry milk than is being displaced by MPC.

Casein imports do not appear to pose a serious threat to U.S. dairy farmers. It is clear from relative prices and the stability of imports that casein does not displace significant quantities of nonfat dry milk or other dairy ingredients. The primary uses of casein are industrial or in food and feed applications for which nondairy proteins can substitute.

Caseinates are another matter

Caseinates are another matter. U.S. imports of caseinates more than doubled between 1993 and 2001, suggesting that they were increasingly being used in food products for which nonfat dry milk might have been employed. On the other hand, the functional characteristics of caseinates are distinctly different from nonfat dry milk, so the increase in imports may be associated with new or expanded uses.

Finally, there are questions pertaining to whether and how domestic production of specialized milk proteins might be stimulated to meet what is clearly a growing domestic demand. Federal subsidies and a separate federal order classification have been offered as options. These and other options merit further discussion. But a first step in any effort to stimulate production is correcting marketplace signals. As long as making nonfat dry milk generates more net dollars per hundredweight of milk than making MPC, U.S. processors will continue to make nonfat dry milk.

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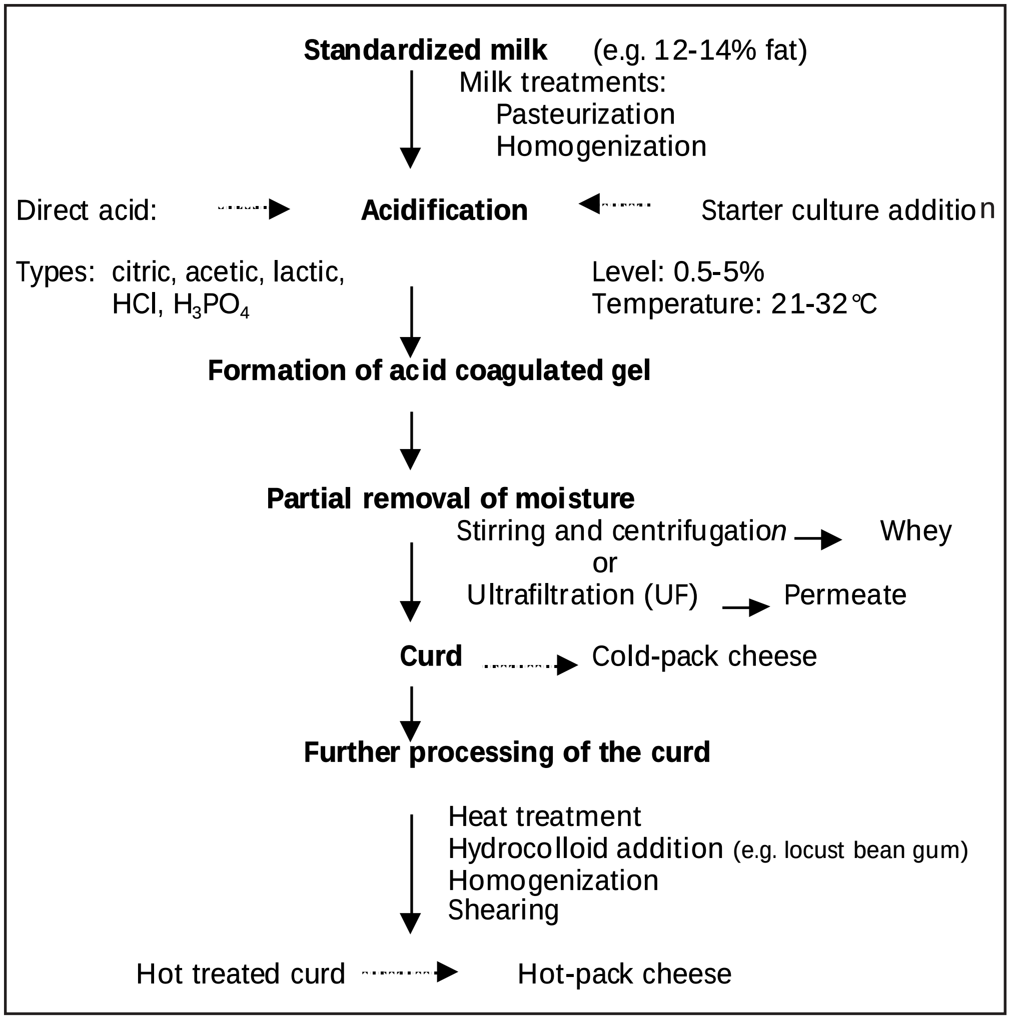
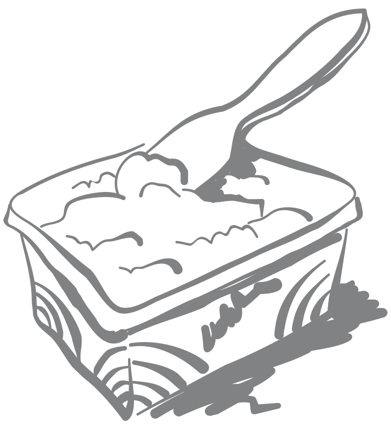


