

Dairy Pipeline

Volume 25 Number 2, 2013

A Technical Resource for Dairy Manufacturers

Wisconsin and Smári, Innovating for Success

Launching a new enterprise is difficult by any standard, but launching an Organic Icelandic yogurt enterprise that requires unique, state-of-the-art equipment is nothing short of an adventure.

For Smári co-founders, Smári Ásmundsson and Doug Stewart, the idea of creating a high protein, low-fat, “super-strained” organic Icelandic yogurt was incredibly appealing. Ásmundsson, who grew up in Iceland, had enjoyed Icelandic yogurt for much of his life and wanted to bring a similar product to market in the U.S. Stewart, a businessman and organic dairy veteran was intrigued by the idea as well and saw an opportunity in the marketplace for a pure, organic yogurt product.

“Smári yogurt is a very high protein yogurt providing approximately 20 grams of protein per 6 ounce serving,” said Stewart. “We take four cups of milk to make one cup of our yogurt. It is fat-free and full of all the vitamins and minerals that make dairy healthy and good for you.”

Ásmundsson and Stewart joined together officially in September 2011 and began working on partnerships with local California farmers and processors. Knowing that Smári yogurt production would take unique equipment and expertise, the partners also reached out to California researchers to seek guidance on processing capabilities and methods.

“Unfortunately, those relationships did not work out. So, in March 2012, we began searching for other partners,” said Stewart. “We likely spoke with a dozen co-packers west of the Mississippi during this time. Our strained yogurt equipment needs were just so unique that it was difficult

to find a place that would be willing to work with us.” During this time Stewart connected with Dan La Valley, a Wisconsin dairy businessman, who recommended that Smári contact the Wisconsin Center for Dairy Research and Wisconsin’s Westby Cooperative Creamery for assistance. Westby turned out to be a great option for Smári. Located near Organic Valley’s shipping center, Westby Cooperative Creamery not only provided processing space and a milk supply, but also access

to Organic Valley’s shipping center, providing economically sound options for shipping the Smári product nationwide.



“We were looking for a supplier of organic, pasture-based Guernsey and Jersey cow’s milk and they were looking for an outlet,” said Stewart. “With room to grow and great logistics, Westby Creamery has made this portion of our business easy.”

While Westby was able to provide processing space, Smári still needed technical help scaling up the process that would allow them to create their “super-strained” yogurt. The Wisconsin Center for Dairy Research processing group was happy to help and invited Ásmundsson and Stewart to the CDR processing pilot plant in July 2012. During the two-day event, Ásmundsson and Stewart worked with three CDR staff; Mike Molitor, Process Pilot Plant Manager, Ray Michels, Cheese Maker and Associate Research Specialist, Becky Kalscheuer. Two prototype batches of strained yogurt were produced using the unique spiral ultrafiltration system Mike had built and has been utilizing to produce various strained products.

“What we are doing is technically difficult by any standard,” said Stewart. “We are the first company in the U.S. to use this method to manufacture strained yogurt. >>



Despite the challenges, Mike has been amazingly helpful, even pivotal to our successful startup. He is a superb operator and craftsman. We started with a recipe imported from Iceland; but Mike really taught us the “why” behind much of that recipe.”

Once the CDR pilot plant trials were complete, the operation moved to Westby Creamery where the commercial equipment was installed. The CDR processing group was there to assist with troubleshooting.

“Upon my request, Mike and Becky came to Westby and went to work evaluating our situation. They made superb recommendations across the board on how to re-engineer our filtration system,” said Stewart. “CDR even loaned us a piece of vital equipment and Mike delivered it to us on Christmas day so that it could be installed and ready for use in time for a critical run. Had CDR not been available during those critical moments, we’d likely be out of business by now. I’ve launched enough businesses, succeeded in enough businesses and failed in enough of them to say that with confidence.”

“It often seems that people don’t think of food as being very innovative,” continued Stewart. “But every food company I’ve ever worked with was innovative. Innovation takes research, experience and money. We really needed that help, taking our product from the kitchen to the lab to the



Smári Ásmundsson

scaled up production and those are not capacities that are widely available. Having that capability to work together to innovate and having that public-private partnership is essential to getting companies off the ground.”

In January 2013, sales of Smári yogurt began. By March, Westby Cooperative Creamery was processing an average of 2,000 gallons of organic Wisconsin milk each week for Smári yogurt. In May of 2013, the milk volume increased to 4,000 gallons of organic Wisconsin milk each week, and sales were projected to be between one and two million dollars this year.



“We use the milk from Wisconsin, we utilize Wisconsin truckers, we bought several pumps built in Wisconsin and had them installed by skilled Wisconsin welders and we employ Wisconsin based Westby Cooperative Creamery to make our product,” said Stewart. “I read all the time about how America and its economy is broken and in decline, but from an outsider’s perspective, there’s nothing broken about Wisconsin’s dairy industry and the Wisconsin Center for Dairy Research. Our story is a shining example of how public and private partnerships work to create good paying jobs, great products, real companies and a vibrant economy.”

