Wisconsin Center for Dairy Research

Dairy Pipeline

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A Technical Resource for Dairy Manufacturers

The Journey to Little Mountain

Over the last two decades, specialty cheese has grown exponentially in Wisconsin. This is especially true when one considers that specialty cheese only accounted for about 4 percent of Wisconsin's cheese back in 1992 when the CDR Specialty Cheese program began. Today, specialty cheese accounts for more than 22 percent of all Wisconsin cheese and that increase is thanks to cheesemakers like Chris Roelli, who are helping to bring new specialty cheeses, such as Roelli's Little Mountain, to market.

Photos courtesy of Roelli Cheese Haus

Little Mountain truly began in 2012 when Roelli, of Roelli Cheese Haus in Shullsburg, Wisconsin met with the CDR Cheese Applications group to discuss the creation of a new Appenzeller cheese. A fourth-generation business, Roelli Cheese Haus produces unique cheddar varieties as well a few other styles of cheese.

"I had some idea of what I wanted to do," said Roelli, "but having not made this particular variety of Appenzeller cheese before, it was great to have CDR there to point me in the right direction."

CDR Cheese Applications coordinator John Jaeggi and the CDR Cheese Group are not strangers to the creative process, having helped to bring about cheeses such as Uplands Pleasant Ridge Reserve and the original Ader Kase. So, when Roelli came to them with his ideas, they were happy to offer their technical expertise and use of the CDR pilot plant; an area that allows cheesemakers to explore options and develop make procedures in a confidential research space.

"Appenzeller was a great choice for Roelli as there is a lot of room for expansion in that market," said Jaeggi. "The style also fit well into Roelli's current line."

After Roelli and the CDR Cheese Group met to discuss the specifics of the cheese, they began experimenting with make procedures. The first experiments were performed at Roelli's plant to test the cheese on Roelli's equipment; but when it came time to determine the specific bulk cultures needed for the cheese the experiments moved back to the CDR pilot plant.

"This style is a finicky cheese," said Roelli. "So, it was really nice to have CDR staff and facilities there to help me through the process."

Once at CDR, Roelli was able to experiment with fine tuning the cheese by using each one of CDR's six, small batch vats to test a different variation on the recipe.

"In the end, Roelli was able to develop a final recipe in less than a year," said Jaeggi. "The end product is a unique, slightly sweet, nutty, surface ripened cheese that is aged to at least six months."

Roelli and his team were pleased with the unique variety they had developed and in 2013 they entered it in the

American Cheese Society's Judging and Competition held in Madison, WI in August. Over 1,700 products were entered from more than 257 companies. Little Mountain took 3rd place in the Open Category-American Made/International Style-Made from Cow's Milk.

By early October 2013, Roelli was ready to launch Little Mountain in the Midwest. Sold online at Roellicheese.com and at specialty retailers throughout the Midwest, Little Mountain is currently sold for $6.90 per half pound and it is already garnering a lot of attention.

"We've been selling primarily in Wisconsin," said Roelli. "But we've already 'pre-sold' all of the Little Mountain available until spring 2014. We also recently built a new aging cellar so that we would have the room to age more cheese varieties. One of the three rooms in the new cellar is specifically for Little Mountain."

Given that the cheese requires six to eight months of aging before it is ready to be sold, Roelli is working to produce more and meet the already growing demand.

"We started out with just an idea and I wasn't sure how to get a means to an end," said Roelli. "But CDR helped me bring it to production and now we are hoping to go nationwide with the cheese by spring."

For more on the CDR Cheese Applications Program, visit www.cdr.wisc.edu/cheese

i6 Update

The CDR i6 Challenge Grant efforts are in full swing at CDR. Over the past few months CDR staff and partners have been working hard to establish additional partnerships, create a technology portfolio, build a web portal and create a new identity for the program that will live beyond the term of the grant.

The i6 Challenge, a $1 million grant awarded by the U.S. Department of Commerce to support an effort to commercialize research ideas that will positively impact economic development, requires award recipients to develop an internal program that can help to bring together entrepreneurs, scientists and economic development partners to create jobs and grow the economy.

