Glossary

AMERICAN Dairy Products INSTITUTE™

3A Standards - Standards which have been established for certain equipment, utensils and other items by the 3A Sanitary Standards Inc. (3-A SSI).

Absolute pressure - Atmospheric pressure added to gauge pressure.

Adulterated - Legal term meaning the product fails to meet legal standards. Example: Addition of a substance that reduces the quality of the product without declaring the presence of the substance. Adding a vegetable protein to whey protein concentrate that is labeled as 100% WPC would be considered adulteration. See misbranded.

Aerobic - With oxygen. Example: Aerobic bacteria require oxygen to grow.

Affinage - From the French word affiné, refers to the craft of maturing and aging cheeses. Affinage translates as finished or refined.

Agglomeration - Process used to increase the size of the powder particles. Agglomeration is a step in the instantizing process.

Alkalinity of ash - Analytical method that titrates the ash with hydrochloric acid. Method can detect the addition of neutralizers to dairy products.

Alpha-lactalbumin enriched whey protein concentrate - Product that has a higher concentration of alpha-lactalbumin as compared to beta-lactoglobulin. The product is said to have high heat stability and solubility.

Ambient temperature - Temperature in the area of the equipment or product.

Amino acids - Simple organic compounds that contain amino ($-NH_2$) and carboyxl (-COOH) groups along with a side chain specific to each amino acid. There are approximately 500 amino acids in nature but only 20 are found in the human body. Amino acids chain together to form proteins.

Amorphous - Without structure. Example: Amorphous lactose is lactose without structure. See also glass.

Anaerobic - Without oxygen. Example: Anaeobic bacteria grow only in the absence of oxygen.

Anhydrous - Without water. Example: α-anhydrous lactose is α-lactose that does not contain a molecule of water associated with its structure.

Anhydrous butteroil - See anhydrous milkfat.

Anhydrous lactose - Primarily β-lactose or a mixture of α- and β-lactose (National Formulary definition).

Anhydrous milkfat (AMF) - Water in oil emulsion that is at least 99.8% fat made by removing almost all of the water and solids-not-fat. See also anhydrous butteroil.

Annatto - An orange-red pigment traditionally used to color cheese.Annatto is an extract of the fruit wall of the tropical shrub achiote (*Bixa orellana*) and is among the oldest colorants known to man.

Ash - Residue that remains when milk/whey is heated to very high temperatures in a muffle oven. Organic acids are lost during ashing. Some minerals such as sulfur and phosphorous also may be lost. Other minerals may be converted to oxides, sulfates, phosphates, silicates and chlorides. In general, ash overestimates the concentration of minerals present since oxygen is combined with minerals in the remaining ash. The term often is used interchangeably with minerals and milk salts.

Atmospheric pressure - Sea level atmospheric pressure is 101.3 kPa or 14.7 psi or 1.01 bar.

Auto ignition temperature (AIT) - See Minimum Ignition Temperature (MIT).

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Babcock test - Test for determining fat content of a product that hydrolyzes (breaks down) components to release the fat so it can be measured in the column of a special bottle (Babcock bottle).

Bacilli - Rod-shaped bacteria. If the word bacillus is capitalized and italicized (*Bacillus*) it then refers to a specific group of bacteria. Example: *Bacillus cereus* which is a food pathogen.

Bacteriophage - A virus that parasitizes bacteria. Bacteriophages first infect the bacteria and then reproduce inside the bacteria. The bacteria eventually bursts thereby releasing the bacteriophages inside.

Bar - Metric unit for pressure. 1 bar = 100 kPa = 14.5 psi

Baseline pressure - Pressure of the baseline or line that feeds the stages in a membrane processing system.

Beta-carotene (β-carotene) - One of a group of yellow to red colored pigments known as carotenoids. Beta-carotene naturally occurs in grass and many vegetables and gives milkfat a yellow color. It is a precursor to Vitamin A.

Biofilm - Microorganisms attached to a surface often with organic and inorganic material.

Black pipe - Steel pipe with a black coating that limits corrosion.

Blast resistant vessel - See pressure-shock resistant vessel.

Blast wave - A shock wave in open air often followed by a strong wind. It is the combination of a shock wave with a strong wind that forms a blast wave.

Bleaching - Use of peroxides to reduce the yellow/orange color of whey that results from the use of annatto during cheese manufacture.

Bovine somatotropin (bST) - Naturally occurring hormone produced by the pituitary gland of dairy cows. The hormone affects the amount of milk produced. Recombinant bovine growth hormone (rBGH) is the synthetic version of bST.

Brevibacterium linens (***B. linens***) - Bacteria used on the surface if washed-rind cheese to develop flavor. It can have an orange/pinkish color and a distinct odor. Brick cheese often uses *B. linens*.

British Retail Consortium (BRC) - Group that works to ensure supplier compliance and secure retailers' ability to guarantee the quality and safety of the food products they produce.

Buffering - The ability of a solution to resist changes in pH when acids or bases are added.

Butter - A water in oil emulsion of fat globules, water and minerals made by churning cream from milk. Butter has at least 80% fat and can approximately 1.2% salt added.

Butteroil - Water in oil emulsion that has at least 99.3% fat and is made by removing most of the water and milk-solids-not-fat.

Calandria - Heating element of an evaporator. The calandria is a series of tubes in a falling film tubular evaporator where product flows down the inside of the tubes and the heating material is on the outside of the tubes.

Carotenoids - A group of pigments containing 40 carbon atoms that are found in fruits and vegetables. More than 600 carotenoids occur in nature and range in color from yellow to orange, red and brown. Beta-carotene is one type of carotenoid and can give milk a yellow hue when cows consume plants with large amounts of the pigment.

Casein - Protein in milk that precipitates at pH 4.6.

Casein (the ingredient) - Acid or rennet is used to coagulate the casein in skim milk. A washing step removes impurities such as lactose and minerals. The functional properties of the resulting casein will depend on the coagulation method used.

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Casein macropeptide (CMP) - See glycomacropeptide.

Caseinate - Acid or rennet casein that has been treated with alkali to make it soluble in water. The exact alkali used determines the functional properties of the resulting caseinate.