As of May 2013, Smári Organic Icelandic yogurt was being sold in seven of the eleven Whole Foods regions in addition to several cooperatives and natural foods stores around the country, including the Westby Cooperative Creamery store in Westby, Wisconsin.

Cultured Dairy Products Short Course

The Wisconsin Center for Dairy Research invites all dairy and food processors to attend the Cultured Dairy Products Short Course, September 10-11, 2013, at Babcock Hall in Madison, Wisconsin.

The Cultured Dairy Products Short Course is a two-day short course designed to cover the basics of manufacturing yogurt, sour cream, kefir and specialty products. The course incorporates lectures, demonstration labs and evaluations which will assist attendees in their production of high quality fermented dairy products. Discussions will include the latest research results in these product areas from the CDR and the UW-Food Science Department. The course will also include discussions on the use of probiotics in cultured products for individualized nutrition.

This course is intended for all dairy and food processors interested in the manufacture and use of cultured dairy products. This course qualifies as an elective course for the Wisconsin Master Cheesemaker® Program. For registration information, directions and accommodations please go to: www.cdr.wisc.edu/short-courses/cultured or contact, CALS Conference Services, Phone: 608-263-1672, Fax: 608-262-5088

	September 10-11, 2013 Cultured Dairy Products Read more
	September 24-26, 2013 Master Artisan Short Course Series, Alpine Cheeses Read more
	October 7-11, 2013 Cheese Tech Short Course Read more
	October 15-16, 2013 Dairy Ingredient Applications Read more

Short Course page on the new CDR website.

The Wisconsin Center for Dairy Research and University of Wisconsin-Madison, are dedicated to supporting the U.S. dairy industry through innovative research, technical support, training and education.

Color Defects in Cheese

While color development during aging and storage is not uncommon in cheese, the chemistry and underlying cause of color development often remains largely unknown. Discoloration or bleaching can come from extensive light exposure (Wendorff) but other colors such as browning take alternate chemical pathogens. Research into this topic is not widely funded, but this complex chemistry causes issues within the cheese industry on a routine basis. CDR Senior Scientist Mark Johnson, Ph.D and UW-Madison Professor and Department Chair of Food Science, Scott Rankin, Ph.D often receive samples of color defect cheese from cheesemakers and end-users. Over the years, thanks to these samples, Johnson, Rankin, and a team of scientists, have been able to understand some of the mystery behind color defects in cheese.

Browning In Parmesan

In 2012, after several years of research, Rankin, along with a team of scientists from CDR, Cornell and UW-Madison published a paper in the Journal of Dairy Science titled, *Evidence for methylglyoxal-mediated browning of Parmesan cheese during low temperature storage*. This article discussed the browning pigmentation found in Parmesan and suggested that the formation of methylglyoxal is a likely cause of browning. Methylglyoxal is commonly derived from sugar metabolism by non-starter bacteria. The study notes that pyrazine compounds were identified in samples where browning had occurred. The formation of pyrazines occurs from condensation of aminoacetone, which itself is formed by reactions involving methylglyoxal. This browning reaction generally occurs while the Parmesan is in storage and the reaction has been known to affect the flavor and texture of the cheese, ultimately damaging the salability. For more on this topic, see Journal of Dairy Science, 95:2347-2354.

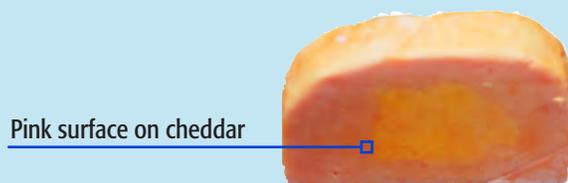
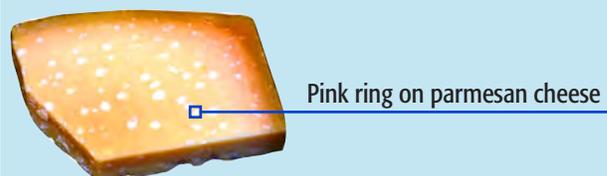
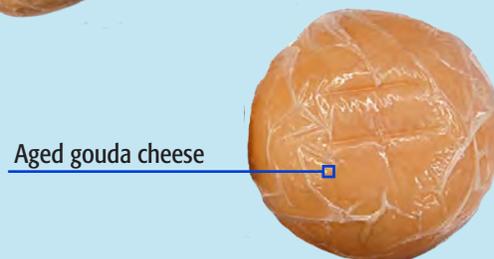
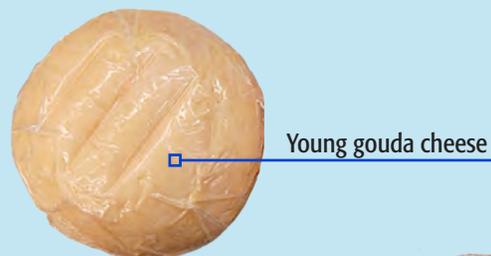
As a part of this study, Rankin and R.D. Divine of Cornell also attempted to identify a reducing agent that would hinder the browning reaction in Parmesan. In early 2013 the team submitted a new paper to the Journal of Dairy Science discussing their findings.