"We've got just about everything in place to move forward," said CDR Commercialization Manager Vic Grassman. "We are continuing to work on the technology portfolio and web portal, but we are ready to help entrepreneurs and companies to develop an idea or product."

The CDR i6 program offers a comprehensive package to clients and partners including technical assistance, business support and external partner assistance. Together, this package gives clients the opportunity to move an idea or product from the bench top to the market as quickly as possible, shortening the commercialization time and lowering risk.

At this time, interested parties are asked to contact Grassman with further questions and inquiries, but in spring 2014, the web portal and technology portfolio should be readily available online.

Also, in early 2014, CDR will unveil the new identity for the i6 Challenge program, which will help CDR and industry to sustain the program beyond the two year grant.

For more on the i6 Challenge Grant or to discuss an idea, please contact Vic Grassman at 608-512-6661 or vgrassman@cdr.wisc.edu

CDR's New Logo and Web Store

After more than 20 years, the Center for Dairy Research is proud to unveil a new logo.

The latest design, which offers a more modern and colorful take on the Center's previous logo was developed to be more easily recognizable. The logo also includes a nod to the Center's relationship with the University of Wisconsin-Madison, including a red strip along the bottom with the letters "UW" incorporated into a small circle. The new logo also compliments the latest website updates which were launched earlier this year.

In addition to the logo changes, CDR has also launched an online store, which is currently selling Dr. Bradley's *Better Butter* Book. At this time, only credit and debit cards are accepted on this site. If you wish to purchase an item with a check, please contact jminor@cdr.wisc.edu. The store will be updated as other materials become available.

CDR Building Update

On November 8, 2013, the Wisconsin Department of Administration selected Zimmerman Architectural Studios Inc. based in Milwaukee, WI as the architectural and engineering (A&E) firm for the Babcock Hall renovation and Center for Dairy Research (CDR) addition project.

Zimmerman and W.M. Sprinkman Corporation, a dairy processing and engineering design firm, partnered on the bid and will work together on the project which is set to break ground in summer 2015.

To assist in the design process, CDR has established an industry advisory group. This group includes more than 10 industry experts who have volunteered to provide input during the design and construction phase of the project. Their insights will be invaluable in creating a world-class facility.

If you have additional questions regarding the campaign or would still like to donate, go to the CDR website www.cdr.wisc.edu/building or contact:
CDR Director John Lucey, 608-265-1195, or email jlucey@cdr.wisc.edu

Mark Johnson UW Superstar

The Center for Dairy Research (CDR) is proud to announce that the University of Wisconsin-Madison has honored Mark Johnson, Ph.D. with the title "Distinguished Scientist". This title is only given to those who have exhibited "unique and outstanding performance" in a chosen field and are recognized by their peers as an invaluable resource. This title is often deemed the "superstar" title (there is no higher designation for University staff) and the designation is certainly well deserved.

Mark Johnson discusses cheese with Master Cheesemaker, Gary Grossen.

A Center employee for more than 30 years, Johnson's research has been vital to the cheese industry, directly contributing to continued innovation. His work on the calcium lactate crystal defect and his continued participation and leadership with regards to the dairy short courses has impacted the dairy industry in countless ways. Johnson's research efforts are always selfless, performing the necessary research and then transferring that knowledge directly to industry. Even before he publishes his research, he is thinking of ways to communicate and teach the new information to those that can use it to advance the dairy industry. He is internationally recognized as one of the World's leading dairy scientists.

Johnson was also awarded the National Cheese Institute's (NCI) Laureate Award in 2012, an award which is presented to individuals who have made significant contributions to the development and growth of the U.S. cheese industry. In 1992, he recieved the American Dairy Science Association Pfizer Award in Cheese and Cultured Products Research and in 2002 the University of Wisconsin-Madison Chancellor's Award for Excellence in Research.

Johnson is an outstanding asset to the dairy industry and we ask you to join us in congratulating him on this tremendous (and well deserved) honor.