Catalase - Enzyme used to breakdown hydrogen peroxide into oxygen and water.

Cavitation - Bubbles that form and then collapse in the housing of a pump. Cavitation in a pump often sounds like marbles rattling around in the housing and can result in severe damage to the pump.

Centrifugal pump - A pump that imparts energy to a liquid with centrifugal force.

Change of state - Change in phase for a material. Example: Liquid to gas; solid to liquid; gas to liquid; solid to gas; etc.

Cheddaring - Cutting slabs of cheese into cubes to allow more whey to drain from the cheese.

Cheese fines - Small pieces of cheese that were not captured in the curd and are present in the whey when drained from the vat.

Cheese trier - Tool for sampling cheese that resembles an apple corer. A cheese trier is used to extract a small plug sample from different parts of a cheese so that the entire body of the cheese can be evaluated for texture, flavor, etc.

Chemical explosion - Result of chemical reaction such as oxidation. Example: Dynamite and dust explosions.

Chymosin - Protease found in rennet. Produced by newborn ruminant animals to aid digestion of milk. See rennet.

Clean in place (CIP) - Automated system of cleaning the interior surfaces of equipment such as tanks, pipes, pumps, silos, etc.

Clean out of place (COP) - Equipment to be cleaned is removed from the area of use and placed in special tanks for cleaning. Items typically requiring COP include fittings, clamps, utensils, impellers, hoses, etc.

Cleaning - Removal of soil from surfaces.

Coccus - Plural cocci, a spherical-shaped bacteria.

Codex Alimentarius - Group responsible for developing a collection of internationally adopted food standards aimed at protecting consumers' health and ensuring fair trade practices in the food trade.

Coliforms - Rod shaped, Gram negative bacteria that are found in the digestive tract of warm-blooded animals, and in plant and soil material. Coliforms often are used as an indicator organism for possible fecal contamination. See also total and fecal coliforms.

Colloid - Mixture in which one substance is dispersed as microscopic particles throughout another substance. The particles will not settle out and cannot be removed by filtering or centrifugation. Emulsions are a type of colloid. Example: Casein micelles in milk.

Colostrum - Milk that comes from cows within 48 hours of giving birth. Colostrum is a concentrated source of biologically active compounds that are needed to promote the health and growth of the calf.

Combustible dust - Solid material composed of distinct particles or pieces, regardless of shape or chemical composition, which due to its small particle size presents a flash-fire or explosion hazard as a result of its ability to propagate combustion when dispersed in air or the process-specific oxidizing medium (OSHA definition).

Combustible particulate solid - Any combustible solid material composed of distinct particles or pieces, regardless of size, shape or chemical composition.

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Compound butter - Butter that has been flavored by blending together various ingredients such as spices, honey, etc.

Concentrate (membranes) - Portion of the feed stream that is retained by the membrane. The terms concentrate and retentate are used interchangeably.

Concentrated milk proteins - Obtained by concentrating bovine skim milk through filtration processes so that the finished dry product contains 40% or more protein by weight. Concentrated milk protein products may be produced by filtration, dialysis or any other safe and suitable process by which all or part of the lactose and minerals may be removed. Products cannot be produced by combining separately produced casein (caseinate) and whey proteins (ADPI definition)

Concentrated whey - Whey where a portion of the water has been removed leaving all other constituents in the same relative proportions.

Concentration Factor (CF) - Ratio of the initial feed volume (weight or flow rate) to the retentate volume. Ratio often is referred is referred to as 2x, 3x, 5x, etc.

$$CF = \frac{\text{volume of initial feed}}{\text{volume of final feed}}$$

Condensate - Material changing from a vapor (gas) to a liquid. Example: Steam changing to water.

Condensible Out Water (COW water) - Water vapor that can be condensed to liquid water in an evaporator system.

Continuous diafiltration (Continuous DF) - Process of adding water to the retentate to reduce the concentration of permeable solids in the retentate. Diafiltration water is added at a rate that equals the rate of removal of permeate in continuous diafiltration.

Co-precipitate - Product consisting of casein and whey protein complexes that have been precipitated together through the use of heat, acid and/or calcium salts.

Co-products - Secondary ingredients that are recovered as part of processing to achieve primary ingredients such as milk protein concentrates, whey protein concentrates, butter, etc. Examples: Permeate, buttermilk, whey protein phospholipid concentrate.

Corrosion - Deterioration of a metal as a result of chemical reactions between the metal and its surroundings. Examples: Rusting of iron, pitting of stainless steel.

Cross flow - Flow of the feed stream parallel to the membrane surface.

Crystallization - Development of crystals. Example: Formation of crystals in concentrated whey or permeate.

Cytokines - Small proteins that are involved in the generation of special types of white blood cells and directing white blood cells to injury sites.

Dairy minerals (product) - Product made from either whey or permeate that is concentrated calcium phosphate along with other minerals found in whey and permeate. Dairy minerals also may be referred to as whey mineral concentrate, milk mineral concentrate or milk calcium.

Dairy permeate - Produced by the removal of protein and other solids from milk or whey resulting in a product with a high concentration of lactose. Removal of the dairy constituents is accomplished by physical separation techniques such as filtration and diafiltration. Also known as dairy product solids (ADPI definition).

Dairy product solids - See dairy permeate.

Daisy - Style of cheese. Traditionally a 22 pound wheel of Cheddar, coated with wax and cheesecloth.

Dead vat - Vat of cheese milk that does not develop acid when cultures have been added.

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Deflagration - Less violent explosion which has a flame front but no noise or shock waves. The energy front moves at less than the speed of sound.

Deflagration hazard - Situation where a combustible dust is normally in suspension or can be put in suspension at a concentration at or above the Minimum Explosible Concentration (MEC).

Deflagration suppression - Technique of detecting and stopping combustion in a confined space while the combusion is still in its initial stages, thus preventing the development of pressures that could result in an explosion.

Delta P (ΔP) - Difference between the inlet pressure and outlet pressure of a membrane housing.

Demineralized whey - See reduced minerals whey.

Denaturation - Change in the structure of a protein.

Density - An indication of compactness or concentration of a material. Density is given as a mass (weight) per unit volume. Mathematically density is mass divided by volume with units such as kg/m^3, g/cm^3, $pounds/ft^3$, etc.