Other Color Defects:

Pinking, browning and other common color defects in cheese continue to be an issue for the cheese industry and somewhat of a mystery to food scientists. Recently, CDR and the UW-Food Science Department have received samples of cheese ranging in color from purple to brown. The reasons for these color defects are often unclear and may require years of research to determine specific causes and possible solutions. Funding for this research will be increasingly important as the incidence of color defects increase.

Please note that CDR and the UW-Food Science Department are always eager to learn of color defect incidents and invite industry to send in samples. If you have a defect, please contact Mark Johnson, Ph.D, jumbo@cdr.wisc.edu or Scott Rankin, Ph.D, sarankin@wisc.edu

Some common cheese defects



Control of Cheese Mites during the Aging Process

By *Bénédicte Coudé, CDR and Bill Wendorff, Professor Emeritus*

What are cheese mites?

Cheese mites are small arachnids which are barely visible to the naked eye (<0.5mm); however, their affinity for cheese and ability to bore holes on the surface of a rind can be a costly consequence for cheese plants that are unknowingly infested with this potential pest.



In fact, Czechoslovakian researchers (Verner & Pulpan, 1965) estimated that the damage to their country's cheese industry by mites amounted to about 1,000,000 Kcs (\$51,255 USD) in 1961. They found that 70% of the 36 cheese stores surveyed had problems with cheese mites. They reported that *Acarus siro* and *Tyrophagus putrescentiae* were the two most prominent species of mites present in their Gouda, Edam, Moravsky and Bochnik cheeses. Robertson (1961) identified three major species of cheese mites. *Tyrophagus longior* was a cool-temperate, *T. palmarum* a temperate and *T. putrescentiae* a subtropical to tropical form. Two cheeses that intentionally use mites in the aging process are the French cheeses, Mimolette and some kinds of Tomme called Tommes céronnées which are inoculated with *Acarus siro*, and the German cheese, Milbenkase, which is inoculated with *Tyrollichus casei* Oudemans.

Concerns about Cheese Mites

Not only does cheese quality suffer from infestation with cheese mites, safety and health problems may also be a potential with the growth of cheese mites. Cheese mites may result in a large number of allergenic diseases such as atopic dermatitis, allergic rhinitis and asthma that may cause individuals physical, social and mental health problems (Cevizci et al., 2010). Mites have been reported to have caused severe dermatitis in cheese handlers, as well as gastro-intestinal disorders in consumers (Domenichini, 1978). During epidemiological and immunological investigations involving 214 cheese plant workers in central France (Molina et al., 1975), 55 positive reactions (25.7%) were obtained with extracts of *Acarus siro*. There have also been reports that spores of *Clostridium botulinum* have been introduced on cheese during mite infestations (Domenichini, 1978). Cevizci et al (2010) stated that in view of the potential allergic reactions, more comprehensive and protective measures should be developed in order to protect public health against mites.

Sources of Mites

Cheese mites tend to be present in any type of cheesemaking environment (Price, 1938). They can be

found in the wood shelves used for aging cheese and are generally distributed by attaching themselves to the clothing or people. Mites may also be carried in an air current and find their way into the cheese room. Unclean conditions in the curing room such as greasy shelves, old dirty cheese boxes, dirty walls, ceilings or floors encourage the development of mites.

In a survey of 120 samples of mature Kashar cheeses in Turkey (Umur, 1995), 85% of samples contained *A. siro*, of which 73% contained all the biological stages of this mite. In an additional Turkish study (Yaman et al., 2000), the rate of mite contamination was found to be 8.25% in the cheese samples. Out of a total of 412 samples, 290 were moldy cheeses and 122 were cheeses packed in skins. *A. siro* was found in 30 (10.34%) of the moldy cheeses and in 4 (3.27%) of the cheese in a skin. Of 141 samples of Mozzarella-type and Mineiro cheeses analyzed in Brazil (Correia & Roncada, 1997), 75.9% contained some form of extraneous contamination (live or dead mites, rodent hair or cow hair.) Aygun et al. (2007) stated that in order to avoid growth of storage mites in cheese, the production and especially storage of cheese should be carried out under hygienic environmental conditions.

Growth Conditions for Cheese Mites

Several factors favor the development of cheese mites in a cheese aging facility. Mites will actively grow at temperatures between 6.4 and 29.9°C (42-86°F) (Sanchez-Ramos & Castanera, 2007). The optimum temperature for growth was calculated to be 25°C (77°F) with a doubling time of 2.8 days. Relative humidity (RH) had a lesser effect than temperature but few mites were able to complete their life cycle at <61% RH. (Hilsenhoff & Dicke, 1963). Survival tests on 3 different substrates (wood, wax, and cheese) showed that on wood or wax, an RH of 61% or less limited survival, while on cheese, an RH of 43% or less was needed to destroy the mites. The mites were shown to be closely associated with the surface *Mucor* mycelium which they utilized as a food source (Renaud et al., 1977).