Choosing a Dairy Protein Ingredient

Contributed by KJ Burrington, CDR Dairy Ingredients Coordinator

A growing consumer interest in high protein diets has led to a significant increase in the development of new dairy ingredients in the U.S. The popularity of dairy protein ingredients is deeply rooted in dairy protein nutrition research which has shown that dairy proteins support muscle recovery, weight management and satiety. This research is part of the reason we've seen such strong growth in Greek yogurt, protein drinks and protein in breakfast foods.

Overall, the dairy protein ingredient market has grown exponentially over the past few years, leading the way for many new high protein dairy-based products. With so many choices of dairy ingredients, however, food manufacturers can often feel unsure about which ingredient is right for their product. The outline below has been provided to assist companies in better understanding dairy ingredients and which one best fits their needs. This also includes a section on food applications along with a simple case study of CDR dairy ingredient work. As always, if you have specific questions about dairy ingredients, you are encouraged to contact CDR directly.

Whey Protein and Milk Proteins:
The dairy protein ingredient options can be broken up into two basic categories, whey protein ingredients and milk protein ingredients.

- The whey protein ingredients include whey protein concentrates (WPC) and isolates (WPI) which range in protein from 34-89% for a WPC to a minimum of 90% for a WPI. Whey protein ingredients have a standard of identity which can be found in the Code of Regulations 21CFR 184.197(c)(a).

- The milk protein ingredients include milk protein concentrates (MPC) and isolates (MPI) with similar ranges in protein as whey protein ingredients. Milk protein concentrates and isolates do not currently have a standard of identity but a GRAS (Generally Recognized as Safe) notification has been submitted to the FDA for these ingredients. The GRAS notification includes milk protein ingredients that are manufactured by processing nonfat milk by ultrafiltration to remove a portion of the non-protein constituents followed by evaporation and spray drying. Milk protein ingredients are relatively newto the U.S. dairy ingredient world with the first MPC manufactured in 2000. The U.S. has now at least five manufacturers of milk protein ingredients.

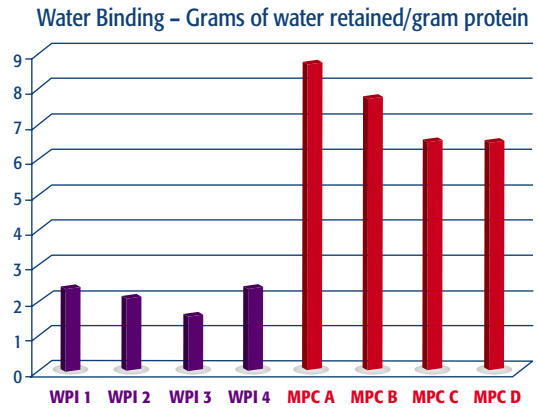
Whether you are a manufacturer or an end user of these ingredients, it is important to understand the differences in functionality before you start recommending or choosing an MPC or a WPC. Though both ingredients offer products with similar protein levels, such as MPC80 or WPC80, you will get a different set of functional properties with each ingredient so it is important to note those differences when making a decision about which ingredient to use. The differences in functional properties are due to the type of protein that is most prevalent in each ingredient. MPC contains the typical 80% casein and 20% whey protein that is found in milk, whereas the protein in a WPC is all whey protein. If you know the basic chemical and functional properties of casein and whey protein, it makes selecting the right ingredient for your application much easier.

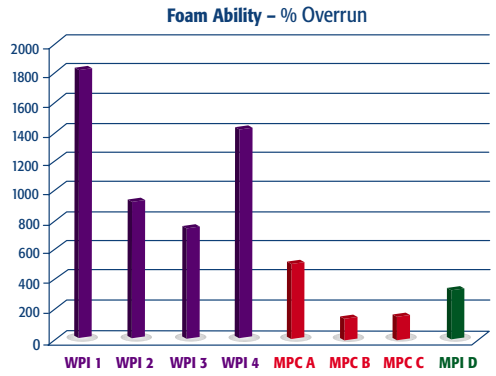
Understanding Functionality Differences
As noted above, MPC contains casein and whey proteins while WPC contains solely whey proteins. Casein and whey proteins react very differently under various conditions so it is important to understand how each protein will react in your application.