Detergent - See wetting agent.

Detonation - Most violent form of an explosion. Produces noise and a shock wave and moves at a speed greater than the speed of sound.

Diafiltration (DF) - Addition of water to the retentate to reduce the concentration of permeable solids in the retentate. Diafiltration may be continuous of discontinuous.

Direct heating - Heating material mixes with the product. An example of direct heating would be steam injected into milk.

Disaccharide - A sugar that contains two monosaccharides. Example: the disaccharide lactose that is made up of glucose and galactose.

Discontinuous diafiltration (Discontinuous DF) - Process of adding water to the retentate to reduce the concentration of permeable solids in the retentate. The volume of retentate is reduced through filtration and water then added to dilute the retentate to a ceratin volume. The retentate is then filtered again. The process of repetitive dilution followed by filtration is known as discontinuous diafiltration.

Disinfect - Remove or kill potentially pathogenic microorganisms.

Dispersants - See wetting agent.

Disulfide bridge - Also known as disulfide bonds (SS-bond). Bond between sulfur molecules ($R\text{-}S\text{-}S\text{-}R^1$) that holds together sections of a peptide or protein.

Drum dryer - Dryer where product is sprayed onto and then scraped off of a rotating, heated drum. The drum may or may not be enclosed in a vacuum chamber.

Dry buttermilk (DBM) - Obtained by removing water from liquid buttermilk derived from the churning of butter. It shall contain not less than 4.5% milkfat and not more than 5% moisture. It shall have a protein content of not less than 30% (CFR definition).

Dry buttermilk product (DBP) - Shall contain not less than 4.5% milk fat and not more than 5% moisture. Dry buttermilk product contains less than 30% protein (CFR definition).

Dry cream - Results from the partial removal water from pasteurized cream. The fat and/or protein content of the cream may have been adjusted, only to comply with compositional requirements. The casein to whey protein ratio may not be altered by the additions/removals (ADPI definition).

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Dry whey - Fresh whey that has been pasteurized and contains all constituents, except water, in the same proportions as found in the original whey.

Dry whole milk (DWM) - Product resulting from the removal of water from pasteurized milk and contains by weight not less than 26%, but less than 40% milk fat and not more than 5% by weight moisture. It contains lactose, milk proteins, milk fat and milk minerals in the same proportions as the milk from which it was made (CFR definition).

Dust - Particles with a diameter of <500 µm (0.5 mm). European Standard defines dust as small solid particles in the atmosphere which settle due to their own weight, but which remain airborne as a dust/air mix for a time.

Dust explosions - Finely divided combustible material that is dispersed in air containing oxygen and ignited within a confined space.

Dust-ignition proof (DIP) - A component where dust is prevented from entering from the outside. Arcs, sparks and heat generated inside the component cannot ignite the exterior surroundings.

Dust-protected - Allows the entry of some dust but the amount within the enclosure is less than the amount needed for an explosion.

Dust tight - Enclosures constructed so that dust will not enter under specified conditions.

Electrostatic discharge (ESD) - Sudden flow of electricity between two electrically charged objects when they come in contact.

Element - A spiral-wound membrane.

Emulsifiers - Compounds that stabilize an emulsion. Examples: Egg yolk, glycerin esters and sugar esters.

Emulsion - Type of colloid. Emulsions are a mixture of two or more liquids where one of the liquids is present as fine droplets in an immiscible (unmixable or unblendable) liquid. Example: Milk fat is present in the water phase of milk as an emulsion.

Enzyme - Molecule that accelerates reactions. Enzymes typically are proteins that act as a biological catalyst. Catalysts are not altered in the reaction. The molecule that the enzyme reacts with is known as the substrate.

Erosion - Wear caused by mechanical action of a liquid on a surface. Erosion is more prevalent with liquids that contain solids. Example: Liquid whey containing lactose crystals.

Escherichia coli - Major species of the fecal coliform group. *E. coli* is generally not found growing in the environment and is an indicator of fecal contamination and possible presence of pathogens.

Exothermic - Reactions that produce heat.

Explosion - Rapid combustion of a flammable material within a confined space that results in a sudden and significant increase in pressure.

Explosion proof - Component that contains an explosion generated within. Burning or hot gases are not released into the surrounding area.

Explosion resistant - Equipment designed to contain the explosion without being permanently deformed.

Explosivity index (E_{index}) - Combination of ignition sensitivity and explosion severity values. The resulting value is ranked from weak to severe for explosion severity.

Eyes - Holes within a cheese formed by trapped gas produced by microorganisms during ripening of the cheese. Swiss cheese is a cheese that typically has eyes.

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Facultative anerobe - Bacteria that wants some oxygen but can grow without it if necessary.

Farmstead cheese - Cheese made only from milk produced at the same location as where the cheese is made.

Fat in dry matter (FDM) - See Fat on a dry basis (FDB).

Fat on a dry basis (FDB) - Percentage of fat in the solids portion (water is not included in the calculation). FDB typically is used when relating composition of a cheese.

Fats - Organic compounds that are combinations of alcohols and acids. Fats contain carbon, oxygen and hydrogen and have a glycerol backbone with fatty acids attached. Fats are not soluble in water but are soluble in organic solvents such as ether and alcohol.

Fecal coliforms - Coliforms found in the intestinal tract of warm-blooded animals.

Feed pump (membranes) - Pump that feeds the baseline and stage pumps.

Filled cheese - Cheese where the butterfat has been replaced with vegetable oil. Also known as imitation cheese.

Fire tetrahedron - Four components, oxygen, heat, fuel and chain reaction, that must be present for a fire to start and continue.

Flame-proof - Term used by International Electrotechnical Commision that is the same conceptually as the US term explosion-proof. The standards, however, are different for meeting the requirements for each term.

Flashing - Rapid change of a liquid to a gas. Example: Rapid change of liquid water to water vapor in a flash evaporator.

Floculate - Process by which particles come out of suspension to sediment (settle) in the form of flocs or flakes.

Flux (membranes) - Rate of permeate production. Flux often is given as a unit of volume or wieght per period of time. Examples of flux units: Gallons/minute, pounds/hour, liters/hour, etc.

