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(71) Applicant *(for all designated States except US)*: **JENEIL BIOSURFACTANT COMPANY, LLC** [US/US]; 400 North Dekora Woods Boulevard, Saukville, WI 53080 (US).

(72) Inventors; and
(71) Applicants *(for US only)*: **GANDHI, Niranjan, R.** [US/US]; 8980 N. Greenbrook Road, River Hills, WI 53217 (US). **PALMER SKEBBA, Victoria** [US/US]; 10326 Lawndale Drive, Cedarburg, WI 53012 (US). **MILANI, Franco, X.** [US/US]; 6855 Moonstone Court, De Forest, WI 53532 (US).

(74) Agents: **DEKRUIF, Rodney, D.** et al.; Reinhart Boerner Van Deuren s.c., 1000 N. Water Street, Suite 1700, Milwaukee, WI 53202 (US).

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[Continued on next page]

(54) Title: RESTRUCTURED NATURAL PROTEIN MATRICES

(57) Abstract: Methods as can be used in the preparation of one or more dairy, dairy analog and cheese products from a range of proteinacous starting materials, such methods comprising protein modification and protein restoration or protein restructure.

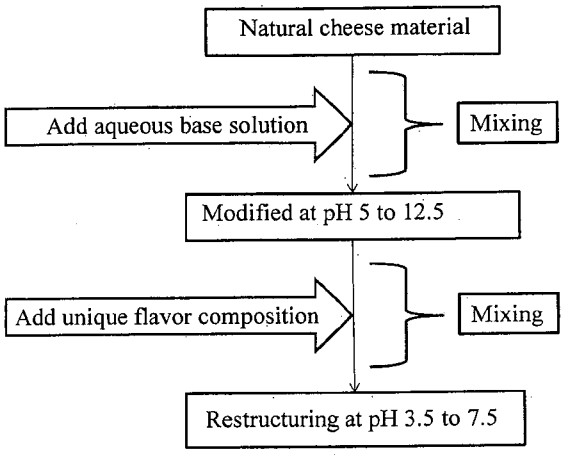

Figure 1

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Restructured Natural Protein Matrices

[0001] This application claims priority benefit of application serial No. 61/852,465 filed March 15, 2013, the entirety of which is incorporated herein by reference.

Background of the Invention.

[0002] Structural transformations are an important part of the modern food industry. Raw materials are changed into refined food products by processing agricultural output. A major objective of food structuring is to recombine food components for improved utilization of food resources. Alternatively, from an economic prospective, such restructuring can be designed to yield products deemed more valuable in the market place.

[0003] More specifically, restructuring is directed to four basic food components: water, proteins, fats and carbohydrates. Micronutrients (e.g., vitamins and minerals) and other microcomponents such as flavors, colors, preservatives and other functional additives (e.g., stabilizers, emulsifiers, etc.) are often introduced at some point during the restructuring process. Regardless, of the four basic components, restructuring processes are most often directed to proteins and starches. Reasons underlying protein and starch restructure include a worldwide demand for dietary protein and carbohydrates and higher prices associated with these foods, thereby supporting higher profit margins and corresponding economic activity.

[0004] The preparation and subsequent use of soy milk, basically a suspension of ground soybeans and water, is well-known and illustrates several widely used techniques for protein restructuring. While soy milk can be consumed as a beverage or fermented, it is more often used as a starting material for several other structured food products. For instance, tofu is prepared by precipitating soy milk proteins with a calcium salt to form a coagulum that is then drained, pressed and washed to yield a proteinaceous food product.

[0005] Various other restructuring techniques can be considered in the context of comminuted meat products, whereby an oil-in-water emulsion is entrapped in a gel of insoluble proteins and muscle fibers. A raw meat protein matrix system, typically low-value, high-connective tissue meat cuts or trimmings, is ground to reduce particle size. After initial grinding, the meat protein matrix is blended with various emulsifying salts (e.g., phosphates, etc.) and other ingredients to promote extraction of a myofibrillar binder. Such muscle proteins bind better under elevated temperature conditions. In these processes, cooking serves to reactivate the protein binder, recombine the ground particles and complete the

restructuring process. Such meat-emulsions are quite stable, but even if coalescence does occur, movement of the fat globules is confined by the restructured protein matrix.

[0006] Cheese illustrates other aspects relating to protein restructuring. From a historical perspective, process cheese was initially developed to address homogeneity and shelf-life issues inherent to natural cheese. While natural cheese is made directly from milk, process cheese is produced by blending one or more natural cheeses in the presence of emulsifying agents and, optionally, other dairy and non-dairy ingredients. Heat processing with continuous mixing leads to a more homogeneous product with extended shelf life. Under the United States Code of Federal Regulations (CFR), process cheese is a generic term including pasteurized process cheeses, pasteurized process cheese foods and pasteurized process cheese spreads, all of which are regulated on the basis of process parameters, ingredients, fat and moisture content and the like. (See, 21 CFR 133.169 - 133.180.) Together with choice of natural cheese (e.g., with respect to age, flavor, etc.), selection of an appropriate emulsifying agent is a key consideration in determining the physiochemical and functional properties of a resulting process cheese.

[0007] Currently, thirteen emulsifying agents (either alone or in combination) are approved for use: mono-, di-, and trisodium phosphates, dipotassium phosphate, sodium hexametaphosphate, sodium acid pyrophosphate, tetrasodium pyrophosphate, sodium aluminum phosphate, sodium citrate, potassium citrate, calcium citrate, sodium tartrate, and sodium potassium tartrate. The most common emulsifying salts used for process cheese manufacture in the United States are trisodium citrate and disodium phosphate. Trisodium citrate is the preferred emulsifying salt for slice-on-slice process cheese varieties, whereas disodium phosphate (or appropriate combinations of di- and trisodium phosphates) is used in loaf-type process cheese and process cheese spreads. In certain applications, low levels of sodium hexametaphosphate are also used along with these emulsifying salts. Sodium aluminum phosphate is frequently used in conjunction with mozzarella type imitation process cheese varieties to replace mozzarella on frozen pizzas. Regardless, the weight of the solids of such an emulsifying salt or salts is not more than 3 percent of the weight of a corresponding CFR-defined process cheese. (21 CFR § 133.169(c).) Emulsifiers used in process cheese not defined by the CFR follow the tenants of being safe and suitable.

[0008] Generally, emulsifying salts serve to sequester calcium and adjust pH. Both functions assist hydration of proteins present in natural cheese, to facilitate interaction with the aqueous and fat phases, thereby producing a more homogeneous emulsion. More specifically, the function of such salts can be understood by contrasting it to natural cheese

production. Bovine milk is characterized by four major types of casein proteins: α_{s1}-casein, α_{s2}-casein, β-casein and κ-casein--each of which is amphiphilic, with hydrophobic and hydrophilic components, and containing covalently-attached phosphate groups. In an aqueous emulsion environment, milk caseins adopt a micellular configuration stabilized by protein-protein hydrophobic interactions and colloidal calcium phosphate-mediated cross-linking. κ-casein is primarily present on the micelle surface, with the hydrophobic component embedded therein and a negatively-charged hydrophilic component directed outward into the aqueous phase. Micelles repel each other, thereby stabilizing the emulsion. During natural cheese production, enzymatic (e.g., rennet) action on κ-casein cleaves the hydrophilic component destabilizing the micelles. Calcium-mediated cross-linking between phosphoserine residues of the α- and β-caseins produces a network of water-insoluble calcium-paracaseinate phosphate complexes, commonly referred to as curds, with the fat phase suspended therein.

[0009] In contrast to natural cheese, process cheese can be described as a stable oil-in-water emulsion. Emulsifying agents, such as the salts described above, improve casein emulsification by--in conjunction with continued heating and mixing--displacing the calcium phosphate complexes and dispersing the calcium-paracaseinate phosphate network. The dispersed network interacts with the fat phase and, upon cooling, provides a process cheese structure--new and distinct from a natural cheese structure with a fat phase emulsified by a uniform protein gel.

[0010] The resulting stable, homogeneous process cheese structure affords a wide range of product forms (e.g., loaves, slices, grates, shreds, spreads and the like) and a corresponding range of end-use applications in the food preparation and service industry. However, the prior art recognizes a number of drawbacks and deficiencies, several of which can be directly related to the use of emulsifying salts. For instance, unsightly crystal formation is observed and has been linked to the relative insolubility of various phosphate and citrate salts, as further influenced by pH or storage conditions. From a more functional perspective, oil separation can result from improper salt content in conjunction with pH, casein level and process temperature considerations. Further, unmelted and melted textural properties of process cheese can be adversely affected by choice of emulsifying salt. Perhaps most consequential, adverse consumer perceptions are drawn from inclusion of emulsifying salts (e.g., pyrophosphates, aluminum phosphates, etc.) on product labels.

[0011] Accordingly, together with other long-standing issues related to process cheese, there remains an on-going concern in the art to provide a cheese product affording

selected benefits of process cheese without disadvantages associated with use of emulsifying salts.

Summary of the Invention.

[0012] In light of the foregoing, it is an object of the present invention to provide one or more methods for the preparation of restructured protein matrices, thereby overcoming various deficiencies and shortcomings of the prior art, including those outlined above. It will be understood by those skilled in the art that one or more aspects of this invention can meet certain objectives, while one or more other aspects can meet certain other objectives. Each objective may not apply equally, in all its respects, to every aspect of this invention. As such, the following objects can be viewed in the alternative with respect to any one aspect of this invention.

[0013] It can be an object of the present invention to provide a value-added natural cheese from lower cost natural cheese starting materials.

[0014] It can be another object of the present invention to provide such a value-added natural cheese, with uniform pre-determined flavor, texture and structural characteristics, notwithstanding corresponding inconsistencies with regard to natural cheese starting materials.

[0015] It can be another object of the present invention, alone or in conjunction with one or more of the preceding objectives, to achieve such results without emulsifying salts of the sort used for process cheese.

[0016] Other objects, features, benefits and advantages of the present invention will be apparent from this summary and the following descriptions of various embodiments, and will be readily apparent to those skilled in the art having knowledge of various cheese production techniques. Such objects, features, benefits and advantages will be apparent from the above as taken into conjunction with the accompanying examples, data, figures and all reasonable inferences to be drawn therefrom.

[0017] Generally, the present invention can be directed to a method of preparing a restructured proteinaceous food product. Such a method can comprise providing an initial matrix system comprising water, fat, protein and salts; treating such a matrix system with a modification component comprising a reagent selected from hydroxide species, anionic basic species and combinations thereof, such a reagent as can be in an amount at least partially sufficient to modify a secondary, tertiary or quaternary structure of such a matrix protein, such modification as can be considered with respect to a visco-elastic property of such a matrix system; and interacting such a modified matrix system with a flavoring composition

comprising at least one flavor component uniquely formulated for a particular proteinaceous food product, such a flavoring composition as can be in an amount at least partially sufficient to restructure such a modified matrix system. In certain embodiments, each of the aforementioned treatment or matrix modification and interaction or matrix restructure steps can be conducted at ambient/room temperatures and pressures, lower such temperatures, elevated such temperatures, positive pressures, negative pressures and/or combinations of such conditions. In certain such embodiments, elevated temperatures can be accomplished by heating such a matrix system through conduction, convection, microwave and infrared processes, and combinations thereof, or as would otherwise be understood by those skilled in the art made aware of this invention.

[0018] Regardless, a fat component of such a matrix system can be selected from animal fats, vegetable fats, fats derived from microbiological sources and combinations thereof; and, independently, a protein of such a matrix system can be selected from animal proteins, vegetable proteins, proteins derived from microbiological sources and combinations thereof. Without regard to fat or protein identity, a matrix modification component can be selected from food grade alkaline metal hydroxide salts, food grade Lewis base reagents and combinations thereof. Likewise, without regard to fat and protein identity or matrix modification component utilized, such a flavoring composition can comprise components selected from organic alcohols, aldehydes, ketones, acids, acid salts, acid esters, mineral acids and acid salts, and combinations thereof. As mentioned above and illustrated elsewhere herein, such a composition, upon interaction with a modified matrix system, can be formulated to provide a restructured proteinaceous food product with one or more flavor characteristics.