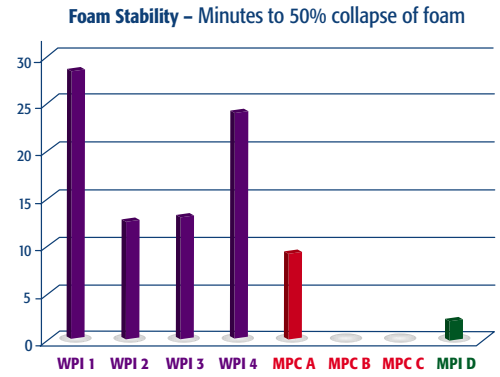
Caseins are generally good at fat emulsification, foaming, water binding and have good heat stability as long as the pH of the application they are used in is above six. When the pH decreases below 6, caseins will form acid gels which is essentially the process that happens during the fermentation of milk into yogurt and cheese.

Whey proteins are known for their foaming ability, gelling properties, high solubility over a wide pH range, and their heat sensitivity. Unlike casein, whey proteins will denature upon heating starting at about 145 degrees Fahrenheit and the proteins will eventually form a gel at a high enough concentration (about 7% protein). Whey proteins do not form acid gels like caseins which is a key difference to consider when choosing a dairy protein ingredient for a yogurt application. Here are some examples of differences in functional properties of milk proteins and whey proteins.

Food Applications
Once you understand the chemistry behind each protein, it is also important to understand how the gelling, solubility and other characteristics will affect your food application.







When it comes to all food applications, knowing the pH of the food and understanding how the dairy protein will behave in those pH conditions is critical to choosing the right ingredient. Beverages are a good example of an application where the pH is important. Protein beverages can be found ranging in pH from 3.0 to 7.0, so knowing the properties of each protein and how they react to pH will make your choice much easier. If you are making a protein beverage in the high acid range, pH 3.0-4.5 where you will typically use a hot fill process, you will automatically pick a whey protein ingredient because milk protein will have poor solubility and will precipitate. If you are making a beverage in the low acid range, pH 6.5-7.0, then you would pick a milk protein ingredient for its heat stability because an UHT (ultra-high temperature) process will be necessary to make a shelf stable product. You could also use a portion of the protein from a whey protein ingredient, since the casein ingredient will act like a chaperone and provide some added heat stability to the whey protein ingredient.

Another major difference between milk and whey protein ingredients is their hydration characteristics. Good hydration is key to achieving optimum functionality from a dairy protein ingredient. For fluid applications such as beverages, it is always recommended to add dairy protein powders and mix it with a high speed mixer to fully dissolve the product in water. Whey proteins are very susceptible to denaturation from high shear, so over mixing will create a lot of foaming and can denature the protein, which in turn will decrease its solubility in acid conditions. Once the proteins are dissolved it is recommended to use slow agitation for the remaining hydration time. Whey proteins will hydrate quickly, so a minimum of 30 minutes (with ambient temperature water) is necessary to achieve good hydration for a beverage application. By comparison, milk protein ingredients are very slow to hydrate. It is not unusual for milk protein ingredients with 70% protein or higher to take up to 2 hours. You can shorten the hydration time by increasing the water temperature to 120-140 degrees Fahrenheit. Other applications where pH and hydration are important for good dairy protein ingredient performance are soups, sauces, yogurt, and confections such as caramel.

Case Study:

An example of an application where pH is not critical would be in a bakery dough. A recent experience that we had at CDR was in the development of a protein enhanced dough for an Asian dumpling prototype for IFT 2013 (www.innovatewithdairy.com/SiteCollectionDocuments/Dumpling_FormuSht_FINAL_06-17-13.pdf). We developed the dough with 10% protein per serving using a WPC80 and then were asked to change the formula and use an MPC80 instead. Due to the higher water binding ability of the MPC compared to the WPC, we could not do a one-to-one replacement without other changes to the formula. The MPC formula required a higher level of water addition to result in a similar dough texture. The comparison of the formulas is below.

Ingredient	Dumpling Dough with WPC	Dumpling Dough with MPC
Flour	61.05	52.95
Water	33.11	40.66
WPC 80	5.84	------
MPC 80	------	6.39
Total	100.00	100.00

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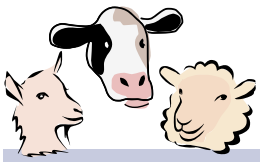
Making Cheeses from Different Milks

Technical Contributors: Bénédicte Coudé, Mark Johnson, Ph.D.