Food allergen - Typically involves naturally occurring proteins in foods that cause abnormal immune responses ranging from rashes to anaphylaxis.

Foam ability - How much foam an ingredient can produce.

Foam stability - How long the foam will last.

Food intolerance - Non-immune system response that often manifests as digestive problems such as bloating, irritable bowel, migraines, etc. that occur when a food is eaten.

Food safety culture - Product of people's values, their ability and their behavioral patterns.

Food Safety Modernization Act (FSMA) - Signed into law January 4, 2011, FSMA gave FDA new authority to regulate the food industry. Focus shifted from responding to food borne illness to preventing it.

Fouling (membranes) - Deposition of material on the membrane surface. Fouling may be reversible or irreversible. Reversible fouling can be removed by cleaning while irreversible fouling cannot. Fouling generally decreases permeate flux and alters the retention characteristics of a membrane.

Free fatty acids (FFA) - Fatty acids that are not attached to the glycerol backbone of a fat.

Fresh cheese - Cheese that has not been aged for more than a few weeks.

Fromager - French for cheesemaker.

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Fugitive dust - Any dust that is lost from manufacturing or other processes.

Galactomyces candidum - Previously known as *Geotrichum candidum*. A mold that is involved in the ripening of washed-rind cheeses and cheese that use other molds for ripening.

Galacto-oligosaccharides (GOS) - Comprised of galactose molecules chained together. GOS are naturally occuring in milk and yogurt and function as prebiotics.

Galvanized pipe - Pipe with a protective zinc coating.

Gasification - Process of gas release by a solid.

Gasket - Material placed between two non moving surfaces that provides a seal and prevents leaking Gaskets may be made of a wide variety of materials depending on the surfaces to be sealed.

Gassy - Production of unwanted gas within a cheese. Gassy is very apparent in packaged cheese where the package has become bloated by gas.

Gem - Style of Cheddar cheese weighing approximately 3 pounds.

Generally Recognized As Safe (GRAS) - A substance that is generally recognized, among qualified experts, as having been adequately shown to be safe under the conditions of its intended use.

Generation time - Time for bacteria to double in number.

Geotrichum candidum - See *Galactomyces candidum*.

Germination - Growth of spores into vegetative cells.

Ghee - Butter that is ~99.5% fat and has been cooked to drive off moisture. The solid residue (protein, lactose and minerals) that results from cooking is removed. Ghee has a nutty flavor and is very similar to clarified butter.

Glass - Without structure. See also amorphous.

Glycomacropeptide (GMP) - A protein fragment that results from the action of rennet on the protein casein. Rennet cleaves κ-casein from casein micelle and the κ-casein fragment is then known as GMP. GMP may also be referred to as casein macropeptide (CMP).

Good Manufacturing Practices (GMPs) - Practices that address activities at the processing level. Activities include methods, equipment, facilities and controls.

Grade "A" (designation) - Designation that focuses on aspects such as design of equipment, product sampling, water quality and handling, dairy farm construction, cleaning/sanitizing procedures, product testing, employee training, etc., with plant inspections to ensure compliance.

Grade "A" products - Dairy products that are highly susceptible to bacterial contamination. Grade "A" dairy products must be made from Grade "A" milk and include fluid milk, yogurt and cottage cheese.

Grade "B" products - Manufactured dairy products such as butter, cheese and ice cream.

Halal - Arabic word meaning lawful or permitted. Halal food is food which adheres to Islamic law as defined in the Quran.

Haram - Arabic word meaning forbidden. Food that is not permitted according to Islamic law as defined in the Quran is haram.

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Hazard Analysis Critical Control Points (HACCP) - System where food safety is addressed through the analysis and control of biological, chemical and physical hazards from raw material production, procurement and handling to manufacture, distribution and consumption of the finished product.

Hazard Analysis Risk-based Preventative Controls (HARPC) - Similar to a Hazard Analysis Critical Contol Plan (HACCP). Identifies biological, chemical and physical hazards.

Heat of combustion ($\Delta H°_c$) - Measure of the energy released as heat when a compound undergoes complete combustion with oxygen.

Heat shock - Application of heat that causes spores to germinate.

Heat stable - Product that has increase tolerance to temperatures that otherwise would lead to denaturation/floculation of the proteins.

Homogenization - Process that disrupts fat globules to produce small, relatively uniformed sized globules.

Hoops - Forms used to press curds into shapes.

Humectant - A hygroscopic (water loving) substance used to keep moisture in food.

Hunter Colorimeter- A color scale for quantifying color that often is used in dairy applications.

Hydrogen bond - Interaction between hydrogen atom and atoms, such as oxygen, that have a strong affinity for hydrogen atoms. Example: Binding between the hydrogen of one water molecule with the oxygen of another water molecule.

Hydrophobic - Water hating.

Hydrophylic - Water loving.

Ice cream - Frozen dessert that per gallon contains not less than 1.6 pounds of total solids, not less than 10% milkfat and not less than 10% milk-solids-not-fat. Ice cream also must weigh not less than 4.5 pounds/gallon (CFR definition).

Ignition temperature - Temperature at which gases are released from solids.

Imitation cheese - See filled cheese.

Immunoglobulins (IgG, IgM, IgA) - Group of proteins known as antibodies that protect against bacteria and viruses.

Impeller - Rotating component of a pump that moves the liquid.

Incandescence - Process of heat producing light.

Indirect heating - A partition is placed between the heating material and product. Example: Plate heat exchanger.

Inerting - Process of introducing inert (non-flammable) gases to a vessel to purge or dilute flammable gases.

Instant nonfat dry milk (INDM) - Nonfat dry milk which has been produced in a manner to substantially improve its dispersing and reconstitution characteristics (ADPI definition).

Instantizing - Process that improves the ability of powder to disperse and dissolve quickly. Lecithin may be added to improve the ability of high fat products to go into solution.

Insulin-like growth factors (IGFs) - Hormones involved in the growth and reproduction of cells.

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International Standards Organization (ISO) - International standards for the food industry. Goal of creating confidence in products we eat or drink by ensuring the world uses the same recipe when it comes to food quality, safety and efficiency.