[0019] Without limitation as to flavoring composition, matrix system fat/protein or modification component, one or more optional additives can be introduced at a time of matrix treatment/modification or interaction/matrix restructure or both, such additives as can be chosen to affect flavor, texture, moisture content and one or more other characteristics of a restructured proteinaceous food product. Likewise, without limitation, such additives can be selected from proteins, fats, oils, carbohydrates, preservatives, minerals, nutrients and combinations thereof, in an amount at least partially sufficient to affect one or more food product characteristics. In certain such embodiments, one or more dried or partially dried proteins, carbohydrates and combinations thereof can be utilized to affect moisture content. In various other embodiments, alone or together with other such additives(s), one or more flavors, spices, colorants, extracts, fruits, meats and combinations thereof can be utilized to

affect flavor. Further, certain embodiments can incorporate various enzymes, cultures and/or related probiotic additives and combinations thereof. Any such additive can be synthetic or derived from various plant, animal and microbiological sources and combinations thereof.

[0020] Regardless, a modified matrix system can be restructured to provide a proteinaceous food product with a texture comprising one or more characteristics of an initial matrix system or modified characteristics unique to a particular end-result proteinaceous food product.

[0021] In part, the present invention can also be directed toward a method of preparing a restructured dairy or dairy analog based food product. Such a method can comprise providing an initial matrix system comprising water, fat, protein selected from dairy proteins and dairy analog proteins and combinations thereof, and salts; treating such a matrix system with a modification component comprising a reagent selected from excess hydroxide species, anionic basic species and combinations thereof, such a reagent as can be in an amount at least partially sufficient to modify a secondary, tertiary or quaternary structure of such a matrix protein, such modification as can be considered with respect to a visco-elastic property of such a matrix system; and interacting such a modified matrix system with a flavoring composition comprising at least one flavor component uniquely formulated for a particular proteinaceous food product, such a flavoring composition as can be in an amount at least partially sufficient to restructure such a modified matrix system. As discussed above, in certain embodiments, each of the aforementioned treatment/matrix modification or interaction/matrix restructure steps, or both can be conducted at ambient temperatures and pressures, lower such temperatures, elevated such temperatures, positive pressures, negative pressures or combinations of such conditions.

[0022] Without limitation, fat and matrix modification components can be as discussed above or illustrated elsewhere herein. Regardless, such a flavoring composition can comprise component ingredients selected from organic alcohols, aldehydes, ketones, acids, acid salts, acid esters, mineral acids and acid salts and combinations thereof. In certain embodiments, such component ingredients can include one or more organic acids, one or more mineral acids or combinations thereof (e.g., one or more protic acids). In certain such embodiments, matrix pH, structure and/or functionality can be adjusted depending on desired food product. More generally, such a composition can be formulated to provide such a restructured product, a dairy or cheese flavor, such flavors as can be selected from, but are not limited to cheddar, parmesan, romano, provolone, swiss, mozzarella, blue and cream cheese, sour cream and yogurt, together with various other dairy/cheese flavors or

combinations thereof as would be understood by those skilled in the art made aware of this invention.

[0023] As discussed above and illustrated elsewhere herein, such a modified matrix system can be restructured with control of various thermal-related rheological properties corresponding to a protein and/or fat component thereof. Such control can be at least in part defined or monitored by the degree of oiling-off (e.g., ranging from the absence to an excess thereof), such a phenomenon as can be incident to consumer food preparation.

[0024] In part, the present invention can also be directed to a method of preparing or using protein structure modification to prepare a restructured cheese. Such a method can comprise providing a proteinaceous natural cheese comprising an initial fat and water content; treating such cheese with an aqueous medium, such a medium comprising a basic species at least partially sufficient to modify and/or impart a liquid consistency to such a natural cheese starting material; and interacting such a modified natural cheese with a flavoring composition of the sort discussed above and illustrated elsewhere herein, such a composition as can be in an amount at least partially sufficient to restore or restructure such a natural cheese. More generally, as discussed above, such a method can comprise providing a proteinaceous natural cheese component; treating such a component with a protein structure modification component comprising a base, such a modification component in an amount and of a pH to modify a protein structure of such a natural cheese component; and interacting or treating such a modified natural cheese component with a flavoring composition comprising an acid and at least one flavor component, such a flavoring composition in an amount and of a pH to restructure such a modified natural cheese component and provide it with a desired flavor characteristic.

[0025] Without limitation, a natural cheese starting material can be selected from mozzarella and cheddar type cheeses. Regardless, cheese restructured therefrom can comprise a moisture and/or fat content similar to or different from that of the natural cheese starting material. In certain embodiments, such a flavoring composition can be formulated to provide such a restructured natural cheese a flavor or textural characteristic, or both, distinct from those of the starting material. Accordingly, in certain such embodiments, a restructured natural cheese of this invention can be, for instance, a parmesan or a provolone cheese. Without limitation, such a flavoring composition can be provided as a dry blend, part of an aqueous formulation or a combination thereof, interaction of which with a modified natural cheese matrix can be accomplished simultaneously or step-wise.

[0026] Optional additives can be as discussed above or illustrated elsewhere herein, and can be introduced at a time of natural cheese treatment/modification, upon restructure or both. In certain embodiments, one or more dry animal proteins, vegetable proteins or combinations thereof can be introduced to affect moisture content, stability or subsequent physical manipulation and packaging of such a restructured natural cheese. In certain such embodiments, such additives are limited only by salts of a nature or in an amount to at least partially emulsify a protein component of a natural cheese starting material--such salt or amount thereof, the presence of which would otherwise be understood by those skilled in the art as providing a process cheese.

Brief Description of the Drawings.

[0027] Figure 1. A schematic flowchart illustrating the restructure of one or more natural cheese materials, in accordance with certain embodiments of this invention.

[0028] Figure 2. A schematic flowchart illustrating the restructure of natural cheddar cheese starting materials, in accordance with certain embodiments of this invention.

Detailed Description of Certain Embodiments.

[0029] Various non-limiting embodiments of this invention can be considered with reference to the schematic flowchart of Figure 1. A starting natural cheese material is treated with food grade aqueous base of sufficient concentration and volume, with mixing, to provide a modified cheese matrix of pH about 5 to about 12.5. In certain embodiments, depending upon starting material and desired restructured cheese product, the matrix is modified and the pH can be about 8 to about 10. Thereafter, with mixing, a unique formulated flavoring composition is introduced to adjust matrix pH, structure and/or functionality depending on desired cheese variety. As discussed above and illustrated below, such a flavoring composition can be formulated to include a food grade proton donor or Lewis acid component. In doing so, the visco-elastic properties of the restructured matrix can be either maintained so as to approximate those of the natural cheese starting material or altered to provide new visco-elastic properties and related textures. Regardless, continued processing of the restructured cheese product can include cutting, slicing, shredding, mixing, grinding, heating and/or dispersing the restructured product, or incorporating into a prepared food product prior to packaging or distribution.

[0030] As used herein, the term "visco" pertains to the rheological parameters of materials such that imparted stress energy and the resultant strain energy is dissipated into the material in the form of heat.

[0031] Also, as used herein, the term "elastic" pertains to the rheological parameters of materials such that imparted stress energy and the resultant strain energy is stored in the material and can be recovered fully upon removal of the stress.

[0032] Also, as used herein, the term "visco-elastic" pertains to rheological parameters of materials such that imparted stress energy and the resultant strain energy has both a partial stored strain that can be recovered upon removal of the stress and a partial strain energy that is dissipated into the material in the form of heat. Various instruments and methods can be used to measure or observe visco-elastic properties, such instruments including, but not limited to, viscometers, penetrometers, shear force cutting machines, flow devices, as well as melting tests or recipes having numeric or judgmental evaluations.

[0033] As discussed above, certain embodiments of this invention can be undertaken at ambient temperatures or pressures. Nonetheless, depending upon any particular cheese starting material, reagent, additive or restructured cheese product desired or combinations thereof, any process step, including matrix modification or matrix restructuring, or both, can be conducted at temperatures from about -20 °C to about 140 °C and at pressures from 0 to about 15,000 psi. Any such method step can be performed under pressure or vacuum, optionally with cooling or upon heating or an appropriate time or at a time at least partially sufficient to achieve a desired intermediate, end result or both. For instance, application of suitable pressure, at an appropriate temperature, structure, density or texture, or a combination thereof, can be imparted to obtain a desired restructured cheese product.

[0034] Figure 1 is provided only by way of illustration and is not intended to limit the scope of this invention in any way. A starting cheese material can be selected from various cheddar, monterey jack, swiss and mozzarella-type cheeses and combinations thereof, together with other cheeses of comparable relative value as would be understood by those skilled in the art made aware of this invention. For instance, such a starting material can be any cheese by-product of trims generation from cut-wrap operations, or any cheese material in or out of standard specification accepted in trade for a given cheese variety. Selection can also take into consideration moisture and fat content of any one or more cheese starting materials or restructured cheese products. With regard to the latter, methods of this invention can be specifically designed and tailored to provide, without limitation, particular cheddar, parmesan, romano, provolone, swiss, gouda, camembert, mozzarella or blue-style restructured cheese products. From an economic perspective, such a product can be selected from these and various other cheeses of higher relative value as compared to a starting

material from which it was prepared. Such restructured products are limited only by a corresponding flavoring composition and the flavor components thereof.

[0035] In addition to the aforementioned cheese flavors, chocolate, tofu, fruit, vegetable, fish, meat, cured meat such as but not limited to bacon, sausage, sourdough, beer, wine, alcoholic spirit, surimi, legume paste flavors and combinations thereof can be introduced. Regardless, a wide range of other additives can be incorporated with such a starting material to affect structure, flavor, preservation, nutrient value, stabilization, color or any combination thereof. Any such additive can be introduced at any process point, but preferably at a point before, during or after matrix modification or, alternatively, at a point before, during or after matrix restructuring. Such additives include but are not limited to flavors, spices, extracts, fruits, meats, enzymes and combinations thereof. Further, various probiotics can also be introduced, alone or in conjunction with other additives, such probiotics including live or deactivated microorganisms, such as eukaryotes, prokaryotes, yeasts, fungi, molds, protozoa and combinations of such live and deactivated microorganisms.

Examples of the Invention.

[0036] The following non-limiting examples and data illustrate various aspect and features relating to the methods and restructured cheese products of the present invention, including the preparation of various value-added, restructured natural cheese products, as are available through the methodologies described herein. In comparison with the prior art, the present methods and restructured products provide results and data which are surprising, unexpected and contrary thereto. While the utility of this invention is illustrated through several starting natural cheese materials, reagents, process parameters and resulting restructured cheese products, it will be understood by those skilled in the art that comparable results are obtainable using various other natural cheese starting materials and process parameters and through corresponding restructured cheese products, as are commensurate with the scope of this invention.

[0037] All natural cheese starting materials, including trims, cuts and the like, are available from sources well-known to those skilled in art. Likewise, food grade reagents and additives are also commercially-available. In particular, natural flavoring compositions, such as but not limited to cheddar, provolone and parmesan flavoring compositions, are available from Jeneil Biotech, Inc. of Saukville, Wisconsin.

Example 1

[0038] With reference to Figure 2, natural cheddar cheese is treated with aqueous base, with mixing, to provide a modified cheese matrix of pH 9.5. With mixing, a selected natural flavoring composition is added for interaction with the modified cheese matrix, bringing the pH to 5.2.

Example 2

[0039] A variation of the method of Example 1 is to provide cheddar cheese (79 wt.%), natural cheddar flavoring composition (17.0 wt.%), and aqueous base (4 wt.%). A restructured cheddar-style cheese product is about 40 wt.% moisture, 30 wt.% fat and 3 wt.% salt.

Example 3

[0040] With reference to Example 2, bacon flavoring and/or bacon bits are introduced at a point before, during or after matrix restructuring.

Example 4

[0041] With reference to Example 2, one or more probiotic cultures, of the sort well-known to those skilled in the art, are introduced. Thereafter, process temperature may be raised from ambient to deactivate at least a portion of one or more such cultures.

Example 5

[0042] With reference to Example 2, moisture content of a resulting restructured cheese product is adjusted and/or stabilizers are introduced, according to desired form (e.g., block, slices, spread, etc.)

Example 6

[0043] A parmesan-style cheese is prepared with mozzarella cheese (76 wt.%, dried to 27% moisture), natural parmesan flavoring composition (16 wt.%) and aqueous sodium hydroxide (8 wt.%). A restructured parmesan-style cheese product is 35% moisture, 25% fat and 4% salt.

Example 7

[0044] With reference to Example 6, dried cheese powder is added to lower moisture content to less than 32%.

