Milk-Derived Ingredients for Confections

Dairy ingredients provide flavor, color, texture, structure and lubricity.

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Ingredients derived from milk are found in chocolates, coatings, truffles, cream fillings, toffees, caramels, fudge and nougats. Milk-derived ingredients contribute desirable flavor, color, structure and textural properties to confections. Milk is a versatile starting material which can be condensed, concentrated and dried to optimize ingredient functionality for specific confectionery applications.

MILK—WHERE IT ALL BEGINS

Milk ingredients for confections are usually made from cow's milk, although goat's milk can be found in some artisanal products. The major components in milk are water, fat, protein and lactose. Minor components in milk are minerals, vitamins and enzymes. Milk is approximately 87 percent water, 4.9 percent lactose, 3.5 percent milk fat, 3.2 percent protein and 0.7 percent ash (mineral content).

Milk is a biological product; therefore, small shifts in overall component concentration and variation within the components are to be expected. The extent to which the variation occurs is influenced by many factors, including species, breed, animal-to-animal differences, stage of lactation, feed and season. However, the variation of the component concentration of milk is not of much concern to the confectioner, because milk in its native form is rarely used directly as an ingredient due to its high water content. Milk ingredients from other countries are also influenced by these variables, and in some instances the functional properties of foreign ingredients can be quite different from U.S. ingredients.

Indicators of quality (flavor, color and functional performance) are specific to the ingredient in question. All dairy ingredients should have a clean, characteristic flavor and aroma with no obvious off-flavors and off-aromas. Flavor descriptors for dairy products can be found in *Sensory Evaluation of Dairy Products*. The ingredient quality is dependent on the quality of the raw milk and the conditions used to manufacture and store the ingredients. High-quality raw milk comes from healthy cows milked under sanitary conditions. Raw milk should exhibit no off-odors, have no free fat floating on the milk surface which would indicate fat deterioration and have a low bacterial and somatic cell count. Bacteria and somatic cells contain enzymes that can contribute to off-flavors and fat and protein deterioration.

The diversity of milk ingredients available necessitates an understanding of the functional properties of milk components (fat, protein and lactose) and how different ingredients deliver these components to confections.

Milk Fat Properties

Milk fat adds flavor to many confections. Milk fat provides lubricity and mouthfeel in caramels and toffees. Milk fat contributes to texture and helps inhibit fat bloom in chocolates.

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file of milk fat spans the spectrum of fresh, heated, cooked, brown and burnt flavor notes depending on the processing used to make the ingredients and the process used to make the finished confection. Milk fat is also an excellent carrier of other fat-soluble flavors. Milk fat is delicate and susceptible to deterioration upon rough handling, exposure to light and oxygen. Milk fat can undergo oxidation of the fatty acids at the double bonds, which leads to off-flavors described as cardboardy, fishy or painty. Hydrolytic rancidity of milk fat results in the cleavage of fatty acid from the glycerol backbone and leads to unpleasant flavors that are reminiscent of lipase-generated flavors found in feta or aged provolone cheese.

Milk fat is present in milk as a globule with a triglyceride core surrounded by a protein and phospholipid membrane. Milk fat remains emulsified in the serum phase of milk as it is concentrated into cream. The phospholipids and membrane proteins provide emulsification to confections that use cream. During the manufacture of butter, anhydrous milk fat, butter oil and milk fat fractions, the globule is disrupted and the membrane material is washed away into the buttermilk. The functionality of these concentrated ingredients is solely based on the properties of the triglyceride core. The fatty acid profile of the triglyceride core is complex and varies due to feed and stage of lactation.

The complex fatty acid profile of milk fat contributes to the wide melting and, conversely, crystallization range of milk fat. The melting range of milk fat is from -40° to +40°C. Milk fat crystallizes into a stable β′ form. The crystallization behavior of milk fat is compatible with cocoa butter. The addition of intact milk fat to cocoa will cause a softer texture and reduced snap in the finished chocolate. Milk fat fractions with high melting points can be incorporated into chocolate to protect against fat bloom without the softening effects. Milk fat can be legally added to pure chocolate, and it is used to help control cost when cocoa butter prices are high.