Mimolette, Wikipedia

Preventing Infection of Mites

The control of cheese mites depends upon a few important factors (Price, 1938). The cheese curing room or cheese storage area should be kept strictly clean. Cheese shelves should be washed thoroughly and this washing should include the supports which carry the shelves. It is wise to give the cheese curing room a thorough scrubbing with caustic cleaner, including the ceiling, walls, as well as the floor, two or three times a year. Perhaps more frequent ➤

scrubbing may be necessary when conditions favor more rapid growth of cheese mites. Aigner (1965) reported that instant destruction of mites was obtained after contact with boiling water, or water temperatures above 160°F for 2-7 seconds.

Old cheese should not be permitted to stay in the cheese curing room or storage unless it is properly paraffined. Scraps of substances, such as cheese, greasy bandages, grain and dried fruits, which might serve as food for cheese mites should not be allowed to remain or collect in the cheese curing room (Price, 1938). Cheese boxes which are suspected of infection should be thoroughly scrubbed, scalded and dried before they are used for cheese in an unaffected room. The use of low temperatures is one of the best methods of preventing the growth of cheese mites. Keep temperatures within a few degrees of 35°F and not higher than 40°F. When temperatures are increased above 40°F, the activity of the mite is correspondingly increased (Sanchez-Ramos & Castanera, 2007).

Another common means of prevention in cave aged or natural rind cheese is the use of diatomaceous earth. This substance is a siliceous, sedimentary rock that contains the cell walls of diatoms, a type of algae from the class *coscinodiscophyceae*. Diatomaceous earth looks and feels somewhat like baking flour and is a natural deterrent for cheese mites. Common practice dictates that the material be spread on the top and bottom of the cheese and then rubbed into the remainder of the cheese using a brush. This method is generally used several times throughout the life of the cheese and generally before the cheese is shipped. It is important to note that the life cycle of a cheese mite is approximately nine days, so be sure that the shipping process does not leave time for the mites to develop.

Getting Rid of Mites

When a cheese curing room is infected with mites, all infected cheese, boxes and accumulations of scrap material should be moved out of the aging room (Price, 1938). The operator should thoroughly clean the cheese curing room, scrubbing the ceilings, walls, floors, uprights, shelf supports and shelves. The whole room should then be thoroughly scalded with >160° F water if possible and dried. Regular cleaning and treatment of aging rooms at 6 month intervals is recommended as a method of controlling mite infections (Rodeiguez, 1979).

The worker who may be handling the infected cheese should not be permitted to carry the clean paraffined cheese into the aging room until he has changed clothes and washed himself thoroughly (Price, 1938). Another worker who has had no contact with the infected cheese may well do this work in order to prevent re-infection. Potential allergic reactions to the mites must be taken into

account when assigning cheese workers to cleanup of mite infections (Renaud et al., 1977).

Various cheese plant evaluations have been conducted over the past years to determine effectiveness of chemical sprays on eliminating mites from aging rooms. Methyl bromide was extremely effective against cheese mites, but its toxicity was so strong that it was banned from use in cheese aging rooms (Burkholder, 1966). Several other chemical sprays (Marzke et al. (1959) have been evaluated over the years with Lindane exhibiting the best results. Phosphine gas (PH₃) was approved as a fumigant for mite control in South African cheese plants in 1984 (Luck & Botha, 1987). Japanese researchers evaluated fenitrothion-treated paper as a means of controlling the presence of cheese mites. They reported that to ensure the insecticidal effectiveness of treated paper after 2 months of storage the initial application of fenitrothion should be at not less than 1 g/m (Ohno & Yoshikawa, 1983).



Since the use of methyl bromide and organophosphate compounds that were effective against mites have been banned due to human health hazards associated with their use in food plants, studies have continued to attempt to find other natural chemical or physical methods of controlling cheese mites (Sanchez-Ramos & Castanera, 2009). Their findings suggest that fatty acids, e.g., caproic, caprylic, pelargonic, and capric, were not effective in controlling mites. The food coating, READOM CBR, by itself effectively controlled mite populations on cheese. However, a major concern associated with use of the product is the modification of the external appearance of the cheese, which could affect salability. They found the best results for controlling mites on Cabrales cheese was obtained with aging cheeses at low temperatures, although at 2°C (36°F), the long time required for the aging period out-weighed the benefit of very little mite development. Their final recommendation was to age the cheese at 4-6°C (40-45°F), which would help maintain the mite population below the economic threshold without excessively delaying the aging period. Moreover, cheese mites tend to be sensitive to the lack of oxygen. Keeping anaerobic conditions for a short period of time might help to limit the growth of cheese mites. ➤➤

Continued on page 9

CDR Building Update

Once again, CDR would like to offer a sincere thank you to all of the CDR Building Campaign donors. Thanks to your support the building campaign continues to be an amazing success.

CDR is now in the final stages of State approval. At this time the Joint Committee on Finance has approved the Building Commission request for various new building projects but some final adjustments will have to be made due to their requirement to reduce overall bonding (State borrowing) within this budget area. Our project continues to enjoy very strong support from the legislators and the Governor.