Example 8

[0045] With reference to Example 6, additional soy and/or dairy protein (e.g., whey protein isolates) are added to lower moisture content, to vary texture and/or to stabilize the cheese product, depending on end-use.

Example 9

[0046] Another parmesan-style cheese is prepared with mozzarella cheese (65 wt.%, dried to 20% moisture), swiss cheese (15 wt.%), parmesan cheese (5 wt.%), natural parmesan flavoring composition (8.0 wt.%), aqueous base (6 wt.%), and added salt (1 wt.%). A restructured parmesan-style cheese product is 31% moisture, 26% fat and 4% salt.

Example 10

[0047] A provolone-style cheese is prepared with mozzarella cheese (44 wt.%), cheddar cheese (45 wt.%), natural provolone flavoring composition (7.0 wt.%) and aqueous base (4.0 wt.%). A restructured provolone-style cheese product is 45% moisture, 25% fat, and 2% salt.

[0048] Referring to Examples 11-21, below, natural cheese products were prepared with the following natural cheese curd components, each of which is commercially available from sources as are well-known to those skilled in the art:

[0049] 1. Lowfat acid curd: Grade A dry curd cottage cheese (no cream dressing);

[0050] 2. Cheese curd: Cheddar cheese;

[0051] 3. Lowfat curd: the moisture is more than maximum moisture content allowed for skim cheese. That same curd could also be partially dried at about 24 to about 30% moisture to meet the definition of skim cheese);

[0052] 4. Low moisture part skim curd: low moisture part skim mozzarella, but with partial moisture removed as well (moisture ranges: about 18 to about 22% moisture, about 25 to about 29% moisture, and about 44 to about 48% moisture);

[0053] 5. Eyed cheese curd: Emmenthal, US style Swiss and Baby Swiss, Gouda, Raclette, and Gruyere; and

[0054] 6. Cheese curd direct acid set: hydrochloric acid added to milk for 6.08 pH, rennet set, cut, cooked to 39.3° C (102.7 F), and whey-drained curd. Processed over the course of 2 hrs, 40 mins.

[0055] Food grade base and acid components are commercially available from sources well known to those skilled in the art. For instance, food grade sodium hydroxide

and hydrochloric acid are available from Sigma-Aldrich (St. Louis, MO). Cheese and dairy flavor components are, as described above, available from Jeneil Biotech, Inc. of Saukville, Wisconsin. Such flavor components can be blended, dry or in an aqueous medium, with an acid or base to provide, as would be understood by those in the art made aware of this invention, a corresponding modification component or flavoring composition. A modification component and flavoring composition can be, respectively, added with mixing until desired pH and protein structure are obtained. With reference to Figures 1 and 2, restructured natural cheese products were prepared as described below.

Example 11

Lowfat Cheddar Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Lowfat acid curd	76 to 80	0.1 to 0.5	0.1 to 0.5	33.4
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	10.0
Lowfat curd	52 to 55	2 to 5	2 to 4	37.0
Additive(s)				
Non-fat milk powder	2 to 4	0.1 to 0.5	trace	6.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	3.0
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	10.6
			TOTAL	100.0

Procedure
1) Grind lowfat acid curd.
2) Add base and flavor components. Mix.
3) Grind remaining curd and non-fat milk power. Add. Mix.
4) Add acid and flavor components. Mix.
5) Mix and cook to 75° C.
6) Pack and cool to 4° C.

	Moisture	**Fat**	**Salt**	**pH**
Lowfat Cheddar Cheese Composition	60%	5.6%	3.3%	5.2

Example 12

Feta Style Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Lowfat acid curd	76 to 80	0.1 to 0.5	0.1 to 0.5	45.0
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	34.0
Additive(s)				
Concentrated milkfat	14 to 20	80 to 85	0 to 1.5	10.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	1.5
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	9.5
			TOTAL	100.0

Procedure
1) Grind lowfat curd, cheese curd, and concentrated milkfat.
2) Add base and flavor components. Mix.
3) Add acid and flavor components. Mix.
4) Mix and cook to 75° C.
5) Pack and cool to 4° C.

	Moisture	**Fat**	**Salt**	**pH**
Feta Style Cheese Composition	56%	21%	2.7%	4.6

Example 13

Blue Style Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	76.0
Additive(s)				
Steam condensate and water	100	0	0	11.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	1.5
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	11.5
			TOTAL	100.0

Procedure
1) Grind cheese curd.
2) Mix and cook to 65° C.
3) Add base and flavor components. Mix.
4) Add acid and flavor components. Mix.
5) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Blue Style Cheese Composition	45%	28%	3.5%	5.6

Example 14

Camembert Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Low-moisture part-skim curd	25 to 29	25 to 31	2.2 to 2.6	20.0
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	53.7
Additive(s)				
Concentrated milkfat	14 to 20	80 to 85	0 to 1.5	10.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	1.5
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	7.8
Additive(s)				
Steam condensate and water	100	0	0	7.8
			TOTAL	100.0

Procedure
1) Grind LMPS curd, cheese curd, and concentrated milkfat.
2) Add base and flavor components. Mix.
3) Add acid and flavor components. Mix.
4) Mix and cook to 75° C.
5) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Camembert Style Cheese Composition	42.5%	31.5%	2.3%	5.8

Example 15

Provolone Style Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Low-moisture part-skim curd	25 to 29	25 to 31	2.2 to 2.6	15.0
Low-moisture part-skim curd	44 to 48	18 to 24	1.5 to 1.9	70.0
Additive(s)				
Concentrated milkfat	14 to 20	80 to 85	0 to 1.5	7.5
Modification Component				
Base and flavor components	50 to 80	trace	trace	2.0
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	5.5
			TOTAL	100.0

Procedure
1) Grind low-moisture part-skim curd and concentrated milkfat.
2) Mix and cook to 65° C.
3) Add base and flavor components. Mix.
4) Add acid and flavor components. Mix.
5) Pack and cool to 4° C.

	Moisture	**Fat**	**Salt**	**pH**
Provolone Style Cheese Composition	44%	25%	2.0%	5.6

Example 16

Reduced Fat Cheddar Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Low-moisture part-skim curd	44 to 48	18 to 24	1.5 to 1.9	40.2
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	37.0
Additive(s)				
Steam condensate and water	100	0	0	13.5
Modification Component				
Base and flavor components	50 to 80	trace	trace	1.3
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	8.0
			TOTAL	100.0

Procedure
1) Grind low-moisture part-skim curd and cheese curd.
2) Add base and flavor components. Mix.
3) Mix and cook to 65° C.
4) Add acid and flavor components. Mix.
5) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Reduced Fat Cheddar Cheese Composition	51%	22%	2.5%	5.3

Example 17

Reduced Fat Cheddar Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Lowfat curd	52 to 55	2 to 5	2 to 4	36.0
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	54.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	2.2
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	7.8
			TOTAL	100.0

Procedure
1) Grind lowfat and cheese curd.
2) Add base and flavor components. Mix.
3) Add acid and flavor components. Mix.
4) Mix and cook to 75° C.
5) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Reduced Fat Cheddar Cheese Composition	45%	20.5%	3.0%	5.3

Example 18

Parmesan Style Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Low-moisture part-skim curd	18 to 22	27 to 33	2.4 to 2.8	46.7

Eyed cheese curd	35 to 39	24 to 30	0.5 to 1.0	20.0
Lowfat curd	24 to 30	2 to 6	3.8 to 4.3	13.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	2.2
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	11.1
Additive(s)				
Steam condensate and water	100	0	0	7.0
			TOTAL	100.0

Procedure
1) Grind lowfat curd.
2) Grind eyed and low-moisture part-skim curd. Add.
3) Add base and flavor components. Mix.
4) Add acid and flavor components. Mix.
5) Mix and cook to 75° C.
6) Pack and cool to 4° C.

	Moisture	**Fat**	**Salt**	**pH**
Parmesan Style Cheese Composition	34%	22%	3.2%	5.2

Example 19

Romano Style Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Low-moisture part-skim curd	25 to 29	25 to 31	2.2 to 2.6	52.3
Eyed cheese curd	35 to 39	24 to 30	0.5 to 1.0	20.0
Lowfat curd	24 to 30	2 to 6	3.8 to 4.3	14.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	2.2
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	8.5
Additive(s)				
Water	100	0	0	3.0
			TOTAL	100.0

Procedure
1) Grind lowfat curd.
2) Grind low-moisture part-skim and eyed curd. Add.
3) Add base and flavor components. Mix.
4) Add acid and flavor components. Mix.
5) Mix and cook to 75° C.
6) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Romano Style Cheese Composition	36.5%	21%	4.1%	5.4

Example 20

Cheese Concentrate				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Cheese curd	34 to 39	30 to 36	1.6 to 2.0	63.0
Modification Component				
Base and flavor components	50 to 80	trace	trace	4.0
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	33.0
			TOTAL	100.0

Procedure
1) Grind cheese curd.
2) Add base and flavor components. Mix.
3) Add acid and flavor components. Mix.
4) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Cheese Concentrate Composition	41%	30%	3.0%	5.0

Example 21

Cheddar Type Cheese				
	Ingredient Composition Range (%)			
Ingredient	**Moisture**	**Fat**	**Salt**	**Percent Use**
Natural Cheese Component(s)				
Cheese curd direct acid set	34 to 39	30 to 36	0.1 to 0.2	94.3
Modification Component				
Base and flavor components	50 to 80	trace	trace	3.0
Flavoring Composition				
Acid and flavor components	40 to 50	20 to 30	2 to 4	2.7
			TOTAL	100.0

Procedure
1) Grind cheese curd direct acid set.
2) Add base and flavor components. Mix.
3) Add acid and flavor components. Mix.
4) Pack and cool to 4° C.

	Moisture	Fat	Salt	pH
Cheddar Type Cheese Composition	39%	30%	1.4%	5.4

Example 22

[0056] With reference to the methods and procedures of the preceding examples, one or more of the following non-limiting protein sources or components can be used, alone or in conjunction with one or more other proteins or additives of the sort discussed herein, to prepare a range of restructured dairy or dairy analog-based food products:

Milk (at all fat levels);

Fractionated milks: microfiltered, ultrafiltered, nanofiltered, reverse osmosis;

Evaporated milk, condensed milk, concentrated milk, sweetened condensed milk;

Dried milk;

Reconstituted milk (at all fat levels);

Cream, at allowed fat levels, half and half;

Butter, concentrated milkfat;

Dry cream;

Butter milk (not cultured);

Cultured dairy products;

Milk protein concentrate, milk protein isolate, fractionated casein protein, rennet casein, sodium caseinate, potassium caseinate, calcium caseinate, etc.;

Cheese; and

Whey, native whey (not from cheese making but isolated from membranes or other technology), whey protein concentrate, whey protein isolate, protein hydrolyzed whey, fractionated whey protein, deproteinized whey, whey permeate, delactosed whey permeate, demineralized whey, milk mineral.

[0057] As is understood in the art, dairy analog proteins are proteins, from either dairy or non-dairy sources, that provide similar nutritive and structural contribution to manufactured diary or dairy emulating products. The preceding proteins of this example can be used, as described herein, alone or in addition to another protein, to prepare various dairy and dairy-analog products, including but not limited to the following:

Creamers (e.g. milk creamer);

Spreads (e.g. process cheese in tubs, butter substitutes);

Sauces (e.g. jar or canned cheese sauce);

Dips (e.g. sour cream based dips);

Fondue (e.g. heated dipping cheese);

Toppings (e.g. whipped cream);

Puddings (e.g. milk pudding, custards);

Fondants (e.g. confection fillings);

Caramels (e.g. confection fillings and coatings);

Whipping agents (e.g. egg white replacer);

Stabilizers (e.g. cream cheese spreads);

Fat mimetic (e.g. reduced fat dairy products);

Yogurts (e.g. acidified sauces);

Frozen Confections (e.g. ice cream); and

Stable fat and water emulsion flavor carrier (e.g. butter and cheese vegetable sauce).

We Claim:

1. A method of preparing a restructured cheese, said method comprising:

providing a proteinaceous natural cheese component comprising an initial moisture content;

treating said natural cheese component with a protein structure modification component comprising a base, said modification component in an amount and of a pH to modify the protein structure of said natural cheese component, said modification providing a liquidity to said natural cheese component; and

treating said modified natural cheese component with a flavoring composition comprising an acid, said flavoring composition in an amount and of a pH to restructure said modified natural cheese component and provide a natural cheese product with a desired flavor characteristic.