While bovine milk continues to dominate the market with more than 196,245 billion pounds being produced annually, an interest in sheep and goat milk cheese is quickly emerging in the U.S.

Sheep and goat milk represent only 0.08 percent of the annual U.S. milk production or about 309 million pounds of goat milk per year and 7.7 million pounds of sheep milk per year (USDA NASS, 2010). Current estimates for annual U.S. imports of sheep milk products, however, are more than 72 million pounds (equivalent to 360 million pounds of milk). On the goat side, the U.S imports more than 50 percent of the dairy goat cheese products consumed. Thus, there is a great deal of room for mixed milk product growth in the U.S.



There are some challenges to developing these products, however, as the number of goats and sheep in the U.S. is limited in comparison with the number of milk cows. The cost of sheep and goat milk is also generally more expensive, which is why blending milks to make cheese has become so popular with U.S. cheesemakers. The method also allows manufacturers to achieve a unique product by mixing the best of bovine, sheep and goat milk to achieve the unique properties and flavors they desire.

The composition of milk varies depending on the breed and genetic history of the animal, the quality of nutrition, stage of lactation and the season of the year. All of these factors will have an impact on the cheesemaking process, yield and the end product so it is important to know the composition of the milk being used to make the cheese. To assist with this understanding, CDR has developed the following material which focuses on the composition of the various milks and how that composition contributes to the end product.

Basic overview of the major constituents in milk
Milk is mostly composed of water, fat, sugar, protein, vitamins and minerals. Protein and fat are the two most important components for the cheesemaker because protein and fat directly impact the cheese yield.

Fat: Milk fat contains a variety of saturated and unsaturated fatty acids of varying chain lengths that contribute flavor, aroma and texture to ripened cheeses. For instance, a low fat cheese (made from skimmed milk) tends to have a dry texture and little flavor. The development and intensity of specific flavors depends on the percentage of different fatty acids in the milk. The size of the fat globules is also very important in the cheesemaking process because bigger globule size incorporates more easily into the curd.

Proteins: The two major milk proteins are casein and whey proteins. To a cheesemaker, casein is the most important milk protein (80% of the total protein) because casein naturally coagulates in an acid environment and allows for curd formation. Coagulation of caseins can also happen when rennet is added. The whey proteins are less important in this case as they do not coagulate and instead end up in the whey.

Additionally, enzymes, which are proteins that catalyze the breakdown of other molecules, play a role in the development of flavor and texture in cheese. These enzymes can be native to the milk or gain entry through contaminant microorganisms. Proteases catalyze the breakdown of proteins while lipase hydrolyzes fat which results in the release of fatty acids.

Minerals: Minerals are also an important part of milk. In particular, calcium and phosphorus play a role in the renneting process. They will help to accelerate the coagulation by binding the caseins.

The composition of milk: cow, goat and sheep
Exact milk composition is hard to predict due to variability in breed, environment, age, etc. The milk components that are found in various reference texts may seem inconsistent and even sometimes contradictory because it all depends on the specific group of animals that are examined. Milk composition is usually given as a generalization or average rather than a range. The data presented in the table below provides a general picture of the compositions of cow, goat and sheep milk.

Milk Composition			
	 1	 2	 1
Fat	3.7	3.6	7.4
Total protein	3.4	3.5	4.5
Casein	2.6	2.6	3.9
Lactose	4.8	4.5	4.8
Ash	0.7	0.8	1.0
Total Solids	12.7	12.4	19.3

[1] *Data taken from Fox et al., 2000.* [2] *Data taken from Guo et al., 2001.*

Sheep milk generally contains much higher fat and protein levels than cow and goat milk. The high solids content of sheep milk strongly affects its coagulation, its acidification properties and its cheese yield potential.