Variation in fatty acid profiles due to feed and other factors can cause significant differences in the melting and crystallization behavior of milk fat ingredients from different locations and different times of the year.

The color of milk fat will vary based on the diet of the animal. Animals grazed on pasture will produce milk fat that is a darker yellow color from the breakdown of chlorophyll in the pasture greens. Animals on rations will produce milk fat that is whiter in color. A notable example of this is anhydrous milk fat (AMF) obtained from New Zealand, where the animals are grazed year round, which is usually a deeper yellow color and has a different melting profile compared to AMF produced in the United States.

Milk Protein Properties

Milk proteins are used in confections as a source of milk solids where they contribute to color, flavor and texture. The amino acids in milk proteins react with lactose in the Maillard reaction to generate desirable brown colors and flavors. The whey proteins form stable gels, which contribute to the body and texture of caramels. Milk proteins function as whipping agents, providing a dense texture and distinct flavor in nougats.

The total protein content in milk is made up of two families of proteins—the caseins and the serum (whey) proteins. The terms *serum* and *whey* are often used interchangeably to mean the soluble proteins in milk. They both refer to the same family of proteins, but the term *whey protein* more accurately reflects the proteins when they have been recovered from the whey stream after cheese making, whereas *serum protein* is used when these proteins are separated from native milk using membrane filtration processes. In bovine milk, the casein accounts for approximately 80 percent of the protein and the serum proteins are approximately 20 percent. ➤

The caseins (α_{s1}, α_{s2}, β, κ) are present in the form of micelles dispersed in the water (serum) phase of milk. The casein micelle consists of submicelles of casein proteins that are held together by calcium phosphate bridges. The κ-casein orients itself on the outside of the micelle, serving as an emulsifier to keep the micelle dispersed, and giving a "hairy" look to the micelle when viewed under a microscope. The casein micelle has a net negative charge and will precipitate from solution with the addition of acid. Acid precipitation tends to form a soft gel, like in yogurt and some fresh cheeses. Enzymatic action will cleave the proteins and form the strong gel characteristic of most cheeses.

The serum proteins (α-lactalbumin, β-lactoglobulin and others) are soluble in the water (serum) phase of milk. These proteins do not participate in coagulation processes. The serum proteins are more globular in shape than the caseins, and will denature at high temperatures, unlike the casein proteins which are stable to heating. When the serum (whey) proteins denature, they unfold and expose binding sites. The denaturation process results in a stable, soft gel that binds water. This property is beneficial in the manufacture of caramels.

Lactose Properties

Lactose is a component of the milk solids. Lactose, or milk sugar, is a disaccharide made up of glucose and galactose. It is a reducing sugar that participates in Maillard browning reactions, producing a range of brown colors and desirable flavors. Lactose can be used to enhance other flavors and as a flavor carrier.

Lactose is less sweet than sucrose and may be used to reduce the sweetness of confections and as a bulking agent. It imparts chewiness and graininess to confections. Lactose solubility is low and it is slow to crystallize from solutions. In confections with a high concentration of lactose or milk solids, lactose crystallization can result in a gritty texture during storage of confections.

THE MANUFACTURE OF DAIRY INGREDIENTS

The following discussion is a general overview of the processes used to produce dairy ingredients. Dairy plants process similar ingredients, but the specific equipment and processing conditions may be unique to that plant. At the processing plant, each incoming tanker of raw milk is tested for antibiotic residues and evaluated for aroma. The milk is tested for component concentration and bacterial counts, either in-house or at a central lab that tests milk for farmer payment purposes.

The single unit operation in common to the manufacture of all confectionery ingredients is pasteurization. Pasteurization can be done using low temperature long time (LTLT), high temperature short time (HTST) or ultrahigh temperature (UHT) processes.