Intrinsically safe - Component that is incapable of releasing sufficient electrical or thermal energy to cause ignition of dust under normal or abnormal operating conditions.

Ion exchange chromatography - Process used to separate molecules, such as proteins, based on their interactions with the ion exchange separating media. Ion exchange chromatography works with almost any charged molecules.

Ionic bond - Bond between two ions (molecules with a charge) of the opposite charge.

Isoelectric point (pI) - pH at which a molecule has no net charge (positive charges equal negative charges on the molecule). Isoelectric point is often abbreviated as pI.

Karl Fischer - Analytical test for moisture that indicates both bound and free moisture (water) in a product.

Kefir - Fermented drink produced with a special kefir grain. Kefir is a viscous beverage with a fresh acid taste and slight yeast flavor. Kefir may have up to 0.8% alcohol.

Kjeldahl - Test to determine amount of protein in a sample. Kjeldahl test uses acid to digest (break down) components to release nitrogen which then is measured by titration. A calculation and conversion factor takes the nitrogen measured by titration and converts it to protein.

Kosher - Hebrew word meaning fit or proper. Food that adheres to kashrut (Jewish dietary law) is considered kosher.

K_{ST} - Normalized maximum rate of pressure rise. Also known as Deflagration Index and Dust Constant.

Lactalbumin (commercial product) - Produced by precipitating whey proteins. Heat and pH changes are used to denature the whey proteins so that they aggregate and separate from the other whey constituents. Lactalbumin is not the same as α-lactalbumin.

Lactoferrin - Iron binding protein that can inhibit the growth of certain bacteria such as *E. coli*.

Lactoperoxidase - Enzyme simliar to lysozyme.

Lactose (milk sugar) - White to creamy white crystalline product, possessing a mildly sweet taste. It may be anhydrous, contain one molecule of water of hydration, or be a mixture of both forms. It is manufactured from whey or permeate by evaporating, crystallizing, refining and then drying the lactose crystals.

Lactose hydrolyzed whey - Whey that has had a portion of the lactose hydrolyzed to glucose and galactose by the addition of lactase enzyme.

Layer ignition temperature (LIT) - See Minimum Ignition Temperature (MIT_{layer})

Lean flammable limit (LFL) - See Minimum Explosive Concentration (MEC).

Limiting oxygen concentration (LOC) - Lowest amount of oxygen that can be present in a dust cloud and still have ignition of the dust.

Lipase - Enzyme that cleaves fatty acids from the glycerol backbone of fats and lipids. Free fatty acids result from the action of lipase on fats and lipids.

Lipoxygenases - Group of enzymes that oxidize or bleach color compounds such as carotene.

Listeria - Gram positive, aerobic rod that is able to grow at refrigeration temperatures. *Listeria moncytogenes* is a pathogen.

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Longhorn - Cylindrical style of cheese. Style is typical for Colby.

Loss on drying - Analytical test that indicates free moisture (water).

Lower explosive limit (LEL) - Lowest concentration of powder that will ignite and propagate a flame (deflagration).

Lower flammable limit (LFL) - Lowest concentration of a dust that can propagate a flame but not necessarily sufficient for deflagration.

Lysozyme - An enzyme that can kill certain disease causing bacteria.

Maillard browning - A nonenzymatic browning reaction between an amino acid and a reducing sugar. In dairy products, proteins and amino acids react with lactose to produce Maillard browning.

Make room - Room where cheese is made.

Marbled - Cheese with two different color curds blended together. Marbled also may be a cheese where colored flavorings, such as red wine, have been added thereby outlining the curds.

Mastitis - Inflammation of the mammary gland caused by trauma or an infection, leading to abnormal and decreased milk production.

Maximum oxygen combustion (MOC) - See Limiting Oxygen Concentration (LOC).

Maximum rate of pressure rise (dP/dt_{max}) - Maximum slope of the curve for a given explosion.

Mechanical explosion - Explosion resulting from a change in the state of a material from liquid to gas. Example: Boiler that continues to have heat applied while pressure relief valve fails to open.

Mellorine - Frozen dessert that has a fat substitute in place of milkfat.

Membrane area - Amount of membrane available for separating product. Typically expressed as square feet (ft^2) or square meters (m^2) (1 m^2 = 10.76 ft^2). The value given may include sections of the membrane, such as glue lines, that are not actually available for separating product.

Mesophilic bacteria - Bacteria that are medium heat loving. In the dairy industry, these typically are bacteria that grow well between 68 and 86°F (20 to 45°C) and have an optimum growth temperature of 86 to 104°F (30 to 40°C).

Micellar casein - Dry form of microfiltered (MF) milk. A portion of the whey proteins have been removed so that the casein to whey protein ratio is no longer the 80:20 ratio typical in milk. Ratio of casein to whey proteins typically ranges between 82:18 and 95:5. Product may also be referred to as native phosphocasein.

Microbial load - Number and type of microorganisms contaminating a product.

Microfiltered (MF) milk - Liquid milk that has a portion of the whey protein, lactose and minerals removed. The ratio of casein to whey proteins is altered such that a greater proportion of casein as conpared to whey proteins is present in MF milk than in typical milk.

Microfiltration (MF) - Membrane process that separates lactose, minerals and small proteins from fat and large proteins.

Microfixing - Process of reestablishing dispersion of moisture in butter that has been in storage.

Midget - Style of cheese, usually Cheddar, that weighs about 12 pounds.

Milk calcium - See Dairy minerals (product).

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Milk mineral concentrate - See Dairy minerals (product).

Milk permeate - Portion of the milk that crosses or permeates an ultrafiltration membrane. Milk permeate contains lactose, minerals and nonprotein nitrogen. May also be known as dairy product solids.

Milk protein concentrate (MPC) - Produced by filtation methods (ultrafiltation and diafiltration) which captures essentially all of the casein and whey proteins contained in the raw material stream in the finished product, resulting in a casein-to-whey protein ratio equivalent to that of the original milk, generally 80:20. MPC has a protein content between 40 - 89.5% (ADPI definition).