Figure 1. Main processing steps in the manufacture of cream cheese

CDR is currently setting up a pilot-scale cream cheese production line. If you are interested in this equipment, call John Jaeggi at (608) 262-2264.



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into packages, where it cools. To help the mechanical separation of whey, curd is sometimes heated to as high as 176º. You can use a tubular heater for this additional heat treatment, or instead of a tubular heater, the hot (~ 158-167ºF) product may be homogenized at 12-15 MPa.

Equipment

The essential equipment for cold-pack cream cheese and Neufchatel includes basic mix pasteurizing vats, homogenizer, plate surface or tubular heat exchangers, fermentation vats, balance tanks, mechanical separator or UF unit, centrifugal and positive displacement pumps, fillers, blenders and packaging lines. Tubular heat exchangers are often used to cool the viscous cheese for cold pack products. For hot-pack cream cheese, large jacketed vats with agitators or a scraped-surface heat exchanger and an additional homogenizer for the hot mix are also†required.

Texture and flavor defects

Texture is an important characteristic of cream cheese and since is it commonly used on bagels cream cheese should be spreadable. What influences texture? Like most cheeses, the pH is critical. If the pH of the cheese is too high (i.e., > 4.8) the texture will be soft and the cheese will lack flavor. At a very low pH (< 4.6), the texture may become too grainy and the flavor too acid.

You'll see nonstandard cream cheese products in the marketplace, too, particularly the more spreadable versions that are made with a higher moisture content.

Potential off-flavors include oxidized and rancid notes. What you really want is a clean, buttery or diacetyl flavor in your cream cheese.

Other texture defects seen in these cheeses include whey separation from the product during storage and a grainy chalky texture, especially in the lower-fat types. Hot pack cheese has a more brittle texture than the cold-pack product due to the additional heating and shearing treatments. The shelf life of the cold pack product is only a few weeks, However the hot-pack cheese has a shelf life of up to 3 months in refrigerated storage.

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Curd Clinic

Curd clinic doctor for this issue is John Lucey, assistant professor of Food Science, UW Madison

Look at the process rather than re-engineer the product.

Q. I am producing yogurt for a new customer who is adamantly against any defects, particularly whey collecting on the surface. No one has complained about this before, so I am not sure how to consistently prevent the problem.

A. Liquid that collects on the yogurt surface is indeed a surface whey defect. The liquid is forced out when the yogurt's gel structure becomes unstable and shrinks. Many manufacturers solve this problem by adding stabilizers like pectin which prevent the gel from separating to avoid the problem. However, there is a simpler solution that you might want to consider.

You can also fix the problem of unstable gels by refocusing your attention to the vat, looking at the process rather than re-engineering the product. Several manufacturing conditions, in particular very high incubation temperatures, influence the stability of the gel. Reducing the incubation temperature from 113°F to at least 104°F will create fewer defects without sacrificing much on production time.

When you adjust the incubation temperature you will also influence the growth of the yogurt bacteria and the flavor and aroma of the product. However, fruit or sweetened yogurt, not plain yogurt dominate the U.S. market and a strong acid or acetaldehyde flavor is probably not essential to most U.S. consumers.

When manufacturers turn their attention to the production of the original yogurt gel to produce a quality product they are often able to avoid the added costs of including extra ingredients to stabilize the gel. It is particularly desirable to avoid added ingredients in a product like yogurt, since is often positioned as a health food. Excessive stabilizers can also impart unwanted sensory attributes and textural defects.

Set-style yogurt is obviously more prone to the wheying off defect and this probably contributed to the popularity of stirred products where stabilizer and fruit/sugar are added. Plain, nonfat yogurt continues to be the most problematic product in terms of this wheying-off problem but for the stirred, or blended, product it is worthwhile to take a fresh look at the amount of milk solids and stabilizers needed to give the desired viscosity, especially since we may be able to reduce these ingredients without sacrificing quality.