CDR is actively working with the UW and the State to select an architectural and engineering (AE) firm for our project, which will be completed by the Fall.

The CDR is putting together a team of industry members to provide advice and input during the design process (if you would be interested in helping us, please let us know). Note that CDR will be updating the building project website regularly, including the latest news on the design phase, to help industry stay up-to-date on the process. The project will likely be built in several phases and in phase 1, we believe that the new CDR addition will be constructed while the operations of the Babcock Dairy plant and CDR

continue in their existing areas. Construction of the new milk intake and raw milk silos, milk processing equipment (e.g., pasteurizer) needed for the new CDR addition will also be completed. In phase 2, the CDR will move into the new addition, the Dairy plant will be closed for some period and renovated. The Dairy plant will likely stockpile ice cream and cheese or make some products off-site. The CDR will start using the new intake and milk processing equipment to begin its research activities in its new addition. Finally, the tentative project schedule is as follows:

Final State Approval	July, 2013
AE Selection	October, 2013
Design Report Approval	June, 2014
Start Construction	September, 2015
Substantial Completion*	March, 2018

*phase 1 will be completed first, so CDR will be in its new addition sooner than this date

If you have additional questions regarding the campaign or you would like to donate, please contact:

CDR Director John Lucey
jlucey@cdr.wisc.edu | 608-265-1195
Barb McCarthy, UW Foundation
barb.mccarthy@supportuw.org | 608-265-5891



© Images | Mike Roemer Photography Inc.

Center for Dairy Research/Babcock Hall



Campaign to Secure Dairy's Future



University of Wisconsin–Madison



Thank You for Helping us Reach our \$16 Million Goal

LEADERS

- * Foremost Farms USA
- * Great Lakes Cheese
- * Len Ivarson
- * Saputo Cheese USA
- * Sargento Foods

PARTNERS

- * Agropur
- * GEA
- * Grande
- * Hilmar Cheese
- * Klondike Cheese
- * Marathon Cheese
- * Schreiber Foods
- * Wis. Cheese Makers Assn.

PROVIDERS

- * Baker Cheese
- * BelGioioso Cheese Inc.
- * Curwood (Bemis Co. Foundation)
- * Kraft Foods
- * Masters Gallery Foods
- * Mullins Cheese
- * Sartori Foods
- * Sealed Air/Cryovac
- * SoftTrace

BUILDERS

- * Ampco Pumps
- * AMPI
- * Arla Foods
- * Arthur Schuman
- * Bel Brands
- * Brewster Dairy
- * Chr. Hansen
- * Colony Brands
- * Crystal Farms
- * Dairy Farmers of America
- * DSM
- * Ecolab
- * Ellsworth Cooperative Creamery
- * Emmi Roth
- * Exo Pack
- * FOSS
- * Galloway
- * George Hutson
- * Georgia Pacific
- * Glanbia/Select Milk Producers
- * Green Bay Packaging
- * Johnson Industries International
- * Lactalis American Group
- * Land O' Lakes
- * Bob Bush & Nusbaum Foundation
- * Maple Leaf Cheesemakers
- * Nelson-Jameson
- * Organic Valley
- * Steven Braun & Amy Pollack
- * Swiss Valley Farms
- * Walter V. Price Family

SUPPORTERS

- * Advanced Process Technologies
- * Agrimark/Cabot Cheese
- * Carr Valley Cheese
- * Cedar Grove Warehousing
- * Chalet Cheese
- * Cheese Market News
- * Culvers
- * Dairy Connection
- * DR Tech
- * Elanco
- * Excel Engineering
- * Fair Oaks Farms
- * Foreign Type Cheesemakers Assn.
- * Glacier Transit & Storage
- * Grassland Dairy Products
- * Great Northern Corporation
- * Henning Cheese
- * Hydrite Chemical
- * Jerry Dryer
- * Kelley Supply
- * LaGrander's Hillside Dairy
- * Lynn Dairy
- * Meister Cheese
- * Milk Specialties Global
- * Nasonville Dairy
- * Packaging Corp of America
- * Pine River Prepack
- * TC Jacoby
- * Tosca
- * Wisconsin Dairy State Cheese

FRIENDS

- * ADPI
- * Bill & Hallie Wendorff
- * Bob & Karen Bradley
- * Cedar Valley Cheese
- * Central Wisconsin Cheesemakers
- * CS Facilities LLC/Continental Dairy Products
- * Dan & Jane Carter
- * Decatur Dairy
- * Domino's
- * DuPont
- * Dupont Cheese
- * Eastern Wisconsin Cheesemakers
- * Eau Galle Cheese Factory
- * Fristam Pumps, USA
- * Gilman Cheese
- * Guggisberg Cheese
- * Kerry Ingredients & Flavours
- * Kickapoo Valley Cheese
- * Mike Matucheski
- * Mill Haven Foods
- * Quaker Oats
- * Southwestern Wisconsin Cheesemakers
- * Stoelting
- * Ted Galloway
- * Terry Lensmire