Cow and goat milk tend to have fairly similar compositions but that does not mean they behave the same way in terms of acidification and coagulation properties. In fact, there are significant differences in the specific fat and protein makeup which have great implications for cheesemaking. Studies on cheese yield of cow milk, for example, have been conducted extensively in the past (Emmons et al., 1990; IDF, 1993). In general, these studies have shown that goat cheese yield tends to be slightly lower due to the formation of a more fragile curd. Currently many companies in the U.S. that produce cheese from goat milk use the formula for cow milk cheese production in order to predict the goat cheese yield. Based on the research available, however, this is inappropriate as both milks are different in terms of chemical composition and characteristics. A study was conducted by Guo et al. in 2004 looking at the relationship between the yield of cheese (Chevre) and the chemical composition of goat milk. Whereas casein and fat are the principal factors affecting cheese yield in cow milk cheese, the study showed that the total solids content in goat milk was the strongest predictor for Chevre yield capacity; thus proving that goat and cow milk should not be treated as one in the cheesemaking process.

Sheep milk, on the other hand, gives higher cheese yield than cow milk. Cheese yield is dependent upon milk composition namely fat and casein which are both higher in sheep milk compared to goat and cow milk. Research studies were conducted on changes in milk composition and the impact on cheese yields for soft and hard sheep milk cheese (Jaeggi et al., 2005; Wendorff, 2004). The following tables show the results of these studies where RF is the fat recovered in cheese, RC is the casein recovered and RS the other milk solids.

Changes in milk composition and the impact on cheese yields

	February Milk	May Milk	August Milk
FDM in Cheese (%)	56.2	53.5	53.7
RF Value	0.84	0.84	0.83
RC Value	0.96	0.96	0.94
RS Value	1.07	1.08	1.08
Cheese Yield (%)	18.45	17.29	16.787

Table 1: Cheese yield and retention factors for hard pressed sheep milk cheese.

Changes in milk composition and the impact on cheese yields

	January Milk	May Milk	September Milk
FDM in Cheese (%)	55.1	54.8	53.7
RF Value	0.82	0.81	0.83
RC Value	0.96	0.96	0.94
RS Value	1.01	1.01	1.01
Cheese Yield (%)	21.08	17.35	17.35

Table 2: Cheese yield and retention factors for soft sheep milk cheese.

Results of this study show that seasons had a significant impact on cheese composition and cheese yield. Fat and protein recoveries in the cheese were not significantly different depending on the season and cheese yields are directly related to the level of fat and casein in the milk. Fat recoveries are also significantly lower in sheep milk compared to cow milk. Sheep milk tends to have more of the smaller fat globules compared to cow milk. That is important to consider in cheesemaking because smaller fat globules will be lost during the cheesemaking process. Cow milk will also have a fat recovery of about 90% whereas sheep and goat tend to have a lower fat recovery of about 85% because of the smaller fat globules.

Fatty acid composition and lipase activity

Lipase is an enzyme that catalyzes the breakdown of the fat (triglycerides) releasing free fatty acids from the fat molecules. Fatty acids are molecules of varying carbon chain length. The short chain free fatty acids (chain of 4 to 8 carbon) have very strong aromas and flavors which are important to cheesemaking. They are the ones presented in the table below. Free fatty acids can, however, be a source of rancid flavor if they are at sufficient concentration. The fat in sheep and goat milk contains higher proportions of short chain fatty acids compared to cow milk, especially caproic, caprylic and capric acids. Those specific fatty acids are responsible for the typical "goaty" and "sheepy"

Fatty Acids (% total FA) [2]

			
Butyric (C4:0)	3.3	2.6	3.2
Caproic (C6:0)	1.6	2.4	2.9
Capylic (C8:0)	1.3	2.7	2.6
Capric (C10:0)	3.0	10.0	7.8
Lauric (C12:0)	3.1	5.0	4.4
Steric (C18:0)	14.6	12.5	9.1
Fat Globules Diama. (um)[1]	4.5	3.5	3.3

Table 3 [1] *Fahmi, 1956.* [2] *Alichanidis, 1996.*

flavor notes in sheep and goat cheeses. Those notes are usually defined as more peppery and piquant. To see the specific levels of each note, consider Table 3.
Milk is susceptible to rancidity because it contains indigenous lipases. The milk fat globules are surrounded by a membrane that protects the fat against the lipase activity. In goat milk, lipase is mostly in the serum portion and directly in contact with the membrane. Any disruption of the membrane allows rapid hydrolysis of the fat. Since lipase is usually deactivated at high temperature, it is usually recommended that goat milk be pasteurized in order to deactivate the lipase and limit the development of rancid flavors. In fact, when goat milk is stored more than 3 days, an increase of rancid and goaty flavors is observed.