2. The method of claim 1 wherein said base is a food grade hydroxide.

3. The method of claim 2 wherein said pH of said modified natural cheese component is about 5.0 to about 12.5.

4. The method of claim 3 wherein said pH is about 8.0 to about 10.0.

5. The method of claim 1 wherein said acid is selected from food grade protic acids.

6. The method of claim 1 wherein said pH is about 3.5 to about 7.5.

7. The method of claim 6 wherein said pH of said restructured natural cheese product is about 4.5 to about 6.0.

8. The method of claim 1 wherein a protein component is introduced to affect the moisture content of said restructured natural cheese product, said protein component selected from vegetable proteins, dairy proteins and combinations thereof.

9. The method of claim 1 wherein said flavoring composition comprises a flavor component selected from parmesan, feta, gouda, camembert, and blue cheese flavorings.

10. The method of claim 1 wherein said natural cheese component is selected from by-products of natural cheese production and handling operations.

11. A method of preparing a restructured cheese, said method comprising:

providing a proteinaceous natural cheese component selected from mozzarella and cheddar cheese components;

treating said natural cheese component with a protein structure modification component comprising an aqueous food grade base, said modification component in an amount and of a pH to provide said natural cheese component a liquid consistency; and

treating said modified natural cheese component with a flavoring composition comprising an aqueous food grade protic acid, said flavoring composition in an amount and of a pH to restructure said modified natural cheese component and provide a natural cheese product with a desired flavor characteristic.

12. The method of claim 11 wherein said modification component comprises aqueous food grade sodium hydroxide.

13. The method of claim 12 wherein said pH of said modified natural cheese component is about 8.0 to about 10.0.

14. The method of claim 11 wherein said protic acid is selected from food grade organic and mineral acids.

15. The method of claim 14 wherein said pH of said restructured natural cheese product is about 4.5 to about 6.0.

16. The method of claim 11 wherein said natural cheese product has a flavor characteristic distinct from the flavor of said natural cheese component.

17. The method of claim 16 wherein said flavoring composition comprises a flavor component selected from parmesan, feta, gouda, camembert and blue cheese flavorings.

18. A method of using protein structure modification to prepare natural cheese product, said method comprising:

providing a proteinaceous natural cheese component;

treating said natural cheese component with a modification component comprising an aqueous food grade base, said modification component in an amount and of a pH to modify a protein structure of said natural cheese component; and

treating said modified natural cheese component with a flavoring composition comprising an aqueous food grade acid, said flavoring composition in an amount and of a pH to restructure the protein of said modified natural cheese component and provide a natural cheese product.

19. The method of claim 18 wherein said modified natural cheese component has a liquid consistency.

20. The method of claim 19 wherein said restructure restores the protein structure of said natural cheese component.

21. The method of claim 19 wherein said restructure provides a said natural cheese product distinct from said natural cheese component.

22. The method of claim 21 wherein said natural cheese component is selected from mozzarella and cheddar components; and said natural cheese product is selected from parmesan, feta, gouda, camembert and blue cheeses.

23. A method of preparing a restructured dairy or dairy analog product, said method comprising:

providing a proteinaceous component selected from dairy proteins and dairy-analog proteins and combinations thereof, said component comprising an initial moisture and fat content;

treating said component with a protein structure modification component comprising a base, said modification component in an amount and of a pH to modify the protein structure of said component; and

treating said modified component with a flavoring composition comprising an acid, said flavoring composition in an amount and of a pH to restructure said modified component and provide a dairy or dairy analog product with a desired flavor characteristic.

24. The method of claim 23 wherein said base is a food grade hydroxide.

25. The method of claim 24 wherein said pH of said modified component is about 5.0 to about 12.5.

26. The method of claim 25 wherein said pH is about 8.0 to about 10.0.

27. The method of claim 23 wherein said acid is selected from food grade acids.

28. The method of claim 23 wherein said pH is about 3.5 to about 7.5.

29. The method of claim 28 wherein said pH of said restructured product is about 4.5 to about 6.0.

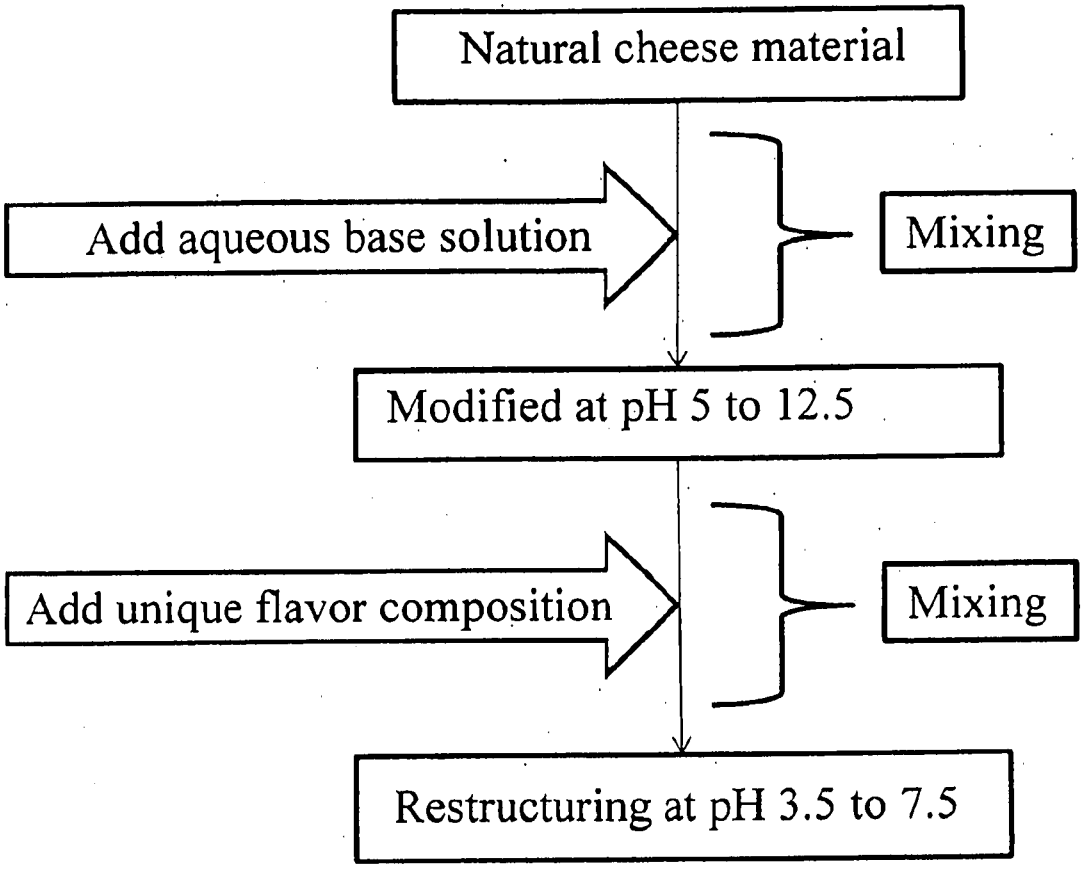
Natural cheese material
Add aqueous base solution
Mixing
Modified at pH 5 to 12.5
Add unique flavor composition
Mixing
Restructuring at pH 3.5 to 7.5

Figure 1

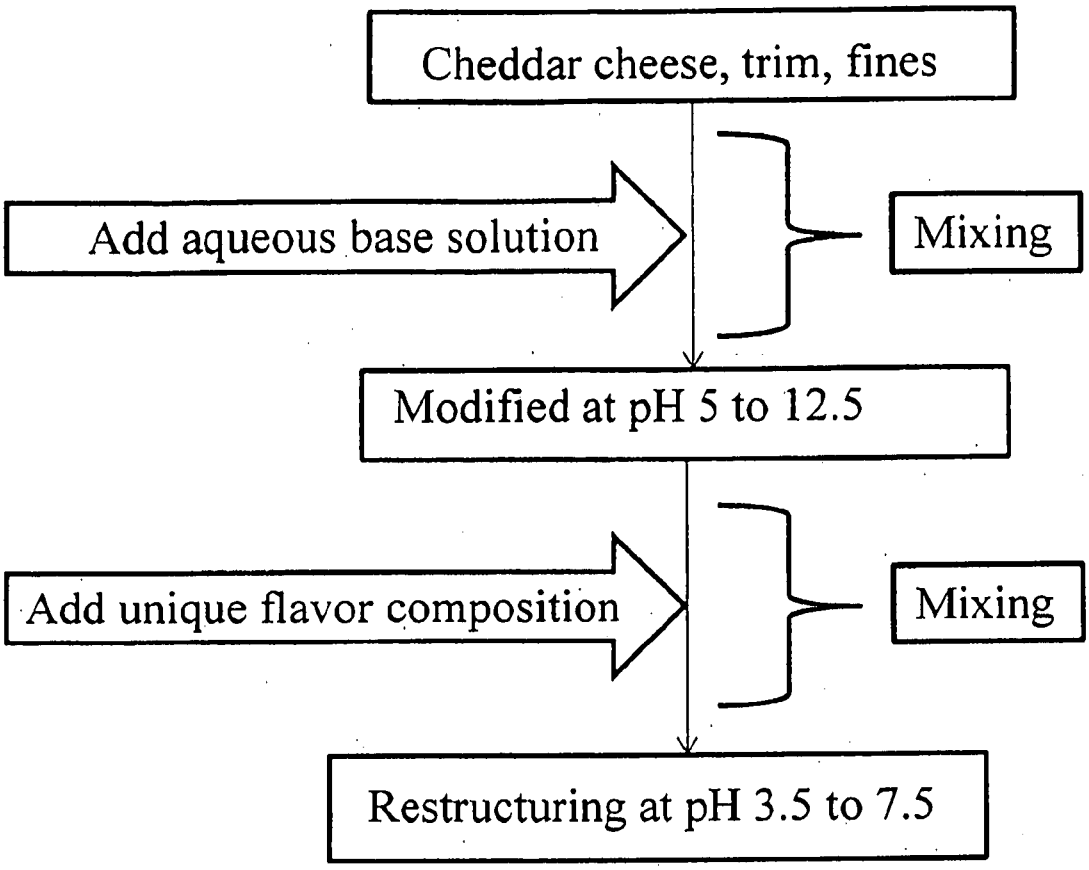
Cheddar cheese, trim, fines
Add aqueous base solution
Mixing
Modified at pH 5 to 12.5
Add unique flavor composition
Mixing
Restructuring at pH 3.5 to 7.5

Figure 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/030879

A. CLASSIFICATION OF SUBJECT MATTER

A23C 19/08(2006.01)i, A23C 19/068(2006.01)i, A23C 19/072(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A23C 19/08; A23C 19/02; A23C 19/14; A23C 11/00; A23L 1/221; A23C 19/00; A23C 19/064; A23C 19/068; A23C 19/072

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: restructed cheese, natural cheese, base, acid

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4197322 A (MIDDLETON) 08 April 1980 See claims 1, 5, abstract.	1-29
A	US 2004-0018292 A1 (LINDSTROM et al.) 29 January 2004 See claim 1, abstract.	1-29
A	US 4343817 A (SWANSON et al.) 10 August 1982 See claims 1, 4, abstract.	1-29
A	US 6586025 B2 (YVON et al.) 01 July 2003 See claim 1, abstract.	1-29
A	US 7309510 B2 (SEKULA et al.) 18 December 2007 See claim 1, abstract.	1-29

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea
Facsimile No. +82-42-472-7140

Authorized officer
PARK, Yeong Gwan
Telephone No. +82-42-481-8147

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 1596669 A1	23/11/2005
		US 2004-0170747 A1	02/09/2004
		WO 2004-075662 A1	10/09/2004

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(71)申请人 简耐而生物公司
地址 美国威斯康星州

(72)发明人 尼兰詹·R·甘地
维多利亚·帕尔默·斯科巴
弗兰科·X·米拉尼

(74)专利代理机构 隆天知识产权代理有限公司
72003
代理人 吴小瑛

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A23C 19/068(2006.01)
A23C 19/072(2006.01)