- * Wisconsin Aging & Grading
- * Wisconsin Cheese Originals
- * Wisconsin Dairy Products Association
- * WOW Logistics

OTHERS/SHORT COURSE CHALLENGE

- * Aladdin Label
- * Alcam Creamery
- * All Star Ltd.
- * Anderson Chemical
- * Atlanta Foods (Russell McCalls)
- * Barbara & Kerry Henning
- * Barbara McCarthy
- * Bernard Prior
- * Brian Riesterer
- * Crave Brothers Farmstead Cheese
- * Daniel Mielke
- * Deborah Moore
- * Debra Wendorff Boyke
- * Dennis Butters
- * Erica Pagel
- * Evan Kinser
- * Hook's Cheese
- * James Johnson
- * James Taylor
- * Jann & Steven Merry
- * Jeff Pfaff
- * Joan & Dennis Behr
- * John Brody
- * John Lucey
- * John Wiskerchen
- * Karen & Cleitus Kirschbaum
- * Larry Steckbauer
- * Maple Grove Cheese
- * Marianne Smukowski & Tom Dulmage
- * Mark Frederixon
- * Michelle & Randy Krahenbuhl
- * North Hendren Coop
- * Pamela Hodgson
- * Patrick Doell
- * Polly & George Koepf
- * Randall Brandsma
- * Rhonda & Tim Pehl
- * Robert Aschebrock
- * Roelli Cheese Factory
- * Spaulding & Associates
- * Steve Lutzke
- * Thiel Cheese & Ingredients
- * Victor Grimm
- * Vincent Lease
- * Zimmerman Cheese



Thanks to WMMB & Wisconsin Dairy Farmers for Your Ongoing Support.

Whey Clinic: Colored Whey Powder

Clinic Doctors: Karen Smith, Ph.D and John Lucey, Ph.D

Introduction:

Colored whey continues to challenge dairy processors working to meet the increased customer demand for uncolored whey. (Figure 1) Powder restrictions both in the U.S. and abroad

are pushing processors to find new ways to remove or limit the color in whey products. Markets exist for colored whey but they are becoming smaller, so it is increasingly important to find ways to efficiently and cost-effectively remove or limit the cheese color in whey.



Figure 1. Range of color for whey powder (with and without annatto).

Why is there color in whey?

Pigments in whey can stem from three main causes, xanthophyll from the feed that cows eat, annatto added to color the cheese or compounds generated from the Maillard reaction.

Xanthophylls are a class of pigments known as carotenoids. They are generally present in fruits and vegetables, but can be found in whey from the pigments ingested by the cow (through grazing on grass, etc.). The cow is unable to completely convert the beta-carotene present in the grass to vitamin A, resulting in yellow colored milk.

Annatto is a colorant used during the cheesemaking process to turn a white or colorless cheese to an orange, red or yellow tinted cheese. Annatto is an extract of the shrub *Bixa orellana* which contains the pigments bixin and norbixin. In cheese whey much of the residual annatto is associated with milk fat membrane material.

The Maillard Reaction is a reaction between amino acids (proteins) and sugar. The initial reaction requires a decrease in pH such as the drop that occurs in whey during cheese manufacture. Subsequent steps in the

whey powder process produce tan to dark brown color compounds. (Figure 2) High storage temperatures and higher moisture content in the powder all result in a more rapid development of dark color in the whey powders. This type of color is not easily removed once formed.

How to limit color?

A new cheese colorant made of an encapsulated blend of red/yellow fat-soluble carotenoid colors of paprika and beta-carotene has become available with the claim that the color remains in the cheese and does not enter the whey stream. Because the color remains in the cheese there is no need to decolorize the resulting whey. The product is produced by Cyber Colors and its partner Socius Ingredients.

How to decolorize or remove the color?

The most commonly used method for color removal in whey is bleaching. New options include enzymatic color removal and chitosan technology.

Bleaching requires the use of hydrogen peroxide or benzoyl peroxide to modify the annatto structure. While the whey will appear white, the residual annatto compounds remain in the product and can be detected through analytical testing methods. CODEX and CFR allow for the use of benzoyl peroxide and hydrogen peroxide, but many countries will not accept imports where benzoyl peroxide has been used, especially in relation to infant formula. Peroxide use can also lead to off flavors and other undesirable attributes so companies should take care when using these methods.

Enzymatic color removal uses a food grade strain of *Aspergillus niger*, to produce a peroxidase-type enzyme that is able to modify annatto. The activity of the enzyme is dependent on temperature and works best when at pH 4.5-6.5.

Chitosan is a polysaccharide that was originally derived from shellfish, but is now commercially produced by genetically engineering *Aspergillus niger* (it has GRAS status). Chitosan is commercially used for its fat binding properties. In the case of whey, chitosan binds to the milk fat globule, where annatto binds. The chitosan complex is then flocculated by pH adjustments >>



Figure 2. Color development in whey powder due to the Maillard reaction.

and removed from the whey entirely through microfiltration. While research into this method is ongoing, University of Wisconsin-Madison Professor Srinivasan Damodaran patented this method in 1995.