Milk protein isolate (MPI) - Produced by filtation methods (ultrafiltration and diafiltration) which captures essentially all the casein and whey proteins contained in the raw material stream in the finished product, resulting in a casein-to-whey protein ratio equivalent to that of the original milk, generally a value of 80:20. MPI has a minimum protein content of 89.5% (ADPI definition).

Milk salts - Includes both inorganic and organic substances. Organic acids with a negative charge and amino acids with positive charges are included in this group. Mineral salts have a molecular weight of 300 or less. The term often is used interchangeably with minerals and ash.

Milk-solids-not-fat (MSNF) - See solids-not-fat (SNF).

Mill - Process of reducing the size of the powder particles by grinding, crushing, etc.

Minerals - Generally refers to elements other than carbon (C), hydrogen (H), oxygen (O) and nitrogen (N) that are found in dairy products. The term often is used interchangeably with salts and ash.

Mineral binding proteins - Proteins which can bind minerals such as iron thereby making the iron more readily absorbed by the body. Examples: Lactoferrin and transferrin.

Minimum explosive concentration (MEC) - Minimum concentration of dust that can support self-sustaining flame propagation.

Minimum hazardous mass (MHM) - Least amount of dust that can cause an explosion.

Minimum ignition energy (MIE) - Minimum energy of an electrical spark which, under defined conditions, is able to ignite the explosive dust/air mixture.

Misbranded - False or misleading in any particular manner. See adulterated.

Mojonnier test - Test to determine fat content of a product. Mojonnier test uses a solvent to extract the fat which then is measured by removing the solvent and weighing the extracted fat.

Molds - Molds are in the fungi kingdom and considered neither plant nor animal. They cannot make their own nutrients and instead must absorb their required nutrients from other sources. Some molds like *Penicillium*, can product antibiotics (penicillin) while other molds, like *Aspergillus*, can produce cancer causing substances (aflatoxin).

Molecular weight cut-off (MWCO) - Separating potential of a membrane typically used to describe ultrafiltration (UF) and microfiltration (MF) membranes. A rejection of 90% of a component of a given molecular weight often is used to determine the separating characteristics of a membrane. Example: A membrane with a 20,000 MWCO would reject 90% of the components with a molecular weight of 20,000 daltons or greater.

Multiple effects evaporation - Steam from one effect of an evaporator provides heat to evaporate product in the next effect.

Multistage pump - Pump that has more than one impeller on the shaft. Multistage pumps often are used to generate pressures greater than those possible with a single impeller pump.

Glossary

Nanofiltration (NF) - Membrane process that separates water and monovalent ions (ions with one charge) from fats, proteins, lactose and divalent ions (ions with two charges). Nanofiltration is used to remove acid components from acidified whey and sodium chloride from salt whey.

National Fire Protection Association (NFPA) - International organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

Native phosphocasein - See micellar casein.

Native whey protein - Whey proteins that have been removed from milk by microfiltration (MF). Native whey proteins have not been through the cheese making process.

Negative air pressure - Condition where the air pressure is lower in one place as compared to another. If the air in one room is at a lower pressure than the air pressure outside the room then air will flow from the outside area into the room.

Neutralizing - Addition of caustic, such as sodium hydroxide, to increase the pH of the product. Neutralizing typically would be used only for acid or fermented whey.

Newtonian fluid - A liquid whose viscosity does not change when agitated. Example: Milk is a Newtonian fluid.

Non condensable gas - Gases such as oxygen, carbon dioxide, nitrogen and air that do not condense into a liquid. Non condensable gases must be removed from an evaporator system to maintain vacuum.

Nonfat dry milk (NFDM, NFM) - Product obtained by removal of water only from pasteurized skim milk. It contains not more than 5% by weight moisture, and not more than 1.5% by weight milk fat unless otherwise indicated. Product may also be known as skim milk powder (SMP) (CFR definition).

Nonincendive - Components that are nonsparking and incapable of releasing sufficient electrical or thermal energy to cause ignition of dust.

Nucleation - Initial process that occurs in the formation of crystals. Nucleation determines the number of crystals that develop.

Occupational Safety and Health Administration (OSHA) - US government agency established to ensure safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education and assistance.

Oil off - Separation of fat from the cheese when the cheese melts.

Oligosaccharides - Complex carbohydrates that limit the attachment of microorganisms to the intestine.

Organic - Regulations that refers to the way agricultural products are grown and processed. Regulations vary from country to country but in the U.S., organic crops must be grown without the use of synthetic herbicides, pesticides and fertilizers or bioengineered genes.

Organoleptic - Relating to qualities such as taste, odor, texture, etc. of a food.

Overpressure - Pressure greater than the surrounding atmospheric pressure.

Overrun - Amount of air incorporated into a product. Overrun is commonly used when describing ice cream. Example: 1 gallon of ice cream mix that results in 1 and 1/2 gallons of frozen ice cream has an overrun of 50%.

Oxidize - Oxygen combining with other elements. Example: Iron rusting.

Passivation - Thin layer of chromium oxide that forms an inert layer on stainless steel to block oxygen thereby preventing corrosion.

Glossary

Pasta filata - Italian for "spun pasta". Process where curds are heated and then stretched before being molded into the desired shape. Mozzarella can be made by the pasta filata process.

Pasteurization - Heat treatment that eliminates pathogens that might be present.

Pathogen - Disease causing microorganism.

Pecorino - Italian sheep's milk cheese. Pecora is Italian for sheep.

Penicillium candidum - Mold added to soft-ripened cheeses to produce a white, bloomy rind.

Penicillium roqueforti - Primary blue mold used in making Blue cheese. The mold originated in the cheese caves of Roquefort, France.

Per hundred weight of milk - One hundred pounds of milk. 100 pounds milk is ~ 11.6 gallons milk

Permeate (membranes) - Portion of the feed stream that permeates or crosses the membrane. The permeate stream contains compounds that are small enough to pass through the pores of the membrane.

pH - A measure of the acidity or alkalinity of a material. The pH scale ranges from 0 (acid) to 14 (alkaline) with 7 considered neutral. pH is a measure of the concentration of hydrogen ions and is defined as the negative log of the hydrogen ion concentration.

Pitting - Surface voids caused by corrosion, erosion or cavitation.