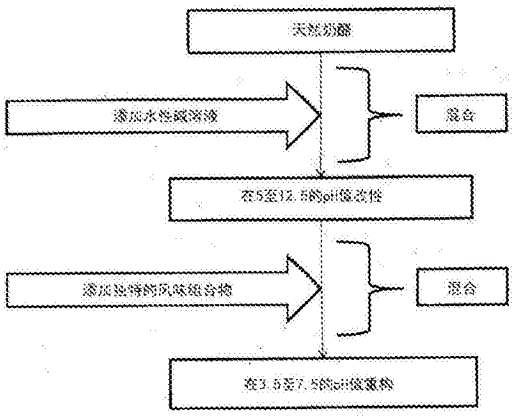
权利要求书2页 说明书19页 附图1页

(54)发明名称

重构天然蛋白基质

(57)摘要

本发明提供一种方法，其可以用于从众多含蛋白的起始材料制备一种或多种乳、乳类似物和奶酪产品，这样的方法包括蛋白改性和蛋白恢复或者蛋白重构。



CN 105324035 A

1. 一种制备重构奶酪的方法，所述方法包括：

提供含蛋白的天然奶酪组分，该天然奶酪组分包含初始水分含量；

用含碱的蛋白结构改性组分处理所述天然奶酪组分，所述改性组分的量和 pH 值为使所述天然奶酪组分的蛋白结构改性的量和 pH 值，所述改性使所述天然奶酪组分具有液体性质；和

用含酸的调味组合物处理所述经改性的天然奶酪组分，所述调味组合物的量和 pH 值为使所述经改性的天然奶酪组分重构并提供具有所期望的风味特性的天然奶酪产品的量和 pH 值。

2. 权利要求 1 所述的方法，其中所述碱为食品级氢氧化物。

3. 权利要求 2 所述的方法，其中所述经改性的天然奶酪组分的所述 pH 值为约 5.0 至约 12.5。

4. 权利要求 3 所述的方法，其中所述 pH 值为约 8.0 至约 10.0。

5. 权利要求 1 所述的方法，其中所述酸选自食品级质子酸。

6. 权利要求 1 所述的方法，其中所述 pH 值为约 3.5 至约 7.5。

7. 权利要求 6 所述的方法，其中所述重构天然奶酪产品的所述 pH 值为约 4.5 至约 6.0。

8. 权利要求 1 所述的方法，其中引入蛋白组分以影响所述重构天然奶酪产品的水分含量，所述蛋白组分选自植物蛋白、乳蛋白、以及其组合。

9. 权利要求 1 所述的方法，其中所述调味组合物包含选自帕玛森奶酪、费塔奶酪、高达奶酪、卡蒙贝尔奶酪以及蓝奶酪调味料的风味组分。

10. 权利要求 1 所述的方法，其中所述天然奶酪组分选自天然奶酪生产和处理操作的副产物。

11. 一种制备重构奶酪的方法，所述方法包括：

提供选自马苏里拉奶酪和车达奶酪组分的含蛋白的天然奶酪组分；

用包含水性的食品级碱的蛋白结构改性组分处理所述天然奶酪组分，所述改性组分的量和 pH 值为向所述天然奶酪组分提供液体一致性的量和 pH 值；和

用包含水性的食品级质子酸的调味组合物处理所述经改性的天然奶酪组分，所述调味组合物的量和 pH 值为使所述经改性的天然奶酪组分重构并提供具有所期望的风味特性的天然奶酪产品的量和 pH 值。

12. 权利要求 11 所述的方法，其中所述改性组分包含水性的食品级氢氧化钠。

13. 权利要求 12 所述的方法，其中所述经改性的天然奶酪组分的所述 pH 值为约 8.0 至约 10.0。

14. 权利要求 11 所述的方法，其中所述质子酸选自食品级的有机酸和无机酸。

15. 权利要求 14 所述的方法，其中所述重构天然奶酪产品的所述 pH 值为约 4.5 至约 6.0。

16. 权利要求 11 所述的方法，其中所述天然奶酪产品具有不同于所述天然奶酪组分的风味的风味特性。

17. 权利要求 16 所述的方法，其中所述调味组合物包括选自帕玛森奶酪、费塔奶酪、高达奶酪、卡蒙贝尔奶酪和蓝奶酪调味料的风味组分。

18. 一种使用蛋白结构改性以制备天然奶酪产品的方法，所述方法包括：

提供含蛋白的天然奶酪组分；

用包含水性的食品级碱的改性组分处理所述天然奶酪组分，所述改性组分的量和 pH 值为使所述天然奶酪组分的蛋白结构改性的量和 pH 值；和

用包含水性的食品级酸的调味组合物处理所述经改性的天然奶酪组分，所述调味组合物的量和 pH 值为使所述经改性的天然奶酪组分的蛋白重构并提供天然奶酪产品的量和 pH 值。

19. 权利要求 18 所述的方法，其中所述经改性的天然奶酪组分具有液体一致性。

20. 权利要求 19 所述的方法，其中所述重构使所述天然奶酪组分的蛋白结构恢复。

21. 权利要求 19 所述的方法，其中所述重构提供不同于所述天然奶酪组分的所述天然奶酪产品。

22. 权利要求 21 所述的方法，其中所述天然奶酪组分选自马苏里拉奶酪和车达奶酪组分；所述天然奶酪产品选自帕玛森奶酪、费塔奶酪、高达奶酪、卡蒙贝尔奶酪和蓝奶酪。

23. 一种制备重构乳或乳类似物产品的方法，所述方法包括：

提供选自乳蛋白和乳类似物蛋白以及其组合的含蛋白组分，所述组分包含初始的水分含量和脂含量；

用包含碱的蛋白结构改性组分处理所述组分，所述改性组分的量和 pH 值为使所述组分的蛋白结构改性的量和 pH 值；和

用包含酸的调味组合物处理所述经改性的组分，所述调味组合物的量和 pH 值为使所述经改性的组分重构并提供具有所期望的风味特性的乳或乳类似物产品的量和 pH 值。

24. 权利要求 23 所述的方法，其中所述碱为食品级氢氧化物。

25. 权利要求 24 所述的方法，其中所述经改性的组分的所述 pH 值为约 5.0 至约 12.5。

26. 权利要求 25 所述的方法，其中所述 pH 值为约 8.0 至约 10.0。

27. 权利要求 23 所述的方法，其中所述酸选自食品级酸。

28. 权利要求 23 所述的方法，其中所述 pH 值为约 3.5 至约 7.5。

29. 权利要求 28 所述的方法，其中所述重构产品的所述 pH 值为约 4.5 至约 6.0。

重构天然蛋白基质

[0001] 本申请要求2013年3月15日提交的申请序列号61/852,465的优先权，其全部内容在此以引用的方式并入本文。

[0002] 发明背景

[0003] 结构转换是现代食品工业的重要部分。通过加工农业产出物使原材料变为精制的食品产品。食品结构构建(structuring)的主要目的是重组食品组分以改善食品资源的利用。或者，从经济预期来看，可以设计这样的重构(restructuring)以获得在市场上被认为更有价值的产品。

[0004] 更具体地，重构涉及四种基本的食品组分：水、蛋白、脂和碳水化合物。经常在重构过程中的某个时间点引入微量营养物质（例如，维生素和矿物质）和其它微量组分如风味剂、色素、防腐剂以及其它功能性添加剂（例如稳定剂，乳化剂等）。无论如何，在四种基本组分中，重构过程大多经常涉及蛋白和淀粉。蛋白和淀粉重构的内在原因包括对于膳食蛋白和碳水化合物的全球需求和与这些食品相关的更高价格（由此支持更高的利润率和相应的经济活力）。

[0005] 豆奶（基本上为粉碎的大豆和水的悬浮液）的制备和随后的用途是公知的并且显示了数种用于蛋白重构的广泛使用的技术。尽管豆奶可以被作为饮料或者经发酵而使用，其更经常地被用作数种其它构建食品产品的起始原料。例如，豆腐是如下制备的：用钙盐沉淀豆奶蛋白以形成凝块，随后将凝块排水、挤压和清洗，得到含蛋白的(proteinaceous)食品产品。

[0006] 可以认为多种其它重构技术是用于粉碎的肉产品情况，由此将水包油型乳液包覆于不溶蛋白和肌纤维的凝胶中。将通常为低价值的原料肉蛋白基质体系和高结缔组织的分割肉或下脚料粉碎以降低颗粒大小。初始粉碎后，将肉蛋白基质与多种乳化盐（例如磷酸盐等）和其它组分混合以促进肌纤维粘结剂的提取。这样的肌肉蛋白在升高的温度条件下粘结更好。在这些过程中，蒸煮是为了重新激活蛋白粘结剂，重组粉碎的颗粒并完成重构过程。这样的肉乳液相当稳定，但即使发生凝聚，脂球的运动也被重构的蛋白基质所限制。

[0007] 奶酪显示了关于蛋白重构的其它方面。从历史角度看，最初发展加工奶酪是为了解决天然奶酪固有的匀质性(homogeneity)和保质期问题。尽管天然奶酪是从奶直接制造，但是加工奶酪是通过在乳化剂的存在下使一种或多种天然奶酪和任选的其它乳或非乳成分混合来生产。持续混合下的热处理导致保质期延长的更匀质产品。在美国联邦法规(United States Code of Federal Regulations)(CFR)中，加工奶酪是通用术语，其包括巴氏杀菌加工奶酪、巴氏杀菌加工奶酪食品和巴氏杀菌加工奶酪涂抹酱，所有这些都基于处理参数、成分、脂和水分(moisture)含量等进行规范（见21CFR 133.169-133.180）。适合乳化剂的选择和天然奶酪的选择（例如，关于年份，风味等）均是确定所得到的加工奶酪的物理化学性质和功能性质的关键因素。

[0008] 目前，有十三种乳化剂被批准使用（单独或组合）：磷酸一、二和三钠，磷酸二钾，六偏磷酸钠，酸式焦磷酸钠，焦磷酸四钠，磷酸铝钠，柠檬酸钠，柠檬酸钾，柠檬酸钙，酒石酸钠和酒石酸钾钠。在美国的加工奶酪生产中最常见的乳化盐为柠檬酸三钠和磷酸二钠。柠

檬酸三钠是用于片状的加工奶酪种类的优选乳化盐，而磷酸二钠（或者适合的磷酸二和三钠的组合）用于条型的加工奶酪和加工奶酪涂抹酱中。在某些应用中，低水平的六偏磷酸钠也与这些乳化盐一起使用。磷酸铝钠经常与马苏里拉(mozzarella)型的模拟加工奶酪类型一起使用，以替代冷冻比萨上的马苏里拉奶酪。无论如何，这样的乳化盐的固体重量不超过相应的CFR限定的加工奶酪重量的百分之三(21 CFR§133.169(c))。在CFR未限定的加工奶酪中使用的乳化剂遵循安全和适宜的临时原则。

[0009] 通常，乳化盐是用于螯合钙和调节pH值。两种功能辅助存在于天然奶酪中的蛋白的水合以促进水相和脂相的相互作用，由此产生更匀质的乳液。更具体地，这样的盐的功能可以通过将其与天然奶酪的生产进行对比来理解。牛乳的特征在于四种主要的酪蛋白类型：α_{s1}-酪蛋白、α_{s2}-酪蛋白、β-酪蛋白和κ-酪蛋白，其中每种均为两亲性的（具有疏水和亲水部分并含有共价连接的磷酸酯基团）。在水性乳液环境中，奶酪蛋白采用由蛋白-蛋白疏水相互作用和胶体磷酸钙调节的交联而稳定的胶束构型。κ-酪蛋白主要存在于胶束表面上，疏水部分嵌入其中并且带负电的亲水部分朝向外面的水相。胶束相互排斥，由此稳定乳液。在天然奶酪生产期间，酶（如凝乳酶）对κ-酪蛋白的作用切割了亲水部分，使得胶束不稳定。α-和β-酪蛋白的磷酸丝氨酸残基之间的钙调节的交联产生水不溶性的钙-副酪蛋白磷酸盐的复合物网络（其通常被称为凝乳），其中悬浮有脂相。

[0010] 相比于天然奶酪，加工奶酪可以被描述为稳定的水包油型乳液。乳化剂（如上述的盐）与连续的加热和混合一起通过替代磷酸钙复合物并分散钙-副酪蛋白磷酸盐网络而改善了酪蛋白的乳化。分散的网络与脂相相互作用，并在冷却时提供具有新的和不同于天然奶酪结构的加工奶酪结构，该加工奶酪结构具有经均匀的蛋白凝胶乳化的脂相。