What is a mole?

by Mark Johnson

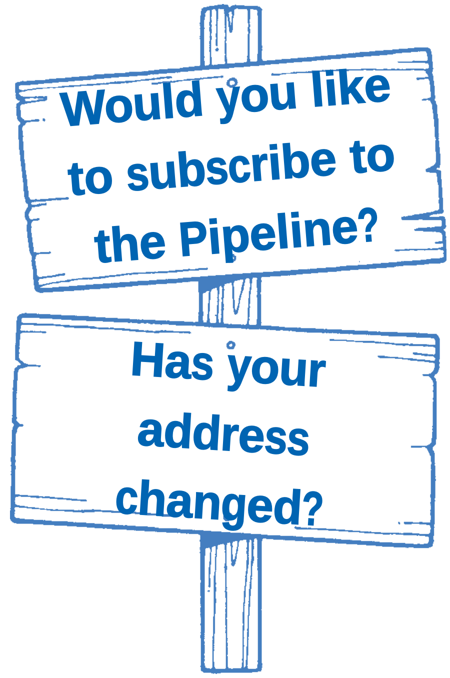
In a recent Dairy Pipeline I wrote an article about pH. I'd like to correct an error of omission an alert reader found in that article. I stated that there are 10^{-5} hydrogen ions in at pH 5.0. I should have stated that there are 10^{-5} moles of hydrogen ions in a liter of water. As we talked I realized that some readers may not understand what a mole is. Moles and molarity are terms from the world of chemistry. A mole is defined in textbooks as the gram formula weight of a chemical substance. If you add the atomic weights (in grams) of all the atoms appearing in the chemical formula of that substance you have the gram formula weight.

Water, H_2O, has a gram formula weight of 18.01534, which is usually rounded off to 18. This number is the result of adding the atomic weight of H, 1 for each hydrogen to get 2 and the atomic weight of oxygen, 16, to get 18. Molarity, abbreviated as M refers to concentration. Molarity is the number of moles of a substance as it actually exists in one liter of solution. Thus, one liter of pure water (1000 grams) has 55.5 gram formula weights of water (1000/18.01534) and is 55.5 M in terms of H_2O. For practical purposes that is true, however, water is not pure H_2O since a very tiny amount of the water molecules dissociate to form OH^- and H_3O^+ ions. Water at pH 7.0 is 0.0000001 M H^+ and .0000001 M OH^-. Strictly speaking then, one liter of water is not exactly 55.5 M H_2O.

A better illustration is NaCl, or salt which has a†gram formula weight of 58.45 grams. Put 58.45 g of NaCl in sufficient water to make up one liter of solution and you have one gram formal weight of NaCl in solution. Some would interchangeably also call it a 1 M solution of NaCl. However, this would not be correct. NaCl completely dissociates to form Na^+ and Cl^- and no NaCl exists. Therefore the solution is actually 1.0 M Na^+ and 1.0 M Cl^-. In terms of NaCl you have a 0M solution. For you advanced chemistry students, you may remember that one formula weight of a substance has 6.023 x 10^{23} molecules of that substance—a constant called Avogadro's number.

News from CDR

Bill Hoesly, CDR's research cheesemaker, has been awarded the College of Agricultural and Life Sciences Classified Staff Recognition Award. The award recognizes outstanding performance or service to the College. Bill will receive his award on April 9^{th}, at the Recognition Banquet. Congratulations!



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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

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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

Apr. 15-16 Wisconsin Cheese Industry Conference, La Crosse, WI. For information, call Judy Keller at (608) 828-4550.

May 6-7 Dairy and Food Plant Wastewater Short Course , Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 13-14 Applied Dairy Chemistry Short Course, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 20   Wisconsin CIP Workshop, Madison, WI. Call Bill Wendorff at (608) 263-2015.

May 21 Dairy HACCP Workshop, Madison, WI. Call Marianne Smukowski at (608) 265-6346.

June 3-4 Wisconsin Cheese Grading Short Course, Madison, WI. Call Scott Rankin at (608) 263-2008 or Marianne Smukowski at (608) 265-6346.

June 4 Biosecurity in the Food Plant, Madison, WI. Sponsored by WI Assn. for Food Protection. For further information, call Neil Vassau at (608) 833-6181.

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

July 12-16 IFT Annual Meeting, Chicago, IL. For information call see www.am-fe.ift.org.

July 31-Aug. 3 American Cheese Society Annual Meeting. San Francisco, CA. For info, call (502) 583-3783.

Aug. 19-20 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.

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

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