Pore size (membranes) - Size of the pores in a membrane. Pore size indicates the size of the smallest particle that will be retained by a membrane. Pore size is given in units of microns (μ) and typically is used with microfiltration (MF) membranes.

Prebiotics - Nondigestible compounds in foods that stimulate the growth/activity of beneficial bacteria in the colon.

Pressure nozzle - Nozzle with a spinning orifice at the end that atomizes product into the hot air of a spray dryer.

Pressure resistant vessel - Vessel designed to contain an explosion without rupturing or deforming.

Pressure-shock resistant vessel - Vessel designed to withstand the maximum pressure of an explosion but the vessel probably will be permanently deformed and require replacement/repair.

Preventative Controls for Human Foods (PCHF) - Management system that addresses food safety. Based on analysis and control of hazards.

Primary explosion - Initial explosion.

Priming - Filling of a pump with liquid before operation.

Probiotics - Live microorganisms, which when administered in adequate amounts confer a health benefit on the host (FAO/WHO definition). Lactic acid bacteria and bifidobacteria are the most common probiotics.

Processed cheese - Cheese product made from natural cheese, other dairy ingredients and emulsifiers.

Proline-rich peptide - Peptide that acts upon the thymus gland to regulate response to injury.

Protease - Enzyme that cleaves proteins. Example: Rennet.

Protein hydrolyzed whey - Whey that has a portion of the whey protein hydrolyzed (cut up) into smaller fragments. Enzymes such as trypsin, chymotrypsin, etc. are used.

Glossary

Psychrotropic - Cold loving or cold tolerant. Bacteria that are considered psychrotropic can grow at or below 45°F (7°C) and have an optimum growth range of 68 to 86°F (20 to 30°C). Examples: Bacteria in the *Enterococcus* and *Pseudomonas* groups.

Quality - Focus on doing things well and producing a product acceptable to consumers.

Quark - A fresh, acid set cheese that more closely resembles a thick yogurt in taste and texture. The fat and protein content of quark is more comparable to yogurt than cheese.

Raw milk - Milk that has not been pasteurized.

Recombinant bovine growth hormone (rBGH) - Synthetic version of the naturally occurring hormone bovine somatotrophin (bST).

Reduced fat milk powder - Product resulting from the partial removal of fat and water from pasteurized milk. The fat and/or protein content of the milk may have been adjusted, only to comply with the compositional requirements below, by the addition and/or withdrawal of milk constituents in such a way as not to alter the whey protein to casein ratio of the milk being adjusted (ADPI definition).

Reduced lactose whey - Whey that has had a portion of the lactose removed. Reduced lactose whey differs from whey protein concentrates (WPCs) in that the minerals are not removed in reduced lactose whey while both lactose and minerals are removed with WPCs.

Reduced minerals whey (RMW) - Whey with a portion of the minerals removed by physical separation techniques such as precipitation, filtration or dialysis. Also known as demineralized whey.

Rejection - Measure of how well a membrane retains a component. The term retention factor is used interchangeably with rejection.

Retentate (membrane) - Portion of the processing stream that does not cross (retained) by the membrane during processing. The retentate contains components that are too large to pass through the pores of the membrane. The terms retentate and concentrate often are used interchangeably.

Retention Factor (RF) - See rejection. Determined by measuring concentrations of a solute in the feed and permeate streams.

$$R = \frac{(C_f - C_p)}{C_f}$$

C_f = concentration of a component in the feed stream
C_p = concentration of a component in the permeate

where R ~ 0, component freely permeates
R ~ 1, component is retained

Reverse Osmosis (RO) - Membrane process that separates water from all other components in milk, whey or permeate. Reverse osmosis resembles evaporation, however, reverse osmosis is not able to achieve total solids as great as possible with falling film evaporators.

Riboflavin (Vitamin B_2) - Water soluble vitamin that gives whey its greenish color.

Rind - Exterior of a cheese. The rind may be inedible (plastic, wax, etc.), natural, mold covered or flavored.

Ripening - Changes during the aging of a cheese.

Rotary atomizer - Spinning disc in a spray dryer that atomizes product into the hot air.

Safety - Focus on avoiding bad events and harm to consumers.

Glossary

Sanitizing - Elimination of microorganisms through removal/inactivation.

Saponification - Fatty acids reacting with alkali to form soap.

Scorched particles - Particles of powder that have dried/overheated such that they are no longer white to cream in color. Scorched particles range from tan to brown to black depending on the degree of overheating.

Secondary explosion - Explosion resulting from ignition of dust that has become air borne due to the blast wave of the primary or initial explosion.

Secondary structure - Structures formed by chains of amino acids. Coils and sheets are the most common types of secondary structures in proteins.

Self Ignition Temperature (SIT) - See Minimum Ignition Temperature (MIT).

Sherbet - Frozen dessert made of fruit juice with added milkfat and milk-solids-not-fat.

Shock wave - Abrupt pressure wave generated by the sudden release of energy.

Skim colostrum product - Obtained by the partial removal of fat and water from colostrum that comes from cows within 48 hours after giving birth. It contains fat (<6%), proteins, carbohydrates, vitamins and minerals (ADPI definition).

Skimmed milk powder (SMP) - Defined by Codex Alimentarius. Codex. Skimmed milk powder allows the protein content of milk powder to be adjusted through the addition of milk retentate, milk permeate or lactose. The protein content of SMP typically is lower than the protein content of NFDM.

Slurry - A liquid with suspended solids. Example: Permeate with crystallized lactose.

Smear ripened - Cheese that is washed with a yeast solution to ripen the cheese. Also known as washed rind.

Soapy - Taste caused by long chain fatty acids.

Solids-not-fat (SNF) - Solids in the product that are not fat. Protein, lactose and minerals are typical solids-not-fat.

Solubility - Ability of a liquid to dissolve another material. Examples: Lactose dissolving in water, alcohol dissolving in water.

Somatic cells - Somatic cells in milk are a mixture of milk-producing cells and immune cells. These cells are shed into milk during the normal course of milking and are used as an indicator of mammary health and milk quality.

Soot - Unburned particles of carbon.