[0011] 所得到的稳定，匀质的加工奶酪结构提供广泛的产品形式（例如条、片、碎块、碎片和涂抹酱等）以及食品制备和服务工业中对应的众多终端用途。然而，现有技术认识到许多缺点和不足，其中数种可能与乳化盐的使用直接相关。例如，观察到刺眼的晶体形成并已经将其与各种磷酸和柠檬酸盐的相对不溶性关联，其进一步受pH值和储存条件的影响。从更功能性的角度看，油分离可能是由不适合的盐含量连同pH值、酪蛋白水平和处理温度条件一起导致的。另外，乳化盐的选择可能不利地影响加工奶酪的不融和融化质地性质。可能最重要的是，从产品标签上的包括乳化盐（例如焦磷酸盐，磷酸铝等）的说明得到不利的消费者感知。

[0012] 因此，连同与加工奶酪相关的其它长期存在的问题，本领域中仍然对于具有所选益处的加工奶酪并且没有与乳化盐使用相关缺点的奶酪产品的提供存在持续关注。

[0013] 发明概述

[0014] 根据上述内容，本发明的目的是提供一种或多种制备重构蛋白基质的方法，由此克服包括上述所列那些在内的现有技术的各种不足和缺点。本领域技术人员应理解，本发明的一个或多个方面能够达到某些目的，而一个或多个其它方面能够达到某些其它目的。每个目的可能不会在其所有方面都等同适用于本发明的每个方面。因此，可以将以下目的视为关于本发明任一方面的可备选方案。

[0015] 本发明的目的可以是从较低成本的天然奶酪起始原料提供增值的天然奶酪。

[0016] 本发明的另一个目的可以是提供这样的增值天然奶酪，其具有均一的预定风味、质地和结构特性，虽然对应的天然奶酪起始原料是不一致的。

[0017] 单独地或者与一个或多个前述目的一起的本发明的另一个目的可以是在不使用加工奶酪所用种类的乳化盐的情况下实现这样的结果。

[0018] 本发明的其它目的、特征、益处和优势将通过本概述和下面各种实施方式的描述而变得明显，并且具有各种奶酪生产技术知识的本领域技术人员将容易理解。从上述内容连同所附实施例、数据、附图和从中得到的所有合理推论可理解这样的目的、特征、益处和优势。

[0019] 总体来说，本发明可以涉及制备重构的含蛋白食品产品的方法。这样的方法可以包括提供包含水、脂、蛋白和盐的初始基质体系；用包含选自氢氧化物类物质、阴离子碱类物质及其组合的制剂的改性组分处理这样的基质体系，这样的制剂的量可以为至少部分地足以改性这样的基质蛋白的二级、三级或四级结构，可以认为这样的改性是针对这样的基质体系的粘弹性性质；以及使这样经改性的基质体系与调味组合物相互作用，调味组合物包含至少一种为特定的含蛋白食品产品独特配制的风味组分，这样的风味组合物的量可以是至少部分地足以重构这样的经改性的基质体系。在某些实施方式中，每种前述处理或基质改性和相互作用或基质重构步骤可以在环境温度／室温和环境压力／常压下、比这样的温度更低的温度下、比这样的温度更高的温度下、正压力下、负压力下和／或这样的条件的组合下进行。在某些这样的实施方式中，可以通过传导、对流、微波、红外处理以及其组合，或者了解本发明的本领域技术人员所理解的其它方式来加热这样的基质体系以达到升高的温度。

[0020] 无论如何，这样的基质体系的脂组分可以选自动物脂、植物脂、得自微生物来源的脂以及其组合；并且独立地，这样的基质体系的蛋白可以选自动物蛋白、植物蛋白、得自微生物来源的蛋白以及其组合。不考虑脂或蛋白种类，基质改性组分可以选自食品级碱金属氢氧化物盐，食品级路易斯碱制剂以及其组合。类似地，不考虑脂和蛋白种类或使用的基质改性组分，这样的调味组合物可以包含选自有机醇、醛、酮、酸、酸式盐、酸酯、无机酸和酸式盐以及其组合的组分。如上所述和本发明中其它地方所示，可以配制这样的组合物，以通过与经改性的基质体系相互作用而提供具有一种或多种风味特性的重构的含蛋白食品产品。

[0021] 不限制调味组合物、基质体系脂／蛋白或改性组分，可以在基质处理／改性或相互作用／基质重构或者其两者的某个时间点引入一种或多种任选的添加剂，可以选择这样的添加剂以影响重构的含蛋白食品产品的风味、质地、水分含量和一种或多种其它特征。类似地无限制地，这样的添加剂可以选自蛋白、脂、油、碳水化合物、防腐剂、矿物质、营养物以及其组合，其量至少部分地足以影响一种或多种食品产品特性。在某些这样的实施方式中，可以采用一种或多种干燥的或部分干燥的蛋白，碳水化合物及其组合以影响水分含量。在多种其它实施方式中，一种或多种风味剂、香料、着色剂、提取物、水果、肉及其组合可以单独地或与其它这样的添加剂一起使用来影响风味。此外，某些实施方式可以掺入各种酶，培养物和／或相关的益生菌添加剂以及其组合。任何这样的添加剂可以是合成的，或得自各种植物、动物和微生物来源，以及其组合。

[0022] 无论如何，可以重构经改性的基质体系以提供含蛋白的食品产品，其质地包含初始基质体系的一种或多种特性或包含特定的最终所得的含蛋白食品产品所特有的改性特性。

[0023] 部分地，本发明也可以涉及制备基于重构乳或乳类似物的食品产品的方法。这样

的方法包括提供包含水、脂、选自乳蛋白和乳类似物蛋白以及其组合的蛋白和盐的起始基质体系；用包含选自过量的氢氧化物类物质，阴离子碱类物质以及其组合的制剂的改性组分处理这样的基质体系，这样制剂的量可以为至少部分地足以改性这样的基质蛋白的二级、三级或四级结构，可以认为这样的改性是针对这样的基质体系的粘弹性性质；以及使这样经改性的基质体系与调味组合物相互作用，调味组合物包含至少一种为特定的含蛋白食品产品独特配制的风味组分，这样的风味组分的量可以为至少部分地足以重构这样经改性的基质体系。如上所讨论的，在某些实施方式中，每种前述处理 / 基质改性或相互作用 / 基质重构步骤或其两者可以在环境温度和压力下、比这样的温度更低的温度下，比这样的温度更高的温度下、正压力下、负压力下或这样条件的组合下进行。

[0024] 没有限制，脂和基质改性组分可以是如上所讨论的或本发明其它地方所示的。无论如何，这样的调味组合物可以包含选自有机醇、醛、酮、酸、酸式盐、酸酯、无机酸和酸式盐以及其组合的组分成分。在某些实施方式中，这样的组分成分可以包括一种或多种有机酸、一种或多种无机酸（例如一种或多种质子酸），以及其组合。在某些这样的实施方式中，可以根据所期望的食品产品调节基质 pH 值、结构和 / 或功能性。更通常地，可以配制这样的组合物以提供这样的具有乳或奶酪风味的重构产品，这样的风味可以选自但不限于车达奶酪 (cheddar)、帕玛森奶酪 (parmesan)、罗马诺奶酪 (romano)、波伏洛奶酪 (provolone)、瑞士奶酪 (swiss)、马苏里拉奶酪、蓝奶酪 (blue cheese) 和奶油奶酪、酸奶油和酸奶，以及了解本发明的本领域技术人员所理解的各种其它乳 / 奶酪风味，或其组合。

[0025] 如上面讨论和本发明其它地方所示，这样的改性基质体系可以通过控制对应于其蛋白和 / 或脂组分的各种热相关的流变性质而重构。可以通过出油 (oiling-off) 程度至少部分地限定或监测这样的控制（例如其从无到过量的变化），这样的现象可以是消费食品制备所附带的。

[0026] 部分地，本发明也可以涉及制备或使用蛋白结构改性来制备重构奶酪的方法。这样的方法可以包括提供包含初始脂和水分含量的含蛋白的天然奶酪；用水性介质处理这样的奶酪，这样的介质包含至少部分足以使这样的天然奶酪起始材料改性和 / 或向这样的天然奶酪起始材料赋予液体一致性的碱类物质；并且使上面讨论和本发明其它地方所示种类的调味组合物与这样经改性的天然奶酪相互作用，这样的组合物的量可以为至少部分足以使这样的天然奶酪恢复或重构。更具体地，如上面讨论地，这样的方法可以包括提供含蛋白的天然奶酪组分；用包含碱的蛋白结构改性组分处理这样的组分，这样的改性组分的量和 pH 值为使这样的天然奶酪组分的蛋白结构改性的量和 pH 值；并用包含酸和至少一种风味组分的调味组合物来处理这样经改性的天然蛋白组分或使该调味组合物与这样经改性的天然蛋白组分相互作用，这样的调味组合物的量和 pH 值为使这样的经改性的天然奶酪组分重构并为其提供所期望的风味特性的量和 pH 值。

[0027] 没有限制，天然奶酪起始材料可以选自马苏里拉和车达类奶酪。无论如何，从其重构的奶酪可以包含与天然奶酪起始材料相似或不同的水分和 / 或脂含量。在某些实施方式中，可以配制这样的调味组合物以向这样的重构天然奶酪提供不同于起始材料的风味或质地特性，或其两者。因此，在某些这样的实施方式中，本发明的重构天然奶酪可以是例如帕玛森或波伏洛奶酪。没有限制，这样的调味组合物可以以干燥的混合物、部分水性制剂或其组合来提供，其与经改性的天然奶酪基质的相互作用可以同时或分步完成。

[0028] 任选的添加剂可以是如上面讨论和本发明其它地方所示的，并且可以在天然奶酪处理 / 改性、重构时或其两者的时间点引入。在某些实施方式中，可以引入一种或多种干燥的动物蛋白、植物蛋白或其组合以影响这样的重构天然奶酪的水分含量、稳定性或随后的物理操作和包装。在某些这样的实施方式中，这样的添加剂仅受限于盐的特性或其量为至少部分地使天然奶酪起始材料的蛋白组分乳化—提供加工奶酪领域的技术人员将以其它方式理解这样的盐或其量或者其存在。

[0029] 附图简述

[0030] 图 1 为展示按照本发明的某些实施方式重构一种或多种天然奶酪材料的流程示意图。

[0031] 图 2 为展示按照本发明的某些实施方式重构天然车达奶酪起始材料的流程示意图。

[0032] 某些实施方式的详细描述

[0033] 可以参考图 1 的流程示意图来考虑本发明的各种非限制性实施方式。在混合下，用足够浓度和体积的食品级水性碱处理起始天然奶酪材料以提供 pH 值为约 5 至约 12.5 的经改性的天然奶酪基质。在某些实施方式中，根据起始材料和所期望的重构奶酪产品将基质改性并且 pH 值可以为约 8 至约 10。此后，在混合下，根据所期望的奶酪种类引入独特配制的调味组合物以调节基质 pH 值、结构和 / 或功能性。按上面所讨论和下面所示的，可以配制这样的调味组合物以包含食品级质子供体或路易斯酸组分。在这样做的时候，重构基质的粘弹性性质可以被保持从而接近天然奶酪起始材料，或者被改变以提供新的粘弹性性质和相关质地。无论如何，重构奶酪产品的继续处理可以包括切割、切片 (slicing)、切碎 (shredding)、混合、粉碎、加热和 / 或分散重构产品，或者在包装或分发前掺入制备的食品产品中。

[0034] 本发明中所用的术语“粘性”与材料的流变参数相关，使得传递的应力能量和所得的应变能量以热的形式发散到材料中。

[0035] 本发明中所用的术语“弹性”也与材料的流变参数相关，使得传递的应力能量和所得的应变能量储存在材料中并且可以在压力去除时完全恢复。

[0036] 本发明中所用的术语“粘弹性”也与材料的流变参数相关，使得传递的应力能量和所得的应变能量既具有部分储存应变（其在压力去除时能恢复）也具有部分应变能量（其以热的形式发散到材料中）。可以使用各种装置和方法来测量或观察粘弹性性质，这样的装置包括但不限于粘度计、透度计、剪切力切削机、流动设备、以及融化测试机或具有数字或判断评估的装置 (recipes)。

[0037] 如上所讨论的，本发明的某些实施方式可以在环境温度和压力下进行。尽管如此，根据任何特定的奶酪起始材料，制剂、添加剂或所期望的重构奶酪产品或其组合，包括基质改性或基质重构或其两者的任何处理步骤可以在约 -20℃至约 140℃的温度下和 0 至约 15,000psi 的压力下进行。任何这样的方法步骤可以在压力或真空下进行，或任选在适合的时间或者时间点冷却或加热以至少部分地足以得到所期望的中间物、最终结果或其两者。例如，可以给予使用适合的压力、适合的温度、结构、密度或质地或其组合，以获得所期望的重构奶酪产品。