Sheep milk has very little native lipase activity so it is less vulnerable to rancidity. It is also the reason why sheep milk is easily frozen as a means of storage during the winter. Keep in mind that long storage or improper storage temperatures can cause rancidity in raw sheep milk. The ideal freezing temperature should be -27°C/-17°F for no more than one year to minimize issues. Cheesemakers experience more rancid flavor development using home freezers where the temperature is generally higher. There is also a risk of casein destabilization when the milk is stored in a home freezer. A mishandling of sheep and goat milk will tend to affect the flavor of the cheese resulting often in intense and unbalanced sheep and goat flavors. When the milk is handled properly, however, sheep and goat cheeses are pleasant and subtle.

Casein composition and coagulation properties
Casein composition and coagulation properties are also an important part of understanding how each milk will react in a cheese. There are four different kinds of caseins in milk designated by Greek letters: alpha- (α), beta- (β), and kappa- (γ) caseins. There are two different alpha-caseins and all caseins present slight variations. The table below (Alichanidia, 1996) presents the percentage of each type of casein in cow, goat and sheep milk.

% of each type of casein in cow, goat and sheep milk			
			
α_{s1}, %	35	5	56
α_{s2}, %	10	25	--
β, %	40	50	33
K, %	15	20	11

Table 4 *Alichanidis, 1996.*

Sheep milk contains higher levels of total protein compared to cow and goat so it also contains more casein. Since the casein coagulates to form the backbone of the cheese, sheep milk coagulates faster and forms a much firmer curd. It yields twice the amount of cheese per unit of milk as cow and goat.
Goat milk contains much lower amounts of the alpha-caseins and much higher amounts of beta-casein. This typically results in a more fragile curd compared to the one obtained with cow and sheep milk and it tends to also result in lower yields.
Alpha s1-casein is structural casein and it gives the texture to the cheese. Goat cheese tends to be softer because of the lower proportions of alpha s1-casein. A study conducted by Dr. Bill Wendorff at the Wisconsin Center for Dairy Research in 2009 looked at the feasibility of manufacturing eyed-cheeses such as Swiss or Emmanthaler using sheep or goat milk. In his study, eyed-cheeses made from goat milk had a much softer body lacking structure to hold the shape of the eyes when formed in the cheese. The result was collapsed or irregular eyes. On the other hand, cheese made from sheep milk did not form eyes due to the very high alpha s1-casein content. The curd was ultimately too dense and lacked good elasticity to allow a good eye formation. When CO_2 was formed inside the cheese in the warm room, it only expanded the mechanical opening to form large splits *(W.L. Wendorff, 2009. You can't make eyed-cheeses from ewe's milk).*

Blending the Milk
When making a mixed milk cheese, the contribution of each milk to the blend is important. The cheesemaker will have to adapt his or her original raw cow milk cheese recipe to the casein and mineral content of the blended milk. The amount of starter culture and rennet added to the milk might have to be adjusted in addition to the curd firmness at cutting, the size of the grain while cutting and the time to press/drain.

Blending milks can also bring interesting flavors to the cheese that would not have been possible with cow milk alone. For instance, adding 10 to 20 percent of goat milk into cow milk to make a Mozzarella would allow some "goaty" character in the cheese while keeping the stretching texture that cow milk allows.

In our experiments on mixed milk cheeses at CDR, we noticed that in mixed milk hard and aged cheeses, in order to be able to detect sheepy or goaty notes in the cheese, it is good to add at least 30 percent sheep or goat milk. The amount will of course vary depending on the kind of cheese: fresh/aged, hard/soft.

Conclusion

Mixing milks to make cheeses brings a lot of potential to create new flavors, unique specialty cheeses or other dairy products. Considering the amount of sheep and goat products imported into the United States every year, there is definitely an opportunity for growth in the domestic mixed milk specialty cheese market. Mixed milk cheeses are innovative and they also have the potential to reduce manufacturing costs when compared to a straight goat or sheep milk cheese. On the other hand, manufacturing a mixed milk cheeses also gives the cheesemaker an opportunity to add value to a cow milk cheese. Milk composition varies greatly so it is very important to know the facts and understand how the composition will affect the end product. With a growing interest in the special qualities of sheep and goat milk, the market for mixed milk cheeses should continue to increase. Thorough control and knowledge of all these elements will allow a cheesemaker to make the best product to take advantage of this potential market.

A copy of this article with references is available on the CDR Insider. www.cdr.wisc.edu/insider

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Choosing a Dairy Protein Ingredient

Conclusion

Dairy protein ingredients have many great functional and nutritional properties. Once you understand the basic differences in the chemistry between casein and whey proteins, you have a better chance of successfully developing a protein enhanced food that has the flavor, texture and appearance that consumers will enjoy. For more information on dairy protein ingredients and formulations visit www.innovatewithdairy.com

Marianne Smukowski Receives Award

CDR Safety and Quality Coordinator Marianne Smukowski was recently honored by the Innovation Center for U. S. Dairy her extensive efforts to improve pathogen control in the dairy industry. A contributor to the IC Food Safety initiatives and an early advisor on the Artisan Cheese Team, Smukowski's passion for safe, wholesome dairy products continues to improve food safety efforts.

Examples of Goat and Sheep Milk Cheeses made in Wisconsin.

Pastorale Blend, Sartori, Pymouth, WI

Meadow Melody, Hidden Springs Creamery, Westby, WI

Ziege-Zacke Blue, LaClare Farms™, Malone, WI

River Bend Sheep, Carr Valley Cheese, La Valle, WI

Canaria, Carr Valley Cheese, La Valle, WI

Billy Blue, Carr Valley Cheese, La Valle, WI

2014 Short Course Calendar

CDR is proud to host more than 25 public and private short courses each year on the UW-Madison campus. With more than 1,000 industry attendees each year, CDR is honored that so many of you come to us for your dairy education needs. As our courses continue to grow we encourage you to register early in order to secure a seat. We look forward to seeing you at one of our 2014 short courses. www.cdr.wisc.edu/shortcourses

Short Course Million Challenge

Challenge to the Industry

Join Bill Wendorff in contributing to the future of dairy education in Wisconsin.

To date more than 10,000 of you have benefited from attending a Wisconsin Center for Dairy Research dairy short course. To ensure the future of dairy education, and as part of the CDR building campaign, **Professor Emeritus Bill Wendorff is challenging each of you to join his Short Course Challenge and donate $100 for each short course you have attended.** This money will put towards the CDR training center facility within the building fund campaign.

This challenge is an opportunity to join the dairy industry and its friends in contributing to a world-class dairy research facility.

For more information on how to donate visit:
www.cdr.wisc.edu/building
www.facebook.com/ShortCourseMillionFund

Donate today to secure Wisconsin's dairy future

University of Wisconsin First in Dairy Education Since 1890

CDR Cheese Applications Coordinator John Jaeggi

was recently named as one of the 10 finalists for the Wisconsin Cheese Makers Association Distinguished Service Award. This award honors those who have "played a significant role in building the success of the United States dairy industry." Jaeggi has been deeply involved in the industry, from his family business to the research and application projects completed during his many years with CDR. Please join CDR staff in congratulating John Jaeggi on this special nomination.

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

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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 Reviewer/Contributors:
Debra Wendorf Boyke, John Jaeggi, Dean Sommer, Tom Szalkucki

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Tim Hogensen

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www.cdr.wisc.edu

Short Course Calendar:

Milk Pasteurization, January 7-8
Batch Freezer Workshop, January 14-16
WI Dairy Field Reps, February 11-12
WI Process Cheese, February 25-26
Buttermakers, March 4-6

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

Events:

2014 International Cheese Technology Exposition
April 22-24, 2014 | Wisconsin Center, Milwaukee, Wisconsin