Specific gravity - Ratio of the mass of liquid of known volume to the weight of water for the same volume. If the specific gravity of a solution is less than 1 then the solution will float on water. If the specific gravity of the solution is greater than 1 then it will sink in water.

Spiral wound membrane - Type of membrane element where sheets of membrane materials are assembled into layers and rolled around a central permeate tube.

Sporulation - Formation of spores by vegetative cells.

Spray dryer - Dryer where product is sprayed (atomized) into hot air within the dryer.

Stabilizers - Bind water molecules or form networks that keep water from moving freely. Examples: gelatin, modified cellulose, starch, agar-agar, pectin, casein and whey proteins.

Glossary

Stage pump (membranes) - Pump that supplies velocity to the retentate/feed as it enters the bank or stage of membranes.

Stainless steel - Alloy steels containing a high percentage of chromium and/or nickel.

Standard plate count - Test for "total" viable bacteria. Test typically measures mesophilic, aerobic bacteria using non selective agar.

Staphylococcus aureus - Gram positive coccus that is ubiquitous and capable of producing a heat stable toxin.

Starter - Bacteria added to milk to produce lactic acid in cheese, yogurt and cultured buttermilk.

Staub (St) - German word for dust.

Sterilize - Remove all forms of life.

Surface ripened - Cheese that ripens from the outside to the inside because of the microorganisms placed on the outside surface.

Surfactant - See wetting agent.

Sweet whey - Whey that has an insignificant conversion of lactose to lactic acid.

Synersis - Expulsion of liquid from a gel. Example: Whey on the surface of yogurt.

Terrior - French word. Characteristics given to a food by the area in which it was grown. Important factors include soil, climate and altitude.

Tertiary structure - Larger protein structures that form from helixes and sheets of the secondary structure. Sphere-like shapes and globular-like arrangements are typical tertiary structures for proteins..

Thermal conductivity - Measure of a materials' ability to conduct heat. Units are Watts/meter·Kelvin, BTU/hr·ft·°F.

Thermalization - Heat treatment that is less than pasteurization.

Thermite reaction - Interaction between light metals and oxides of metals which produces an intense burst of energy. Example: Aluminum striking rusty iron.

Thermophilic bacteria - Heat loving. Thermophilic bacteria grow well above 113°F (45°C) and have an optimum growth temperature of 131 to 149°F (55 to 65°C). Examples: *Bacillus* and *Clostridium* species.

Thermoplasticity - Powders that become plastic-like at elevated temperatures.

Thixotropic fluid - A fluid whose viscosity decreases with agitation. Example: Ketsup.

Thymosin - Hormone that works with the thymus gland to maintain the immune system.

Titratable acidity (TA) - Measurement of the total acid concentration in a product. Acids typically found in food products include acetic, lactic, citric, etc. Titratable acidity is determined by neutralizing the acids with a known quantity of sodium hydroxide.

Total coliforms - Coliform bacteria found in soil, water, and human and animal waste.

Transfer factors - Small proteins that work in concert with white blood cells to control unwanted bacteria.

Transferrin - An iron binding protein that works with lactoferrin to inhibit the growth of certain bacteria.

Glossary

Transmembrane pressure (membranes) - Driving force of membrane separations. Transmembrane pressure is defined as the average of the inlet and outlet pressures, minus permeate backpressure.

Ultrafiltration (UF) - Membrane process that separates proteins and fats from lactose and minerals. Ultrafiltration is used to produce milk protein and whey protein concentrates.

Ultrafiltered milk (UF milk) - Liquid milk that has a portion of the lactose and mineral removed. The ratio of casein to whey protein is unchanged from the original milk.

Upper explosive limit (UEL) - Highest concentration of powder that will ignite and propogate a flame.

Vacuum - Pressure less than atmospheric.

Van Slyke formula - Formula for predicting cheese yield.

Velocity - Measurement of the speed of liquid in a system. Velocity can be given in units such as meters/second, feet/second, etc.

Viscosity - Resistance of a fluid to a change in shape or movement between layers of the fluid. Viscosity informally corresponds to the concept of "thickness".

Volume resistivity - Indicates how strongly a material opposes the flow of electrical current.

Washed curd - Cheese curds that have had the whey removed and replaced with water to "rinse" some of the lactose from the surface of the curds. Example: Gouda.

Water hammer - Occurs in a closed piping system when there is a rapid change in the velocity of a liquid resulting in a sudden pressure increase. A "bang" like a hammer hitting pipe indicates a water hammer has occurred. Damage to equipment often results with repeated water hammers.

Water ice - Frozen dessert consisting of water, sugar and fruit concentrate.

Wetting agent - Ability of a detergent to lower the surface tension between soil and equipment surface so that the soil can be removed and the surface cleaned. Other terms for wetting include detergent, surfactant, dispersant and emulsifier.

Whey - Liquid obtained from cheese manufacture.

Whey cheese - A cheese made from coagulated whey proteins. Example: Traditional ricotta.

Whey cream - Small fat globules that were not trapped within the cheese matrix and go with the whey when it is drained from the curd.

Whey mineral concentrate - See Dairy minerals (product).

Whey protein - Protein in milk that remains in water phase after casein precipitates.

Whey protein nitrogen index (WPNI) - Measure of the amount heat treatment the product has received. Index measures the amount of whey protein that has not been denatured by heat. A higher value indicates less whey protein has been denatured.

Whey protein phospholipid concentrate (WPPC) - Product resulting from microfiltration of whey to produce whey protein isolate (WPI) or low fat whey protein concentrate (WPC). WPPC contains whey proteins in addition to whey phospholipids.

White metal - Copper-nickel alloys of varying composition. White metal often contains copper, nickel, tin, lead, zinc, iron, manganese and chromium. Magnets will adhere to white metal.

Glossary

Whole colostrum powder - Obtained the drying of colostrum that comes from cows within 48 hours after giving birth. It contains fat (>17.5%), proteins, carbohydrates, vitamins and minerals (ADPI definition).

Yeast - Yeast are in the fungi kingdom along with molds. Yeasts are single, oval shaped cells that are known for converting sugars into alcohol and carbon dioxide. *Saccharomyces* and *Candida* are example yeasts.