[0038] 仅是以说明的方式提供图 1，而不是为了以任何方式限定本发明的范围。起始奶酪

材料可以选自各种车达奶酪、蒙特里杰克(monterey jack)奶酪、瑞士奶酪和马苏里拉型奶酪、其组合，以及了解本发明的本领域技术人员所理解的具有相当的相对价值的其它奶酪。例如，这样的起始材料可以是切割包装(cut-wrap)操作生成的任何奶酪下脚料副产品，或者符合或超出给定奶酪种类贸易中所接受的标准规范的任何奶酪材料。选择时也可以考虑任何一种或多种奶酪起始材料或重构奶酪产品的水分和脂含量。对于后者，可以具体设计和定制本发明的方法以提供特定的车达奶酪、帕玛森奶酪、罗马诺奶酪、波伏洛奶酪、瑞士奶酪、高达(gouda)奶酪、卡门培尔(camembert)奶酪或蓝奶酪式的重构奶酪产品(且不限于这些)。从经济的角度看，这样的产品可以选自这些或者各种其它奶酪，该各种其它奶酪相比于其从中制备的起始材料具有更高的相对价值。这样的重构产品仅受其对应的调味组合物以及风味组分的限制。

[0039] 除上述奶酪风味之外还可以引入巧克力，豆腐，水果，蔬菜，鱼，肉，腌肉例如但不限于培根、香肠，酵母，啤酒，葡萄酒，酒精类烈酒，鱼肉酱，豆类酱风味以及其组合。无论如何，宽泛范围的其它添加剂可以掺入到这样的起始材料中以影响结构、风味、防腐性、营养价值、稳定性、颜色或其任意组合。可以在任何处理点，但优选在基质改性之前、期间或之后的点，或者可备选地，在基质重构之前，期间或之后的点引入任何这样的添加剂。这样的添加剂包括但不限于风味剂、香料、提取物、水果、肉、酶及其组合。此外也可以单独地或与其它添加剂一起引入各种益生菌，这样的益生菌包括活的或失活的微生物，如真核生物、原核生物、酵母、真菌、霉菌、原生动物以及这样活的或失活的微生物的组合。

[0040] 发明实施例

[0041] 下列非限制性实施例和数据说明了与本发明的方法和重构奶酪产品相关的各方面和特征，包括如通过本发明描述的策略可以获得的各种增值的重构天然奶酪产品的制备。与现有技术相比，本方法和重构产品提供了令人惊讶，出乎意料或与之相反的结果和数据。尽管通过数种起始天然奶酪材料、制剂、处理参数和得到的重构奶酪产品说明了本发明的应用，本领域技术人员应理解，如符合本发明范围的，使用各种其它天然奶酪起始材料和处理参数并通过对应的重构奶酪产品能获得相当的结果。

[0042] 可从本领域技术人员公知的来源获得所有天然奶酪起始材料(包括下脚料，切片等)。类似地，也可购得食品级制剂和添加剂。特别地，可以从Saukville,Wisconsin的Jeneil Biotech,Inc.获得天然调味组合物(例如但不限于车达奶酪，波伏洛奶酪和帕玛森奶酪调味组合物)。

[0043] 实施例1

[0044] 参考图2，在混合下用水性碱处理天然车达奶酪以提供pH值为9.5的改性奶酪基质。在混合下添加所选择的天然调味组合物以与改性的奶酪基质进行相互作用，使pH值达到5.2。

[0045] 实施例2

[0046] 使用实施例1方法的变体以提供车达奶酪(79重量%)、天然车达奶酪调味组合物(17.0重量%)和水性碱(4重量%)。重构的车达式奶酪产品为约40重量%的水分、30重量%的脂和3重量%的盐。

[0047] 实施例3

[0048] 参考实施例2，在基质重构之前，期间或之后的时间点引入培根调味料和/或少量

培根。

[0049] 实施例 4

[0050] 参考实施例 2，引入本领域技术人员公知种类的一种或多种益生菌培养物。此后，处理温度可以从环境温度升高以使至少部分的一种或多种这样的培养物失活。

[0051] 实施例 5

[0052] 参考实施例 2，根据所期望的形式（例如块、片、涂抹酱等）调整得到的重构奶酪产品的水分含量和 / 或加入稳定剂。

[0053] 实施例 6

[0054] 用马苏里拉奶酪 (76 重量%，干燥至 27%水分）、天然帕玛森奶酪调味组合物 (16 重量%）和水性氢氧化钠 (8 重量%）来制备帕玛森式奶酪。重构的帕玛森式奶酪产品为约 35 重量%的水分，25 重量%的脂和 4 重量%的盐。

[0055] 实施例 7

[0056] 参考实施例 6，加入干燥的奶酪粉末以使水分含量降低至小于 32%。

[0057] 实施例 8

[0058] 参考实施例 6，根据最终用途，加入另外的大豆和 / 或乳蛋白（如乳清蛋白分离物）以降低水分含量并改变质地和 / 或稳定奶酪产品。

[0059] 实施例 9

[0060] 用马苏里拉奶酪 (65 重量%，干燥至 20%水分）、瑞士奶酪 (15 重量%）、帕玛森奶酪 (5 重量%）、天然帕玛森奶酪调味组合物 (8.0 重量%）、水性碱 (6 重量%）和添加的盐 (1 重量%）来制备另外的帕玛森式奶酪。重构的帕玛森式奶酪产品为约 31 重量%的水分、26 重量%的脂和 4 重量%的盐。

[0061] 实施例 10

[0062] 用马苏里拉奶酪 (44 重量%）、车达奶酪 (45 重量%）、天然波伏洛奶酪调味组合物 (7.0 重量%）和水性碱 (4.0 重量%）制备波伏洛式奶酪。重构的波伏洛式奶酪产品为约 45 重量%的水、25 重量%的脂和 2 重量%的盐。

[0063] 对于下面的实施例 11-21，用下列天然奶酪凝乳组分制备天然奶酪产品，每种天然奶酪凝乳组分可以从如本领域技术人员公知的来源购得。

[0064] 1. 低脂 (lowfat) 酸凝乳 :A 级干凝乳农家奶酪（无奶油调料）；

[0065] 2. 奶酪凝乳 :车达奶酪 ；

[0066] 3. 低脂凝乳 :水分高于脱脂奶酪所允许的最高水分含量。该相同的凝乳也可以部分干燥至约 24 至约 30%的水分以满足脱脂奶酪的定义。

[0067] 4. 低水分部分脱脂凝乳 :低水分部分脱脂的马苏里拉奶酪，但也去除了部分水分（水分范围 :约 18 至约 22%的水分，约 25 至约 29%的水分和约 44 至约 48%的水分）；

[0068] 5. 有孔 (eyed) 奶酪凝乳 :爱芒特奶酪 (Emmenthal)、美式瑞士奶酪和 Baby 瑞士奶酪、高达奶酪、拉克莱特奶酪 (Raclette)、格律耶尔奶酪 (Gruyere) ;和

[0069] 6. 奶酪凝乳直接酸凝结物 (acid set) :将盐酸加入奶中至 6.08 的 pH 值，用凝乳酶凝结，切割，蒸煮到 39.3℃ (102.7F) 并排出凝乳乳清，处理过程历经 2 小时 40 分钟。

[0070] 食品级的碱和酸组分可以从本领域技术人员公知的来源购得。例如，食品级氢氧化钠和盐酸可以从 Sigma-Aldrich(St.Louis,MO) 获得。如上所述的奶酪和乳风味组分可

以从 Saukville,Wisconsin 的 Jeneil Biotech,Inc. 获得。如了解本发明的本领域技术人员所理解的,这样的风味组分可以是以干燥的或在水性介质中的形式与酸或碱混合,以提供对应的改性组分或调味组合物。可以在混合下分别添加改性组分和调味组合物,直至获得所期望的 pH 值和蛋白结构。参考图 1 和 2,如下描述重构的天然奶酪产品的制备。

[0071] 实施例 11

[0072]

低脂车达奶酪				
	成分组成范围（%）			
成分	**水分**	**脂**	**盐**	**使用的百分数**
天然奶酪组分				
低脂酸凝乳	76 到 80	0.1 到 0.5	0.1 到 0.5	33.4
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	10.0
低脂凝乳	52 到 55	2 到 5	2 到 4	37.0
添加剂				
脱脂奶粉	2 到 4	0.1 到 0.5	微量	6.0
改性组分				
碱和风味组分	50 到 80	微量	微量	3.0
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	10.6
			总计	100.0

工序
1) 磨碎低脂酸凝乳。
2) 添加碱和风味组分；混合。
3) 磨碎剩余的凝乳和脱脂奶粉；加入；混合。
4) 添加酸和风味组分；混合。
5) 混合并蒸煮至 75℃。
6) 包装并冷却至 4℃。

[0073]

	水分	脂	盐	pH 值

低脂车达奶酪组成	60%	5.6%	3.3%	5.2

[0074] 实施例 12

[0075]

费塔奶酪式奶酪				
	成分组成范围（%）			
成分	**水分**	**脂**	**盐**	**使用的百分数**
天然奶酪组分				
低脂酸凝乳	76 到 80	0.1 到 0.5	0.1 到 0.5	45.0
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	34.0
添加剂				
浓缩乳脂	14 到 20	80 到 85	0 到 1.5	10.0
改性组分				
碱和风味组分	50 到 80	微量	微量	1.5
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	9.5
			总计	100.0

[0076]

工序
1) 磨碎低脂凝乳、奶酪凝乳和浓缩乳脂。
2) 加入碱和风味组分；混合。
3) 加入酸和风味组分；混合。
4) 混合并蒸煮至 75℃。
5) 包装并冷却至 4℃。

[0077]

	水分	脂	盐	pH 值
费塔奶酪式奶酪组成	56%	21%	2.7%	4.6

[0078] 实施例 13

[0079]

蓝奶酪式奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	76.0
添加剂				
蒸汽冷凝液和水	100	0	0	11.0
改性组分				
碱和风味组分	50 到 80	微量	微量	1.5
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	11.5
			总计	100.0

[0080]

工序
1) 磨碎奶酪凝乳。
2) 混合并蒸煮至 65℃ .
3) 加入碱和风味组分 ;混合。
4) 加入酸和风味组分 ;混合。
5) 包装并冷却至 4℃。

[0081]

	水分	脂	盐	pH 值
蓝奶酪式奶酪组成	45%	28%	3.5%	5.6

[0082] 实施例 14

[0083]

卡蒙贝尔奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低水分部分脱脂凝乳	25 到 29	25 到 31	2.2 到 2.6	20.0
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	53.7
添加剂				
浓缩乳脂	14 到 20	80 到 85	0 到 1.5	10.0
改性组分				
碱和风味组分	50 到 80	微量	微量	1.5
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	7.8
添加剂				
蒸汽冷凝液和水	100	0	0	7.8
			总计	100.0

[0084]

工序
1) 磨碎 LMPS 凝乳、奶酪凝乳和浓缩乳脂。
2) 加入碱和风味组分 ;混合。
3) 加入酸和风味组分 ;混合。
4) 混合并蒸煮至 75℃。
5) 包装并冷却至 4℃。

[0085]

	水分	脂	盐	pH 值
卡蒙贝尔式奶酪组成	42.5%	31.5%	2.3%	5.8

[0086] 实施例 15

[0087]

波伏洛式奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低水分部分脱脂凝乳	25 到 29	25 到 31	2.2 到 2.6	15.0
低水分部分脱脂凝乳	44 到 48	18 到 24	1.5 到 1.9	70.0
添加剂				
浓缩乳脂	14 到 20	80 到 85	0 到 1.5	7.5
改性组分				
碱和风味组分	50 到 80	微量	微量	2.0
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	5.5
			总计	100.0

[0088]

工序
1) 磨碎低水分部分脱脂凝乳和浓缩乳脂。
2) 混合并蒸煮至 65℃。
3) 加入碱和风味组分 ;混合。
4) 加入酸和风味组分 ;混合。
5) 包装并冷却至 4℃。

[0089]

	水分	脂	盐	pH 值
波伏洛式奶酪组成	44%	25%	2.0%	5.6

[0090] 实施例 16

[0091]