Conclusions:

Colored cheese whey creates some issues for whey processors, but there are several viable solutions on the market today. When determining which method to use, consider market needs and expectations, the overall cost, including time and equipment needed and the positives and negatives of removing the color versus masking the color. Remember to think about the overall effect the method will have on your product and always consider customer acceptability and quality before moving forward with a processing method.

References:

Smith, Karen. 2008. Bleaching. Wisconsin Center for Dairy Research.

Hwang D-C and S. Damodaran. 1995. Selective precipitation and removal of lipids from cheese whey using chitosan. *Journal of Agriculture and Food Chemistry* 43: 33.

Continued from page 5

Final Recommendations for Control of Mites

In general, the control of cheese mites depends on a few critical factors. The cheese curing room or cheese storage area should be kept strictly clean. Cheese shelves must be washed thoroughly and this washing should include the supports which carry the shelves. Cleaning with hot water and detergent generally removes most of the residual bacteria, regardless of bacterial species, wood species or age of the wood. It is wise to give the cheese curing room a thorough scrubbing, including the ceiling, walls, as well as the floor, two or three times a year. Perhaps more frequent scrubbing may be necessary when conditions favor more rapid growth of mites.

The cleaning procedure alone is not sufficient to eliminate cheese mites. We recommend that freshly cleaned boards be sanitized by heating the boards to 80°C for 5 minutes or using a sanitizer with either a chlorine-based or QAC-base to ensure freedom from any potential pathogens and potential mites. With good sanitation and aging cheese at 4-6°C (40-45°F) (maximum), one should be able to control mites so that they are not a problem in the aged cheese.

Thank you to WCIC Attendees

CDR and the Wisconsin Cheese Makers Association joined in co-hosting WCIC, April 17-18, 2013 in La Crosse, Wisconsin. More than 1,400 U.S. dairy and cheese industry staff were in attendance for two days of sessions, expos and more.

CDR led three sessions this year including the general session on biofilms, which was mediated by Dr. John Lucey and Dr. Mark Johnson. Dr. John Lucey, Dean Sommer, KJ Burrington and Dr. Karen Smith participated in a discussion of the Wisconsin whey opportunities group report and recommendations. KJ Burrington, Dr. Dana Wolle and Mike Molitor participated in the discussion on yogurt and cultured products. CDR also hosted a hands-on cheese grading workshop Thursday afternoon, led by Marianne Smukowski, Dr. Mark Johnson, John Jaeggi and Luis Jimenez-Maroto.

It was a busy week for all involved but, as always, WCIC provided many opportunities for education and networking. We hope you will join us again next year.

For more information on WCIC or next year's International Cheese Technology Conference to be held in Milwaukee, please see www.wischeesemakersasn.org



© Images | Mike Roemer Photography Inc.

CDR Launches New Website

CDR is excited to announce the launch of a new and improved CDR website. Along with a new overall look, the site now includes a more user friendly interface, improved navigation and a greater emphasis on industry interactions.

The home page features links to a streamlined short course page, an improved news and events section and a link to the new password protected portion of the CDR site, The Insider, developed for Wisconsin manufacturers.

Other improvements include success stories for the various program areas and unique visual elements such as slide shows and a Master Cheesemaker map. The bottom navigation has also been improved and now contains links to frequently visited portions of the site as well as information for media or visitors.

Also, please note the new Dairy Innovation Resources section of the site which is designed to provide companies and entrepreneurs with important contacts and information related to dairy innovation. Information on the i6 Challenge is also available through the Dairy Innovation Resource link.

CDR invites you to visit the new site www.cdr.wisc.edu and discover all that it has to offer. Also, please feel free to contact the Communications group at communications@cdr.wisc.edu with your questions and comments regarding the site.

ACS 2013

The American Cheese Society (ACS) will be hosting its annual competition and conference at the Monona Terrace in Madison, Wisconsin, July 31-August 3, 2013. Several CDR staff members will have active roles at the event serving as judges or speakers.



In particular, CDR Safety and Quality Coordinator, Marianne Smukowski, who served on the program committee helping to plan and coordinate the event, will be serving as a judge as well as a speaker. CDR Assistant Director and Senior Scientist Mark Johnson, Cheese Industry & Applications Coordinator John Jaeggi, Assistant Coordinator Cheese Industry & Applications Gina Mode, Sensory Coordinator Luis Jimenez-Maroto and UW-Madison Professor Emeritus Bob Bradley will also be serving as judges. A full list of CDR staff speakers is provided below.