The specific time-temperature combinations for each of these processes is legally set in the Pasteurized Milk Ordinance (USDHHS and FDA, 2011) to provide an equivalent destruction of pathogenic bacteria, regardless of the equipment or process used. Pasteurization conditions above the legal minimum may be used to increase the shelf life of dairy products or because of the nature of the ingredients (e.g., heat treatments for condensed milk products).

Concentrated Milk Fat Ingredients

Quality indicators for these ingredients are based on the properties of the milk fat. Cream should have a light, off-white color and a clean aroma. As the milk fat becomes concentrated into butter, butter oil, anhydrous milk fat and milk fat fractions, the flavor has more characteristic butter flavors (Figure 1). Concentrated milk fat ingredients that are mishandled will have oxidized or rancid aromas. The color of the concentrated ingredients is highly dependent on the feed of the animals that produced the milk. Protecting concentrated milk fat ingredients from direct sunlight, high heat and exposure to air will preserve the flavor and quality. ➤

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Cream Cream is made by centrifugal separation of milk. Milk separators are common operations in most dairy plants because they are used in the production of fluid beverage milk. Most milk is separated after it has been partially warmed during the pasteurization process, although it can also be separated cold using equipment designed for cold separation. The separator contains a stack of cone-shaped plates with holes that allow for the less-dense cream to rise and the more-dense skim milk phase to flow out of the lower channel. The fat content of the cream is determined by the setting of the adjustable set screw on the separator. The cream and skim milk phases are piped to the desired location in the dairy. Fluid milk for beverage purposes is standardized by combining the correct proportions of skim milk and cream to meet the fat content of the desired product (1%, 2%, etc.). The fat content for heavy cream is 38 to 42 percent, and 18 to 22 percent for light cream. The fat globules remain intact in the manufacture of cream.

Butter Butter is made by churning heavy cream to invert the emulsion of oil in water found in milk and cream to the water-in-oil emulsion of butter. Heavy cream is tempered at cold temperatures to initiate crystallization in the milk fat globule. The solid fat aids in breaking the globules in the churning process. As the fat globules break, the liquid fat is released and aids in agglomeration of fat crystals to form butter granules. As the churning progresses, the fat forms a mass and the serum phase is separated out. This serum phase is called *buttermilk* and is rich in globule membrane proteins and phospholipids, giving it excellent emulsification properties. True buttermilk is different from the buttermilk available in grocery stores, which is made by culturing milk. True buttermilk may be condensed or dried and used as ingredients in other food products. The fat mass is washed to remove traces of buttermilk, and then worked to evenly distribute the water droplets in the fat matrix. If the product is to be salted, a salt solution is added after washing and before the working step.

Butter oil and anhydrous milk fat Butter oil and anhydrous milk fat (AMF) are similar products that differ only in the amount of moisture in the products, 0.5 percent

Typical Composition of Dairy Ingredients Used in Confections

General Category	Ingredient	Water (%)	Fat (%)	Protein (%)	Lactose (%)
Concentrated					
	Cream, light		18-22		
	Cream, heavy		38-42		
	Cream, plastic (oil-in-water emulsion)		80		
	Butter (water-in-oil emulsion)		80		
	Butteroil		99.5		
	Anydrous milk fat		99.8		
	Milk fat fractions		99.8		
Condensed					
	Condensed skim milk	73.0	0.3	10.9	14.7
	Condensed whole milk	74.0	7.6	6.8	10.0
	Sweetened condensed milk[1]	27.2	8.7	7.9	11.4
Dried					
	Whole milk powder	2.5	26.7	26.3	38.4
	Skim milk powder	3.2	0.8	36.2	52.0
	Whey powder	3.2	1.1	12.9	74.5
	Lactose	5	0	.01 – 0.6	94

1 The content of milk components varies depending on the amount of sucrose added to the condensed milk and whether the milk base contains fat.

Figure 1 *Bassette and Acosta, 1988*

and 0.2 percent respectively. Both products are made using the same starting steps, and can be made by two different methods. The first method involves centrifugal concentration of heavy cream (40% fat) to a more concentrated cream (75% – 80% fat). The concentrated emulsion is then inverted from a water-in-oil emulsion to an oil-in-water emulsion using a homogenizer. The oil-in-water emulsion is further concentrated to butter oil (95.5% fat) using centrifugation. The second method starts with butter as the raw material. The butter is melted and the fat phase is separated from the liquid phase. Centrifugation is also used to concentrate the product to butter oil. The production of AMF starts with butter oil, obtained from either method. A vacuum treatment is applied to reduce the moisture content from 0.5 percent in butter oil to 0.2 percent for AMF.

Milk fat fractions Milk fat fractions are available in other countries, but currently are not produced in the United States. The high-melting fractions (melting point greater than 35°C) are of particular interest to the confectioner because they inhibit cocoa butter bloom without softening the chocolate, which happens when intact milk fat is added. Milk fat fractions are made by crystallizing AMF under controlled conditions to a desired temperature. The slurry of solid crystals and liquid milk fat is separated using vacuum or pressure filtration. The liquid fraction can be fractionated at subsequently lower temperatures to produce fractions with different melting profiles. The properties of the fractions are highly dependent on the physical state of the fraction at separation (i.e., the solid or liquid fraction), the temperatures used for fractionation and the number of steps in the fractionation process.

Condensed Dairy Ingredients

The manufacture of condensed dairy ingredients (Figure 1) involves heating steps, which impart a cooked flavor. Depending on the severity, the Maillard browning reaction may occur, resulting in brown colors and flavors. The heating steps also increase the viscosity of the finished products. Gel formation is considered undesirable and results from too much heating and the resultant denaturation of the serum proteins. Lactose crystallization is also a concern in these concentrated products, which could lead to sandiness or grittiness in the product.

Condensed whole and skim milk Condensed milk products have a long shelf life, and, therefore, must be given a stronger heat treatment than typical pasteurization to ensure destruction of bacteria and spores and improve heat stability. The ultrahigh-temperature pasteurization also denatures some of the serum proteins which increases the viscosity of the condensed milk. After the heat treatment, the milk is pumped to an evaporator. There are several different designs of evaporators. The water is removed under vacuum until the desired level of solids is reached. If the product contains fat, it is homogenized after the evaporation step. The product is then cooled and packaged. Condensed milk is packaged in aseptically filled paperboard containers, or sealed in cans and processed.

Sweetened condensed milk The manufacture of sweetened condensed milk adds a sugar-incorporation step either by adding dry sugar to the milk before the heat treatment or by incorporation of a sugar slurry during the evaporation step. After the milk has been evaporated and cooled, it undergoes a controlled-crystallization step. The addition of sucrose decreases the total water in the product, thus increasing the concentration of lactose in the water phase. If the excess lactose crystallizes freely it will create large crystals and result in a gritty product. Therefore, the product is seeded with small lactose crystals and crystallized under agitation to keep the lactose crystals small. After the crystallization process ➤

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is completed, the product is packaged as described above for condensed milk.

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Dried Dairy Ingredients

Dried milk powders (Figure 1) may take on a cooked flavor. Higher-heat treatments found in roller-dried and some spray-dried products may cause the Maillard reaction, resulting in brown colors and undesirable flavors. Whey powders may take on an undesirable, cheesy or sour flavor if the whey is not processed soon enough after the cheese-making process.

Burnt particles are a common defect in milk powders. Solubility and flowability of milk powders can be important to an application and these properties will vary based on the processing conditions used to manufacture the ingredient. Milk powders are hygroscopic and will pick up water upon storage, resulting in clumps of milk powder that are difficult to incorporate into a finished product.

Whole and skim milk powder Milk powders also have a long shelf life, but since the water content is very low they do not necessarily need a particularly high heat treatment, and may be pasteurized using normal high-temperature short-time (HTST) conditions; thus they are referred to as *low-heat milk powder*. Higher-heat treatments increase the stability of the milk powder, but decrease its solubility, and are referred to as *medium-heat* and *high-heat powders*. The milk is standardized to the desired fat content by blending skim milk and cream; whole milk is typically 3.25 percent fat. The milk is concentrated in an evaporator to increase the solids content to approximately 45 to 55 percent to facilitate the drying process.

The majority of milk powders are produced using a spray-drying process. The concentrated milk is pumped through an atomizer into a heated chamber. The hot air in the chamber evaporates the water from the milk droplets. The milk powder stays suspended in the drying air, and is collected in cooling cyclones as the drying air exits the chamber.

Spray-dried milk powder manufactured for easy reconstitution may be instantized so it forms more-porous agglomerated particles. Milk powder is often agglomerated using a fluid bed process, where the milk powder from the spray dryer enters the chambers and then is humidified with steam to form agglomerates. This additional moisture is removed from the agglomerates in drying chambers as the milk powder passes down the bed.

Milk powders can also be produced using a roller-drying process. In this process, the milk is dried by contact with rotating steam-heated drums. The milk can be supplied to the drying rollers either from a trough fitted between two rollers or by spray nozzles above the rollers. The water is evaporated from the milk during contact with the warm rollers. As the rollers turn, the milk powder passes over a scraper that removes the milk from the roller surface. The milk powder flakes are then ground to the desired particle size.

Whey powder Whey is the coproduct of cheese making. During cheese making the caseins are coagulated to form a gel, which traps most of the fat and some of the serum. The remaining serum phase is drained from the curd, and this is called the *whey*. It contains small amounts of fat, lactose, the soluble proteins now called *whey proteins*, minerals and water-soluble vitamins. Whey is processed as soon as possible after it is collected at the end of the cheese-making process to stop the growth of the cheese-making bacterial cultures and maintain quality. The whey is filtered to remove any bits of cheese curd and traces of fat, and then pasteurized. For the manufacture of whey powder, whey is then processed in a manner sim- ➤

ilar to milk powder. It is concentrated in an evaporator and spray dried.

Milk and whey protein concentrates There is a wide range of milk and whey protein concentrates and isolates available for use as food ingredients. Milk protein concentrates are obtained directly from native milk and, therefore, will contain all of the caseins and serum proteins. Whey protein concentrates contain only the soluble proteins remaining after the cheese-making process. These ingredients are primarily made with membrane filtration processes using conditions appropriate to obtain the desired protein and other component (e.g., lactose) content. Once the desired concentration of components is obtained, the liquid concentrates are spray dried. These ingredients are manufactured as specialty ingredients with a range of protein contents, compositions and functional properties.

Lactose Lactose as a concentrated ingredient is recovered from cheese whey (Figure 1). The whey may be processed to remove the valuable proteins before the lactose is obtained. The whey is first concentrated in an evaporator to increase the lactose concentration. The whey is then seeded to encourage lactose crystal growth. After crystallization, the lactose is centrifugally separated from the whey, dried and ground to the desired particle size.

CONCLUSION

Many dairy ingredients that exist for use in confections provide flavor, color, texture, structure and lubricity. A thorough understanding of the confection being made and the characteristics desired from the dairy ingredients are paramount in choosing the correct ingredient for the application. Most ingredients have a range of component concentrations, such as heavy cream containing 38 to 42 percent fat (Figure 1). The functional properties of an ingredient, such as melting profile or solubility, will also vary with the specific ingredient and supplier.

It is highly recommended that the user define a specification for the desired ingredient, and request a certificate of analysis with each lot, guaranteeing that the specification is met, in order to have reproducible functionality from an ingredient. It is also recommended that ingredients be evaluated for quality attributes upon receipt to verify that the quality standards are met and then again prior to incorporation into the finished product to ensure that changes did not occur upon storage. □

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Questions and Answers

Q: What has changed in the U.S dairy industry that has increased the stability of WMP from 3 to 6 months?

A: I'm not sure what specific changes were made to the WMP process, but the industry is constantly improving its processing and handling practices in order to improve the quality and shelf life of dairy products.

Q: It is my understanding that The Hershey Co. originated in this area due to the quality of milk. How does central Pennsylvania's milk rate compared to North America?

A: Milk quality is related to care taken on individual farms and throughout the milk handling and processing system. Therefore, it isn't fair to say milk quality is better in one region of the country over another. Central Pennsylvania is a very high dairy producing region made up of many small to mid-size dairy farms that take care to produce high quality milk. The geographical concentration of farms and the quality of the milk in central Pennsylvania would certainly have been an attraction for Mr. Hershey.

Q: What are the flavor differences between spray dried, instantized and roller dried milk powders?

A: It depends on the processing conditions used to produce the specific samples in question. Typically milk receives a more severe heat treatment during the roller drying process compared with the spray drying process. However, spray dried milk powder can be made using different conditions (e.g., low-heat, moderate heat, or high-heat). Instantizing adds steam to the process. The flavor differences are going to depend on the extent of the heat treatment. As the heat treatments increase, more proteins denature and can produce sulphury flavors that may be pleasant like cooked milk or custard, or unpleasant like old eggs. Increases in heat treatment will increase the opportunities for the Maillard reaction to occur. A range of flavor and color profiles can be produced depending on the extent of the heat treatment.

Q: Are there any differences between milk from cows treated with BST versus cows that have not been?

A: No. All milk contains BST (bovine somatotropin), a naturally-occurring hormone. A synthetic form of BST, called RBST is sometimes used as a herd management tool. The synthetic hormone is chemically identical to the naturally-occurring hormone, and cannot be distinguished by analysis.

Q: What is the shelf life of AMF/butter oil as a tote package? Is all butter oil nitrogen flushed when packed?

A: You would have to check with individual suppliers to see what they recommend for the shelf life of their totes. Not all suppliers flush their products with nitrogen, so please check with your supplier.

Q: What are the brown particles in dried milk? How can they be prevented?

A: The brown particles are burnt milk solids, usually proteins. This could be due to too high of processing conditions or build up on the inside surface of the driers that would cause it to burn and then flake off into the particle stream. Careful monitoring of the drying processing should reduce the amount of burnt particles.

Q: Is there any difference in shelf life between butter oil and AMF?

A: Not really. Butter oil is 99.6 percent milkfat and AMF is 99.8 percent milkfat, and the 0.2 percent moisture difference does not affect shelf life. For best shelf life these products should be kept cool, away from light and air exposure.

Q: Explain the difference between butter oil and AMF.

A: See previous question Butter oil is 99.6 percent milkfat and AMF is 99.8 percent milkfat, as defined in the Code of Federal Regulations, 7 CFR 58.347.

Q: What is the difference between evaporated and condensed milk?

A: Whole evaporated milk is defined by the Code of Federal Regulations (21 CFR 131.130) as having not less than 6.5 percent milkfat, not less than 16.5 percent solids not fat, and not less than 23 percent by weight milk solids. Concentrated or condensed milk is defined (21 CFR 131.115) as having not less than 7.5 percent by weight milkfat and not less than 25.5 percent total milk solids. From a practical perspective, evaporated skim milk would be the same as condensed skim milk.

The product sweetened condensed milk (21 CFR 131.120) contains not less than 8 percent by weight milkfat and not less than 28 percent total milk solids, and has sufficient nutritive carbohydrate sweetener to prevent spoilage.

Q: How can a milk powder supplier vary the yellow color of the powder?

A: The yellow color in milk may be the result of differences in feed of the cows. Animals fed pasture and grass consume more carotenoids and their milk, and thus products produced from this milk, are more yellow in color. You may also be thinking of a creamy, brown color that is seen in milk powders. This is a result of the Maillard browning reaction occurring during the spray drying process. The supplier can monitor the processing conditions to minimize the browning.

Q: What is the difference in cultured buttermilk and buttermilk as you made it? How is it processed?

A: True buttermilk is the aqueous phase separated from the fat during the butter making process. When the milk fat globules are broken during the phase inversion step to make butter, the phospholipids and proteins that were part of the milk fat globule ➤

membrane are released into the aqueous phase. True buttermilk has excellent emulsifying properties because of this. Buttermilk from the butter making process is concentrated or dried and sold as ingredients in the food industry.

Cultured buttermilk is the product that we buy in the grocery store. It is milk (fat content varies) that has been cultured to give it a buttery, tangy flavor and thick texture. If the buttermilk contains fat, it is present as intact globules.

Q: Is there any difference in milk that comes from cows eating GMO corn versus cows eating non-GMO corn?

A: No. To my knowledge there is no data to show that there are any changes in the milk.

Q: Why is disodium phosphate used in confections made with condensed milk and what is the function?

A: Disodium phosphate functions as an emulsifier in condensed milk to prevent the separation of the fat and aqueous phases, and help prevent gel formation.

Q: What is acid whey? Is there a use for it in the confectionery industry?

A: Acid whey is the whey obtained from the manufacture of cheese that uses primarily acid for coagulation rather than rennet. The pH of the whey from cheese made with acid coagulation (e.g., cottage cheese) are quite a bit more acidic than cheese made with rennet (e.g., cheddar, mozzarella, swiss-types). The whey is collected after cheese making, then concentrated and dried for use as a food ingredient. Acid whey is very sour in flavor. I do not know if there is a use for acid whey in confectionery products.

Q: Is there a concern for coliforms and E. coli in milkfat?

A: As with all dairy and food products there is the possibility for contamination through improper processing, poor sanitation, or post-pasteurization contamination. I would be concerned if these organisms were identified in finished milk fat products. There is very little moisture in AMF and butteroil to support growth of microorganisms, but that does not rule out the possibility of survival if organisms were present.

Q: Is there a special storage tank type and condition acceptable for bulk milkfat storage? Any idea how long it could be stored?

A: I would check with your supplier to see what they recommend based on how the milkfat is delivered. A bulk tank implies that the product is liquid and therefore must be delivered and stored heated. The shelf life will depend on the tank and storage conditions (temperature, agitation, nitrogen flushing, etc.).

Q: We hear in the news that some people believe in health benefits of raw milk consumption. What is your viewpoint?

A: My personal viewpoint is that, based on the information I have reviewed, the health benefits I get from drinking milk can be obtained from pasteurized milk without the risks associated with raw milk.

Q: Does instantizing incorporate any emulsifiers or other ingredients or can it be purely processing based without additional ingredients?

A: I assume you are talking about the process of instantizing milk powders. The instantizing process uses steam during the agglomeration process. For products containing fat such as whole milk powder or buttermilk powder, an emulsifier such as lecithin may be incorporated during the agglomeration process to improve the fat stability.

Q: In AMF, how do you keep the milk fat amorphous? Does it tend to crystallize?

A: Milkfat naturally crystallizes into a beta prime form as it solidifies, it will not remain amorphous. The average crystal size depends on the condition under which the milkfat is cooled (agitation, temperature, cooling rates, etc.).

Q: If milk is so sensitive to oxidation, why isn't it sold in containers that block light?

A: There are milk containers that do block light. The traditional paperboard containers with the gable-top opening block light. Some dairies sell milk in opaque white or yellow light-blocking plastic jugs for just this reason.

Q: What is the shelf life of condensed whole milk in bulk?

A: It will depend on the processing conditions used to manufacture the product and the packaging. Please check with your supplier for details.

Q: How can you replace the properties of lactose in a product?

A: It will depend on what properties you are using lactose for in the product—sweetness, bulking agent, Maillard reactant, etc. First identify the functional properties you need, then look for replacers.