降（reduced）脂车达奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低水分部分脱脂凝乳	44 到 48	18 到 24	1.5 到 1.9	40.2
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	37.0
添加剂				
蒸汽冷凝液和水	100	0	0	13.5
改性组分				
碱和风味组分	50 到 80	微量	微量	1.3
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	8.0
			总计	100.0

[0092]

工序
1) 磨碎低水分部分脱脂凝乳和奶酪凝乳。
2) 加入碱和风味组分；混合。
3) 混合并蒸煮至 65℃。
4) 加入酸和风味组分；混合。
5) 包装并冷却至 4℃。

[0093]

	水分	脂	盐	pH 值
降脂车达奶酪组成	51%	22%	2.5%	5.3

[0094] 实施例 17

[0095]

降脂车达奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低脂凝乳	52 到 55	2 到 5	2 到 4	36.0
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	54.0
改性组分				
碱和风味组分	50 到 80	微量	微量	2.2
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	7.8
			总计	100.0

[0096]

工序
1) 磨碎低脂和奶酪凝乳。
2) 加入碱和风味组分；混合。
3) 加入酸和风味组分；混合。
4) 混合并蒸煮至 75℃。
5) 包装并冷却至 4℃。

[0097]

	水分	脂	盐	pH 值
降脂车达奶酪组成	45%	20.5%	3.0%	5.3

[0098] 实施例 18

[0099]

帕玛森式奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低水分部分脱脂凝乳	18 到 22	27 到 33	2.4 到 2.8	46.7
有孔奶酪凝乳	35 到 39	24 到 30	0.5 到 1.0	20.0
低脂凝乳	24 到 30	2 到 6	3.8 到 4.3	13.0
改性组分				
碱和风味组分	50 到 80	微量	微量	2.2
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	11.1
添加剂				
蒸汽冷凝液和水	100	0	0	7.0
			总计	100.0

[0100]

工序
1) 磨碎低脂凝乳。
2) 磨碎有孔和低水分部分脱脂凝乳；加入。
3) 加入碱和风味组分；混合。
4) 加入酸和风味组分；混合。
5) 混合并蒸煮至 75℃。
6) 包装并冷却至 4℃。

[0101]

	水分	脂	盐	pH 值
帕玛森式奶酪组成	34%	22%	3.2%	5.2

[0102] 实施例 19

[0103]

罗马诺式奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
低水分部分脱脂凝乳	25 到 29	25 到 31	2.2 到 2.6	52.3
有孔奶酪凝乳	35 到 39	24 到 30	0.5 到 1.0	20.0
低脂凝乳	24 到 30	2 到 6	3.8 到 4.3	14.0
改性组分				
碱和风味组分	50 到 80	微量	微量	2.2
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	8.5
添加剂				
水	100	0	0	3.0
			总计	100.0

[0104]

工序
1) 磨碎低脂凝乳。
2) 磨碎低水分部分脱脂和有孔凝乳；加入
3) 加入碱和风味组分；混合。
4) 加入酸和风味组分；混合。
5) 混合并蒸煮至 75℃。
6) 包装并冷却至 4℃。

[0105]

	水分	脂	盐	pH 值
罗马诺式奶酪组成	36.5%	21%	4.1%	5.4

[0106] 实施例 20

[0107]

奶酪浓缩物				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
奶酪凝乳	34 到 39	30 到 36	1.6 到 2.0	63.0
改性组分				
碱和风味组分	50 到 80	微量	微量	4.0
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	33.0
			总计	100.0

[0108]

工序
1) 磨碎奶酪凝乳。
2) 加入碱和风味组分；混合。
3) 加入酸和风味组分；混合。
4) 包装并冷却至 4℃。

[0109]

	水分	脂	盐	pH 值
奶酪浓缩物组成	41%	30%	3.0%	5.0

[0110] 实施例 21

[0111]

车达类奶酪				
	成分组成范围（%）			
成分	水分	脂	盐	使用的百分数
天然奶酪组分				
奶酪凝乳直接酸凝结物	34 到 39	30 到 36	0.1 到 0.2	94.3
改性组分				
碱和风味组分	50 到 80	微量	微量	3.0
调味组合物				
酸和风味组分	40 到 50	20 到 30	2 到 4	2.7
			总计	100.0

工序
1) 磨碎奶酪凝乳直接酸凝结物。
2) 加入碱和风味组分；混合。
3) 加入酸和风味组分；混合。
4) 包装并冷却至 4℃。

[0112]

	水分	脂	盐	pH 值
车达类奶酪组成	39%	30%	1.4%	5.4

[0113] 实施例 22

[0114] 参考前面实施例的方法和工序，可以单独地或联合一种或多种本发明中讨论的其它蛋白或添加剂来使用一种或多种下列非限制性蛋白源或组分，以制备多种基于乳或乳类似物的重构食品产品：

[0115] 乳（所有脂水平）；

[0116] 分馏奶 (Fractionated milk)：微孔过滤，超滤，纳米过滤，反渗透；

[0117] 淡奶 (Evaporated milk)，炼乳，浓缩奶，甜炼乳；

[0118] 奶粉；

[0119] 复原乳 (Reconstituted milk)（所有脂水平）；

[0120] 奶油（允许的脂水平），各占一半；

[0121] 黄油，浓缩乳脂；

[0122] 干奶油；

[0123] 全脂奶 (Butter milk)（未培养）；

[0124] 培养的乳产品；

[0125] 奶蛋白浓缩物，奶蛋白分离物，分馏的酪蛋白，凝乳酶酪素，酪蛋白酸钠，酪蛋白酸钾，酪蛋白酸钙等；

[0126] 奶酪；和

[0127] 乳清，天然乳清（不是来自奶酪制造，而是通过膜或其它技术分离），乳清蛋白浓缩物，乳清蛋白分离物，蛋白水解乳清，分馏的乳清蛋白，去蛋白乳清，乳清渗透物，脱乳糖乳清渗透物，去盐乳清，乳矿物质。

[0128] 如本领域中理解的，乳类似物蛋白是来自乳或非乳源的蛋白，其给制造的乳或乳模拟产品提供类似的营养和结构属性。如本发明所述，可以单独地或结合另外的蛋白使用本实施例的前述蛋白，以制备包括但不限于下列产品的各种乳和乳类似物产品：

[0129] 奶精（creamers）（例如奶的奶精）；

[0130] 涂抹酱（例如桶中（in tubs）的加工奶酪，黄油替代品）；

[0131] 酱料（例如罐或罐头装的奶酪酱）；

[0132] 蘸酱（例如基于酸奶油的蘸酱）；

[0133] 融化奶油（例如加热的蘸酱奶酪）；

[0134] 浇头配料（toppings）（例如生奶油）；

[0135] 布丁（例如奶布丁，蛋奶沙司（custards））

[0136] 软糖（例如甜点馅料）；

[0137] 焦糖（例如甜点馅料和涂层）；

[0138] 搅拌剂（whipping agents）（例如蛋清替代品）；

[0139] 稳定剂（例如奶油奶酪涂抹酱）；

[0140] 脂模拟物（例如降脂乳产品）；

[0141] 酸奶（例如酸化酱）；

[0142] 冷冻甜点（例如冰淇淋）；和

[0143] 稳定的脂和水乳液风味载体（例如黄油和奶酪植物酱）。

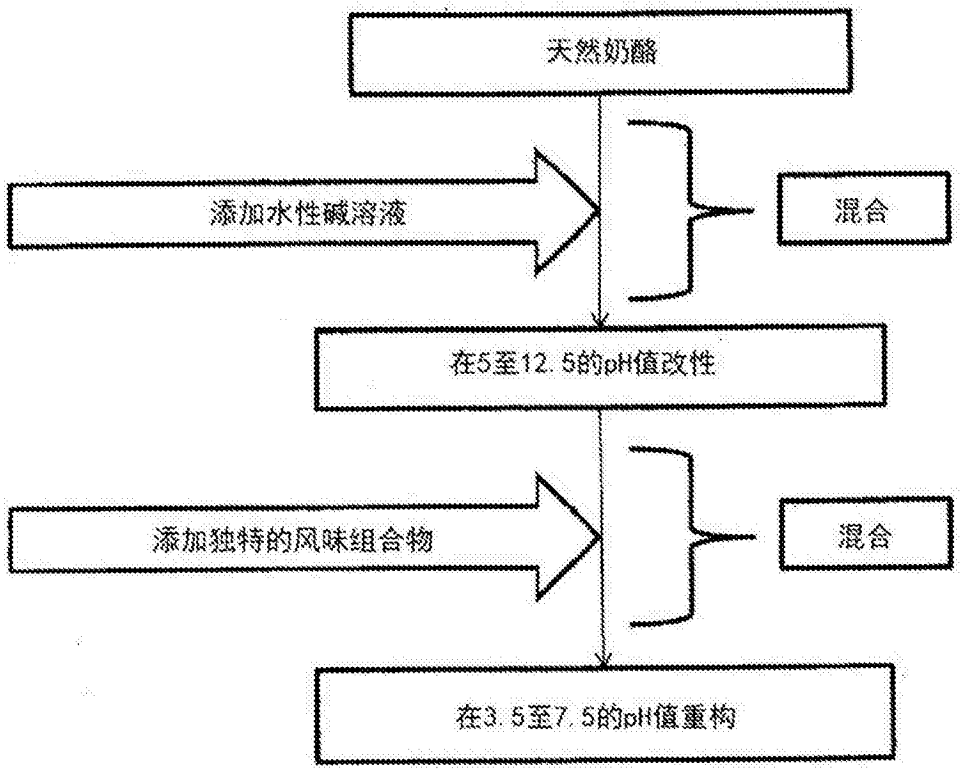

天然奶酪
添加水性碱溶液
混合
在5至12.5的pH值改性
添加独特的风味组合物
混合
在3.5至7.5的pH值重构

图 1

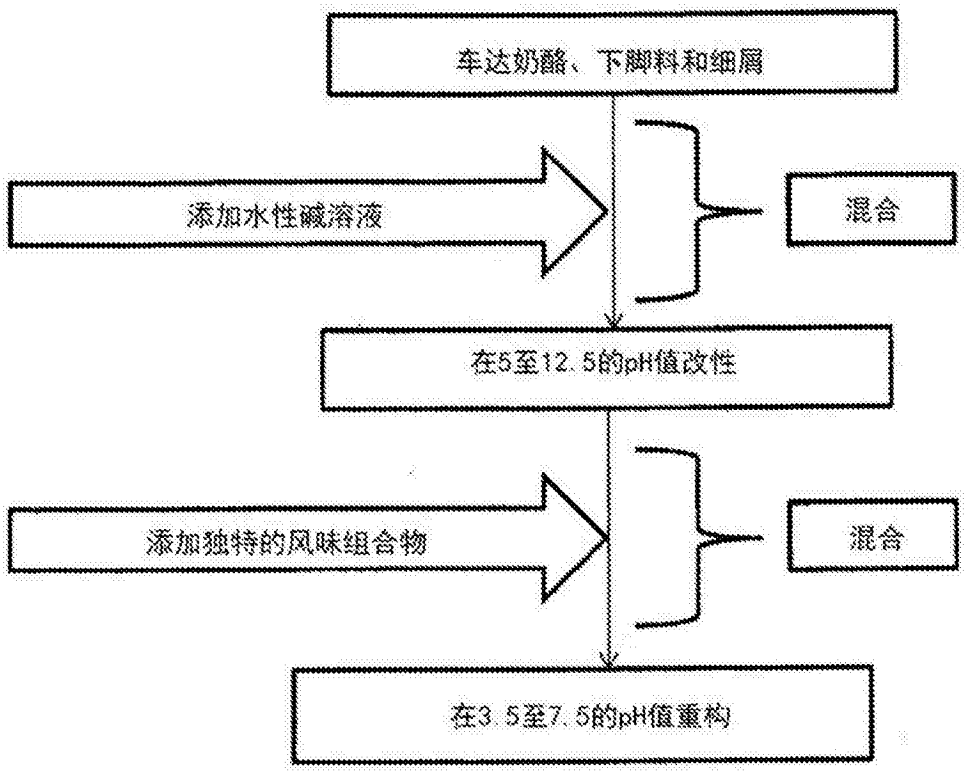

车达奶酪、下脚料和细屑
添加水性碱溶液
混合
在5至12.5的pH值改性
添加独特的风味组合物
混合
在3.5至7.5的pH值重构

图 2