Wednesday, July 31

8:00 – Noon ▶ Flavored Cheeses, Cheesemaking demonstration, CDR staff

Thursday, August 1

10:00 – 11:30 ▶ Unique & Often Confounding Flavors Found in Milk, Bob Bradley & Scott Rankin

1:45 – 3:15-Cheesemaking 101, Dean Sommer

Friday, August 2

8:30 – 10:00 ▶ Sensory Evaluation of Mexican Cheeses, Luis Jimenez-Maroto & Arnoldo López-Hernández

10:30 – Noon ▶ Cheesemaking 101 (repeated), Dean Sommer

Saturday, August 3

8:45 – 10:15 ▶ Striving for a Successful FDA Inspection, Marianne Smukowski

10:45 – 12:15 ▶ The Art & Science of Smear-ripened/Washed-rind Cheeses, Mark Johnson & John Jaeggi

10:45 – 12:15 ▶ Safe Cheese Storage, Marianne Smukowski

2:00 – 3:30 ▶ Understanding Common Cheese Defects & How to Avoid Them, Mark Johnson

For more information or to register for the 2013 American Cheese Society conference, visit www.cheesesociety.org/conference/2013-conference

CDR Staff to Present at IFT

It's that time of year again when folks here in the Dairy Ingredients and Functionality program at CDR get revved up for IFT. The Institute of Food Technologists (IFT) Annual Meeting and Food Expo is where the world's top food science and technology professionals gather to identify food trends that will shape the industry. IFT will be held July 14-16 this year in Chicago at McCormick Place—the nation's largest convention center. Experts in R&D, product development, marketing and new business development from industry, government and academia will gather to learn and share their most recent product, ingredient and technology developments.

Under the direction of CDR Ingredients and Functionality Coordinator KJ Burrington, Applications Lab Coordinator Sarah Minasian and Associate Research Specialist Rebecca Kalscheuer have developed two dairy specific prototypes in collaboration with U.S. Dairy Export Council (USDEC). The prototypes will be exhibited in USDEC's booth during the Food Expo, where in addition to the estimated 20,000 attendee exposure, one on one meetings will be held with key media individuals that in turn spread our dairy application message.

With Asian cuisine continuing to grow in ethnic popularity, Minasian has developed a delectable dumpling stuffed with a colorful mixture of shredded cabbage, red bell pepper, spinach, scallion, fresh basil and shiitake mushrooms. With no apparent visible protein, one needs to look a little closer to find the eleven grams of milk protein concentrate 80 (MPC80) per serving hidden within the dumpling dough. Once steamed, dumplings are served with a savory reduced-sodium soy sauce flavored with sesame, ginger, garlic, rice vinegar and honey. The addition of whey permeate in the sauce boasts a reduction of 37 percent sodium without losing flavor.



Dumplings work as an appetizer, meal or late night snack, but for a boost first thing in the morning, Kalscheuer has developed an eight ounce, chilled coffee drink made with yogurt and whey protein concentrate 80. The drink combines the same amount of caffeine found in a cup of coffee with not only 10 grams of protein, but 30 percent of the recommended daily value of calcium, and the live active probiotic cultures found in yogurt. The coffee flavor is rounded out with hints of Indonesian bourbon vanilla and Stevia, and drinks like a kefir. "Our Café Yogurt Frappé is a convenient on-the-go product where you can get your protein, calcium and caffeine all in one," says Kalscheuer.



CDR's KJ Burrington Tapped for ADPI Center of Excellence

CDR Dairy Ingredients and Functionality coordinator, KJ Burrington, will serve the American Dairy Products Institute as a dairy ingredient applications resource professional, through their Center of Excellence. For more information visit ADPI Ask an Expert www.adpi.org/AskAnExpert/bid/347/Default.aspx



Sign up for the electronic version of the Pipeline at subscribe_pipeline@cdr.wisc.edu

Sign up for the Pipeline Newsletter

Phone, fax or e-mail your mailing information. Have a change of address? Please help us keep our mailing list current!

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



Follow us on Facebook

www.facebook.com/wicdr
Learn more about short courses, events, research updates and the latest news.



Follow us on Twitter @WICDR

Learn more about short courses, upcoming milestones and events, research updates and the latest news.

Name _____

Company _____

Street address _____

City _____

State _____ Zip _____

Country _____

Change Add Remove

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

Nonprofit Org.
U.S. Postage
PAID
Madison, WI
Permit No. 658

ADDRESS SERVICE REQUESTED

DAIRY PIPELINE

Center for Dairy Research
1605 Linden Dr.
Madison, WI 53706-1565

📞 608-262-5970 | 📠 fax: 608-262-1578

We welcome your questions and comments.

Send to: Bekah Gillespie, Editor

✉️ rgillespie@cdr.wisc.edu | 📞 608-262-8015

Technical Reviewers:

Mark Johnson, Mike Molitor, John Lucey,
Marianne Smukowski, Tom Szalkucki,
Sarah Minasian- contributing author for the IFT story

Newsletter Design & Layout

Tim Hogensen

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) You can also find the Dairy Pipeline on our website:

www.cdr.wisc.edu



Short Course Calendar:

Milk Pasteurization , Aug. 6-7
Cultured Dairy Products, Sept. 10-11
Master Artisan Short Course, Sept. 24-26
Cheese Technology, Oct. 7-11

For detailed information on each CDR short course
www.cdr.wisc.edu/shortcourses

Events:

