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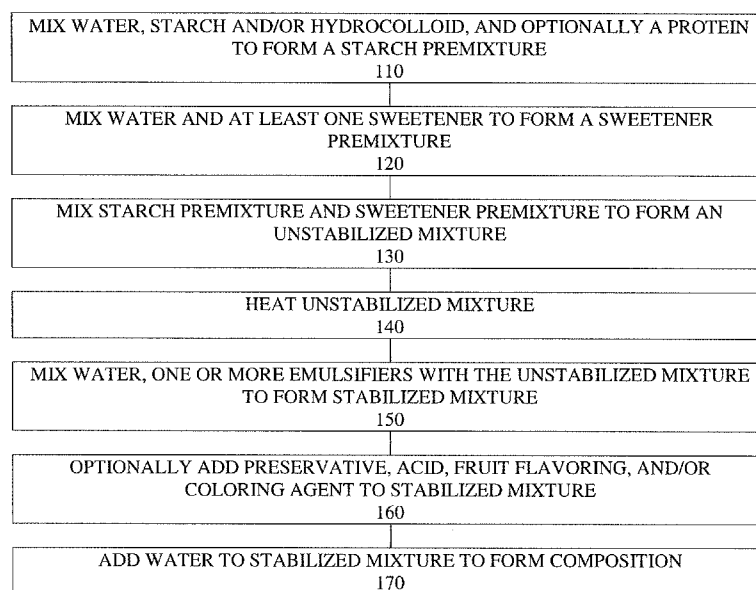
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(54) Title: MOISTURE-RETENTIVE COMPOSITION

FIG. 1



(57) Abstract: A moisture-retentive composition that includes water, sweetener, modified starch and emulsifier. The moisture-retentive composition exhibits improved water retention.



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MOISTURE-RETENTIVE COMPOSITION

[001] The present invention claims priority on United States Provisional Application Serial No. 62/637,081 filed March 1, 2018, which is incorporated herein by reference.

[002] The present disclosure relates to moisture-retentive compositions, and more particularly to toppings for baked goods with improved moisture-retentive properties. The moisture-retentive compositions can be useful as fruit gels and other types of products.

BACKGROUND OF THE DISCLOSURE

[003] Fruit gels are low solids content products that include a stabilizer base and play a prominent role in the successful marketing of cakes and other sweet bakery foods. Fruit gels have a consistency that enables the gel to easily flow over a food product to cover and decorate cakes that are iced with a topping (e.g., a non-dairy topping). This fruit gel gels well with different toppings on cakes, adds flavor, and provides the finishing touch to baked goods.

[004] Iced cakes with a fruit gel topping can be stored uncovered in refrigerated display racks prior to selling to a customer. Due to this type of open-handling and cold storage, known fruit gels commonly turn rubbery in two to three days and begin to separate from the icing on the food product and form open gaps on the icing of the food product.

[005] In view of the current state of the art, there is a need for a moisture-retentive composition (e.g., a fruit gel) which remains moist and provides a protective shield that preserves freshness in iced cakes for longer time periods (e.g., four days or more) in uncovered refrigerated display racks.

SUMMARY OF INVENTION

[006] The present invention is directed to moisture-retentive compositions such as fruit gels. The moisture-retentive composition is a low solids and stabilizer base product that has a consistency that enable the moisture-retentive compositions to flow or be spreadable on a food product (e.g., cake or other dessert products) in ambient temperatures (e.g., 70-80°F) or refrigerated temperatures (33-50°F) so that the moisture-retentive composition flows on and enrobes and decorates the food product. The moisture-retentive composition is formulated to cohere with different toppings on cakes and other dessert products so as to add flavor and/or color to the coated food product. The food products that are coated with the moisture-retentive

composition can be stored uncovered in a refrigerated display rack (e.g., 33-50°F) for more than four days and typically at least ten days while 1) remaining moist without turning rubbery, 2) providing a protective shield for the food product so as to preserve the freshness of the food product, and 3) not separating from the icing on the food product and forming open gaps on the icing of the food product. The moisture-retentive composition of the present invention thereby functions as an excellent protective layer for cream/iced cakes and other types of food products, and thus facilitates in extending the shelf life of the food product. The moisture-retentive composition generally has a low viscosity (e.g., Brookfield reading of 12,600-12,800 cps at 70-75°F, Bostwick Consistometer Reading of 8-10 cm at 70-75°F), thus is flowable/spreadable and still delivers good coating properties on a food product (e.g., cake etc.), and can successfully coat a food product using less material than compared to prior art flavored gels. The firmness and viscosity of the moisture-retentive composition of the present invention changes very little for at least four days in refrigerated conditions, and typically at least ten days. The moisture-retentive composition of the present invention does not required further stirring prior to being applied to a food product. As such, the moisture-retentive composition of the present invention is a ready-to-use protect that can be directly poured or otherwise dispensed from a container onto the food product. After the moisture-retentive composition of the present invention is applied to a food product (e.g., iced cake, bakery product, etc.), the food product that includes the moisture-retentive composition of the present invention can be immediately displayed in a refrigerated display. The consistency of the moisture-retentive composition of the present invention is such that the moisture-retentive composition of the present invention can be poured and/or spread onto a food product and easily be spread on the top and side surfaces of the food product without problems associated with the moisture-retentive composition of the present invention running off the top and sides of the food product.

[007] As can be appreciated, the moisture-retentive composition of the present invention can be used as a filling (e.g., fruit filling, Bavarian filling, French cream filling, cream cheese filling, etc.). The moisture-retentive composition of the present invention can also be used with other products that will be put in a refrigerated display rack uncovered.

[008] The moisture-retentive composition of the present invention includes a novel composition of one or more emulsifiers (e.g., monoglyceride, diglyceride, polysorbate, etc.). The use of one or more emulsifiers was found to improve the moisture-retentive composition of the

present invention that resulted in the moisture-retentive composition not gelling or turning rubbery for at least four days in refrigerated conditions as compared to prior art fruit gels that gelled and become rubbery in two to three days in refrigerated conditions. The use of the one or more emulsifiers in the moisture-retentive composition of the present invention was also found to create a synergy in the moisture-retentive composition that resulted in the moisture-retentive composition not gelling or turning rubbery for at least ten days in refrigerated conditions as compared to prior art fruit gels that gelled and become rubbery in two to four days in refrigerated conditions. The one or more emulsifiers were found to interact with the other ingredients of the moisture-retentive composition to inhibit gelling of the moisture-retentive composition and the moisture-retentive composition turning rubbery when exposed to refrigerated temperatures. The use of the one or more emulsifiers have been found to improve the moisture retention of the moisture-retentive composition as compared to a prior art fruit gels that include fat or a fat derivative. Prior art fruit gels gel and turn rubbery within two to four days after being applied to a food product in refrigerated temperatures. In one non-limiting embodiment, the total HLB (hydrophile-lipophile balance) of the emulsifier in the moisture-retentive composition is 8-16 (and all values and ranges therebetween).

[009] A comparison of the strength or firmness of the moisture-retentive composition of the present invention (e.g., Invention Orange, Invention Passion, Invention Strawberry) as compared to three commercial available fruit gels as set forth in Table 1 and FIG. 4 illustrate that after one to two days, the moisture-retentive composition of the present invention had lower strength or firmness values than the commercial products. The gel strength or firmness of the moisture-retentive composition is a measure of the rigidity of a gel formed and prepared according to the formulation's prescribed conditions. Gel strength or firmness is a measure of force (weight) required to depress a prescribed area of the surface of the sample a distance of 5 mm. Additional information regarding the measurement of gel strength or firmness and the types of analyzers used to measure such gel strength or firmness is set forth in the *Standard Testing Methods For Edible Gelatin* published by Gelatin Manufacturers Institute of America (July 2013) (<http://www.gelatin-gmia.com>), which is incorporated herein by reference. The procedure for testing the gel strength or firmness as illustrated in Table 1 and FIG. 4 is as follows:

[0010] 1. Weigh 100 gram of sample and place into a 4 oz (110 ml) container using Mettler Toledo scale.

- [0011] 2. Sample is placed in a cooler (4°C +/- 1°C) for 24 hours before first measurement.
- [0012] 3. Set up LFRA (Brookfield Engineering) or TA.XT2 (Texture Technologies) texture analyzer according to instrument manufacturer.
- [0013] 4. Center the container on the texture analyzer platform so that the probe is positioned as close as possible to the sample without touching the sample.
- [0014] 5. Press “Start” (LFRA) or “Run” (TA.XT2) to run the gel firmness test. Repeat as needed until all gel strength determinations are complete. The temperature of the sample during measurement is about 4°C +/- 1°C.
- [0015] 6. Place sample back in cooler (4°C +/- 1°C) after each measurement.
- [0016] 7. Record each test day results and temperature of the sample.
- [0017] 8. Repeat steps 3-7 to determine firmness of gel sample for each day.

[0018] The lower firmness values represent a gel that is maintaining its original texture and exhibits a less rubbery appearance and texture. Firmness values of less than 10 (e.g., less than 10 grams of force applied by the texture analyzer on the tested sample) are desirable to maintain the desired appearance and texture of the fruit gel. Firmness values of less than 10 identify a gel that has texture characteristics relating to wetness, softness and liquidity. Firmness values above 10 identify gels having a texture characteristic that begins to be pasty. Firmness values above 10 identify gels that are rubbery. As illustrated in Table 1 and as illustrated in FIG. 4, the three commercial fruit gels had firmness values exceeding 10 product firmness as measured in grams after eight days in a refrigerated environment, and the moisture-retentive compositions of the present invention had firmness values of less than 10 (i.e., less than 7) as measured in grams after ten to thirteen days. Such low and relatively little changed firmness values over a ten to thirteen days period is a significant improvement over prior art commercially available fruit gel.

[0019] **Table 1**

PRODUCT FIRMNESS (Grams)

DAYS	INVENTION ORANGE	INVENTION PASSION	INVENTION STRAWBERRY	COMPETITOR #1 ORANGE	COMPETITOR #1 PASSION	COMPETITOR #2 ORANGE
1	6.5	6.4	6.4	6.4	6.4	7.5
2	6.7	6.4	6.5	6.7	7.3	10.8
3	6.5	6.4	6.4	7.0	8.4	12.6

4	6.5	6.6	6.5	8.4	9.4	14.0
5	6.5	6.5	6.5		10.6	
6	6.5	6.5	6.5		11.1	
8	6.6	6.6	6.5	14.6	11.7	22.1
9	6.4	6.6	6.5	14.4	12.5	45.2
10	6.8	6.6	6.5	11.7	14.9	26.6
13		6.8			13.6	

[0020] Table 1B

PRODUCT FIRMNESS (Grams)		
DAYS	Fruit Glaze w/ Starch & HC	INVENTION - Fruit Glaze w/ Starch & HC & Emulsifier
0	7.3	7.1
1	8.1	7.6
4	10.1	9.5
5	11.0	9.5
6	11.6	9.5
7	14.0	9.7
11	15.4	9.9

[0021] As illustrated in Table 1B, the Fruit Glaze that only included starch (modified starch) and hydrocolloid (HC), namely methylcellulose, had a firmness value that exceed 10 after a four-day period. The Fruit Glaze that included starch (modified starch) and hydrocolloid (HC, namely methylcellulose, and emulsifier (polysorbate 60), had a firmness value that did not exceed 10 after an eleven-day period.

[0022] The novel use of the one or more emulsifiers in the moisture-retentive composition of the present invention resulted in the moisture-retentive composition not gelling or turning rubbery in refrigerated temperatures (a firmness value of less than 10) for at least four days, and at least up to ten to thirteen days in refrigerated temperatures, thus extending the freshness of the coated food product. As such, the moisture-retentive composition, after being coating on a food product, extends the shelf life of the coated food product in refrigerated temperatures.

[0023] Generally, the emulsifier content in the moisture-retentive composition of the present invention is at least about 0.01 wt.%. The content of the emulsifier in the moisture-retentive

composition generally does not exceed 5 wt.%. In one non-limiting embodiment, the content of the emulsifier in the moisture-retentive composition is 0.01-3 wt.% (and all values and ranges therebetween). In another non-limiting embodiment, the content of the emulsifier in the moisture-retentive composition is about 0.1-2 wt.%, more typically about 0.2-1 wt.%, and still more typically 0.2-0.5 wt.%.

[0024] Non-limiting examples of the emulsifier that can be used include polyoxyethylene ethers of sorbitan monostearate (polysorbate 60) and polyoxyethylene ethers of sorbitan monooleate (polysorbate 80); span-20, span-40, span-60, span-80; lecithin; hydroxylated lecithin; mono-, di-, or polyglycerides of fatty acids, such as stearin and palmitin mono and diglycerides; polyoxyethylene ethers of fatty esters of polyhydric alcohols, or the polyoxyethylene ethers of sorbitan distearate; fatty esters of polyhydric alcohols such as sorbitan monostearate; polyglycerol esters of mono and diglycerides such as hexaglyceryl distearate; mono- and diesters of glycols such as propylene glycol monostearate, and propylene glycol monopalmitate, succinoylated monoglycerides; and the esters of carboxylic acids such as lactic, citric, and tartaric acids with the mono- and diglycerides of fatty acids such as glycerol lacto palmitate and glycerol lacto stearate, and calcium or sodium stearyl lactylates and all members of the sucrose ester family thereof; all varieties of diacetyltartaric esters of fatty acids; esters of sorbitol (e.g., sorbitan tristearate, etc.); glycerol and fatty acids mixtures (e.g., polyglycerol polyricinoleate, etc.); "DATEMS", and the like, and mixtures thereof. Several non-limiting examples of emulsifiers that can be used in the moisture-retentive composition of the present invention to maintain the product firmness of the moisture-retentive composition for at least four days at a temperature of about 4°C is set forth in Table 2 and FIG. 5. As illustrated in Table 2 and FIG. 5, several emulsifiers and combinations of emulsifiers that were used in combination with starch and hydrocolloid resulted in the firmness of the moisture-retentive composition in accordance with the present invention to be maintained at less than 10 for six or more days. As illustrated in Table 2 and FIG. 5, a moisture-retentive composition of the present invention that included modified starch and hydrocolloid (e.g., methylcellulose, etc.) and various types of emulsifier resulted in firmness values of less than 10 for at least eight days in refrigerated conditions.

[0025] Table 2

PRODUCT FIRMNESS (Grams)										
DAYS	METHYL-CELLULOSE	SUCROSE ESTER (SE)	PS 80	SSL	LECITHIN	DISTILLED MD	SMS	MD & PS60	MD & PS80	SE & MD
1	6.5	6.5	6.5	6.6	6.6	6.4	6.6	6.4	6.6	6.5
2	6.5	6.5	6.4	6.5	6.5	6.6	6.4	6.4	6.6	6.6
3	6.1	6.7	6.5	6.7	6.7	6.5	6.5	6.4	6.6	6.7
4	6.4	6.8	6.6	7.0	6.6	6.8	7.1	6.6	6.5	6.8
5	6.9	7.0	6.8	7.3	7.1	7.1	7.4	6.5	6.8	7.0
6	7.6	7.5	6.9	7.9	7.9	7.7	7.8	6.5	7.3	7.2
7	8.0	8.0	7.2	8.5	8.6	8.1	8.1	6.6	8.0	7.4
8	8.9	8.9	7.6	9.0	9.2	8.7	8.7	6.6	8.7	7.8

[0026] In one non-limiting embodiment, the moisture-retentive composition includes both polysorbate and mono-, di-, and/or polyglycerides of fatty acids. In another non-limiting embodiment, the moisture-retentive composition includes polysorbate, monoglycerides of fatty acids and diglycerides of fatty acids. In another non-limiting embodiment, the moisture-retentive composition includes polysorbate 60, monoglycerides of fatty acids and diglycerides of fatty acids. In another non-limiting embodiment, the moisture-retentive composition includes polysorbate, and mono-, di-, and/or polyglycerides of fatty acids, and the weight percent content of polysorbate is greater than the content of the weight percent content of mono-, di-, and/or polyglycerides of fatty acids. In another non-limiting embodiment, the weight ratio of polysorbate to other emulsifiers is 1.01:1 to 2:1 (and all values and ranges therebetween), typically 1.01:1 to 1.6:1, more typically 1.05:1 to 1.5:1, and even more typically 1.1:1 to 1.2:1. In one non-limiting formulation, the moisture-retentive composition includes 0.1-0.4 wt.% monoglyceride and diglyceride, and 0.11-0.41 polysorbate 60, wherein the amount of polysorbate 60 is greater than the amount of monoglyceride and diglyceride. In another non-limiting formulation, the moisture-retentive composition includes 0.15-0.25 wt.% monoglyceride and diglyceride, and 0.16-0.28 polysorbate 60, wherein the amount of polysorbate 60 is greater than the amount of monoglyceride and diglyceride.

[0027] The moisture-retentive composition, in addition to including emulsifier, also includes water, sweetener and/or bulking agent, and starch, and can optionally include one or more

additional ingredients such as, but not limited to, hydrocolloid, preservative, acidulates, flavoring agent, and colorant.

[0028] The water content of the moisture-retentive composition of the present invention is about 25-75 wt.% water (and all values and ranges therebetween). In one non-limiting embodiment, the moisture-retentive composition includes about 35-70 wt.% water. In another non-limiting embodiment, the moisture-retentive composition includes about 40-65 wt.% water. In another non-limiting embodiment, the moisture-retentive composition includes about 42-60 wt.% water. Generally, the water content of the moisture-retentive composition is greater than any other component of the moisture-retentive composition. As can be appreciated, a portion or all of the water (e.g., 0.1-100%, etc.) can be substituted for fruit juice and/or vegetable juice. It has been found that liquids such as milk, NDC (non-dairy cream), and coconut milk are undesirable due to the acidity of the moisture-retentive composition and the hot processing and packing of the moisture-retentive composition.

[0029] The sweetener/bulking agent in the moisture-retentive composition of the present invention can include one or more types of sweetener (e.g., monosaccharides, disaccharides, polysaccharides, etc.). Specifically, the sweetener can be comprised of one or more sugars (e.g., sucrose, fructose, dextrose, maltodextrin, or glucose); sugar syrups (e.g., corn syrup, glucose syrup, maple syrup, golden syrup, high-fructose corn syrup, etc.); polyols (e.g., maltitol, sorbitol, xylitol, erythritol, isomalt, etc.) and/or intensive sweeteners (e.g., aspartame, acesulfame, alitame, saccharin, cyclamates, trichloro sucrose, etc.). The moisture-retentive composition generally includes about 15-70 wt.% sweetener/bulking agent (and all values and ranges therebetween). In one non-limiting embodiment, the moisture-retentive composition includes about 30-49 wt.% sweetener/bulking agent. In another non-limiting embodiment, the moisture-retentive composition includes about 35-48 wt.% sweetener/bulking agent. Generally, the sweetener/bulking agent content of the moisture-retentive composition is less than the water content of the moisture-retentive composition; however, this is not required. In one non-limiting specific formulation, the weight ratio of water to sweetener/bulking agent is about 1.01:1 to 1.6:1 (and all values and ranges therebetween), typically about 1.02:1 to 1.5:1, still more typically about 1.03:1 to 1.4:1, and even more typically 1.04:1 to 1.1:1. In another non-limiting embodiment, the sweetener is formed of two or more different types of sweetener. In one non-limiting formulation, the sweetener/bulking agent includes a combination of sugar syrup and sugar. When the

sweetener/bulking agent includes a combination of sugar syrup and sugar, the weight percent of sugar is generally less than the weight percent of sugar syrup. In one non-limiting formulation, the weight ratio of sugar syrup to sugar is about 1.1:1 to 20:1 (and all values and ranges therebetween), typically about 2:1 to 10:1, still more typically about 3:1 to 7:1, and even more typically 4:1 to 6:1. For example, the sugar content (e.g., dextrose, galactose, and/or sucrose, etc.) can be about 2-12 wt.% (and all values and ranges therebetween) and the sugar syrup (e.g., liquid glucose) can be about 20-45 wt.% (and all values and ranges therebetween). In another non-limiting formulation, the sweetener/bulking agent includes a combination of sugar and sorbitol. In one non-limiting formulation, the weight ratio of sugar to sorbitol is about 1.1-5:1 (and all values and ranges therebetween), typically about 1.2:1 to 4:1, and still more typically about 1.3:1 to 2:1. In another non-limiting formulation, the sweetener/bulking agent includes sugar and two of more liquid sugars (e.g., corn syrup, HFCS, etc.). In one non-limiting formulation, the content of corn syrup is greater than the content of HFCS. In another non-limiting formulation, the sweetener includes 3-15 wt.% sugar, 15-30 wt.% corn syrup and 10-20 wt. % HFCS, and typically 5-10 wt.% sugar, 20-26 wt.% corn syrup and 12-18 wt. % HFCS. Generally, the corn syrup content is greater than the content of sugar and HFCS, and the content of HFCS is greater than the content of sugar; however, this is not required.

[0030] The moisture-retentive composition includes one or more starches. The one or more starches are modified starches. Non-modified starches are not desirable in the moisture-retentive composition due to the inability of non-modified starches to properly function in an acidic formulation. The modified starches have been found to be better in withstanding the high heat used to form the moisture-retentive composition, and to withstand the mixing process and final pH of the moisture-retentive composition when forming the moisture-retentive composition, as compared to non-modified starches. The modified starch is used in the moisture-retentive composition to function as a stabilizer, binder, thickener, texture and gelling agent. Non-limiting examples of modified starches that can be included in the moisture-retentive composition include dextrin, acid-treated starch, alkaline-treated starch, bleached starch, oxidized starch, starches-enzyme-treated, monostarch phosphate, distarch phosphate, phosphated distarch phosphate, acetylated distarch phosphate, starch acetate, acetylated distarch adipate, hydroxypropyl starch, hydroxypropyl distarch phosphate, hydroxypropyl distarch glycerol, starch sodium octenyl succinate, modified corn starch (e.g. Starch 465, etc.) and acetylated oxidized starch. In one non-

limited embodiment, the moisture-retentive composition includes acetylated adipat di-starch (e.g., Clearam™ CH2020, etc.), modified corn starch (e.g. Starch 465, etc.), high amylose corn starch (Amylo N-400), and hydroxypropyldistarch phosphate (e.g., Clearam CR 2010, Roquette, France).

[0031] The one or more starches are present in the moisture-retentive composition in an amount of at least about 0.1 wt.%. The content of the one or more starches in the moisture-retentive composition generally does not exceed about 10 wt.% (e.g., 0.1-10 wt.% and all values and ranges therebetween). Generally, the starches is present in the moisture-retentive composition in an amount of about 1-8 wt.%, typically about 2-6 wt.%, and more typically about 3-5 wt.%. In another non-limiting embodiment, the weight percent content of starch in the moisture-retentive composition is greater than the weight percent content of emulsifier in the moisture-retentive composition. In one specific non-limiting embodiment, the weight ratio of starch to emulsifier in the moisture-retentive composition is about 1.1:1 to 25:1 (and all values and ranges therebetween), typically 3:1 to 15:1, more typically 6:1 to 11:1, and even more typically 8:1 to 10:1.

[0032] The moisture-retentive composition can optionally include one or more acidulates. The one or more acidulates (when used) are present in the moisture-retentive composition in an amount of at least about 0.01 wt.%. The content of the one or more acidulates in the moisture-retentive composition generally does not exceed 1 wt.%. In one non-limiting embodiment, the content of the one or more acidulates in the moisture-retentive composition (when used) is 0.01-1 wt.% (and all values and ranges therebetween), typically 0.1-0.5 wt.%, and more typically 0.15-0.3 wt.%. Acidulates can optionally be added to impart tartness, control pH, and/or serve as a preservative for the moisture-retentive composition. Non-limiting examples of acidulates that can be used include phosphoric acid, tartaric acid, malic acid, citric acid, fumaric acid, glucono delta lactone, pHase, and the like. The one or more acidulates can optionally be added in a sufficient amount to the moisture-retentive composition to lower the pH of the moisture-retentive composition to less than 7, and typically a pH of less than about 4.5. In one non-limiting embodiment, the pH of the moisture-retentive composition is about 3-3.4. As can be appreciated, if the pH of the moisture-retentive composition is to be a neutral pH or a basic pH, acidulate is generally not included in the moisture-retentive composition.

[0033] The moisture-retentive composition can optionally include one or more stabilizers. The one or more stabilizers (when used) are present in the moisture-retentive composition in an amount of at least about 0.01 wt.%. The content of the one or more stabilizers in the moisture-retentive

composition generally does not exceed about 2 wt.% (e.g., 0.01-2 wt.% and all values and ranges therebetween). Generally, the stabilizer (when used) is present in the moisture-retentive composition in an amount of about 0.02-1 wt.%, and more typically about 0.05-0.9 wt.%. Non-limiting examples of one or more stabilizers that can be used include hydrophilic colloids. The hydrophilic colloids can be natural, such as vegetable, or synthetic gums and may be, for example, carrageenan, guar gum, alginate, xanthan gum, locust bean gum, Arabic gum, gellan gum, pectin, and the like, or semi-synthetic, such as methylcellulose, carboxyl-methylcellulose, ethylcellulose, hydroxy-propylmethylcellulose (HPMC), and microcrystalline cellulose. The stabilizer, when included in the moisture-retentive composition, functions as a stabilizer and thickener.

[0034] The moisture-retentive composition can optionally include one or more proteins or protein sources. The one or more proteins or protein sources (when used) are present in the moisture-retentive composition in an amount of at least about 0.0001 wt.%. The content of the one or more proteins or protein sources in the moisture-retentive composition generally does not exceed 2 wt.%. In one non-limiting embodiment, the content of the one or more proteins or protein sources in the moisture-retentive composition (when used) is 0.0001-2 wt.% (and all values and ranges there between), and typically 0.001-1 wt.%, and more typically 0.005-0.2 wt.%. Non-limiting proteins or protein sources that can be used include milk proteins such as isolated sodium, potassium or calcium caseinates, whey protein concentrates, alpha lactalbumin and beta lactoglobulin can be used. Vegetable proteins including, but not limited to, soy protein, pea protein, wheat protein, cottonseed protein, peanut protein, and corn protein are also useful. In one non-limiting formulation, the moisture-retentive composition includes a milk protein source such as skim milk or skim milk powder. The protein, when used, is used as a dispersing agent and for taste.

[0035] The moisture-retentive composition can optionally include one or more preservatives. Suitable preservatives that can optionally be used in the moisture-retentive composition includes benzoates (e.g., sodium benzoate, benzoic acid, etc.), nitrites (e.g., sodium nitrite, etc.), sulphites (e.g., sulphur dioxide, etc.) and sorbates (e.g., sodium sorbate, potassium sorbate, etc.). The one or more preservatives (when used) are present in the moisture-retentive composition in an amount of at least about 0.001 wt.%. The content of the one or more preservatives in the moisture-retentive composition generally does not exceed about 0.2 wt.% (e.g., 0.001-0.2 wt.% and all values and ranges therebetween). Generally, the preservatives (when used) are present in the moisture-

retentive composition in an amount of about 0.02-0.15 wt.%, and more typically about 0.04-0.1 wt.%. In one non-limiting embodiment, the moisture-retentive composition includes up to about 0.1 wt.% potassium sorbate and/or up to 0.1 wt.% sodium benzoate. In another one non-limiting embodiment, the moisture-retentive composition includes up to about 0.06 wt.% potassium sorbate and/or up to 0.08 wt.% sodium benzoate. In another one non-limiting embodiment, the moisture-retentive composition includes only a single preservative. The preservative (when used) is used to increase the shelf life of the moisture-retentive composition.

[0036] The moisture-retentive composition can optionally include one or more flavoring agents. Suitable flavoring agents can be employed to impart vanilla, cream, chocolate, coffee, maple, spice, mint, butter, caramel, fruit flavor, and other flavors. The flavoring agent (when used) is present in the moisture-retentive composition in an amount of at least about 0.01wt.%. The content of the flavoring agent in the moisture-retentive composition generally does not exceed 2 wt.% (e.g., 0.01-2 wt.% and all values and ranges therebetween). In one non-limiting embodiment, the content of the flavoring agent in the moisture-retentive composition (when used) is about 0.02-2 wt.%, typically about 0.03-1 wt.%, and more typically about 0.05-0.5wt.%. In another non-limiting embodiment, the flavoring agent (when used) is a fruit flavoring (e.g., passion fruit flavoring, strawberry flavoring, blueberry flavoring, cantaloupe flavoring, orange flavoring, lemon flavoring, etc.); however, this is not required.

[0037] The moisture-retentive composition can optionally include one or more colorants. The colorant (when used) is present in the moisture-retentive composition in an amount of at least about 0.0001wt.%. The content of the colorant in the moisture-retentive composition generally does not exceed 1 wt.% (e.g., 0.0001-1 wt.% and all values and ranges therebetween). Non-limiting colorants that can be used are caramel coloring, chocolate coloring, yellow coloring, red coloring, and any other natural or artificial colorant.

[0038] The moisture-retentive composition can optionally include one or more other ingredients such as vitamins, minerals, thickeners, antioxidants, sequestrant, etc. When such ingredients are included in the moisture-retentive composition, the total weight percent of such components in the moisture-retentive composition is less than 2 wt.%, typically less than 1 wt.%, and still more typically less than 0.8 wt.%.

[0039] The moisture-retentive composition of the present invention also has a shelf-life of at least six months, and typically at least twelve months when stored in a sealed air-tight package at

ambient and refrigerated temperatures (e.g., 65-75°F) while maintaining good taste and properties when applied to a food product. As such, the moisture-retentive composition can be stored for extended periods of time in both ambient and refrigerated temperatures in a sealed air-tight package or container prior to being applied to a food product. It has been found that small amounts (e.g., less than 2 wt.%) of fat can be added to the moisture-retentive composition of the present invention; however, such fat additions have been found to reduce the shelf-life of the moisture-retentive composition.

[0040] The moisture-retentive composition of the present invention generally has a low solids content (e.g., 20-49 wt.% solids and all values and ranges therebetween). In one non-limiting embodiment, the moisture-retentive composition of the present invention has a solids content of about 42-47 wt.%, and typically about 44-46%. For a moisture-retentive composition of the present invention that has no sugar added, the solids content is generally about 20-25%.

[0041] Non-limiting formulation of the moisture-retentive composition in weight percent is as follows:

Ingredient	Example 1	Example 2	Example 3	Example 4
Water	25-65	35-60	40-55	42-49.5
Sweetener	25-60	30-55	40-50	41-48
Modified Starch	0.1-10	1-8	2-6	3-5
Emulsifier	0.01-5	0.1-2	0.2-1	0.3-0.6
Protein and/or Protein source	0-2	0.0001-2	0.001-1	0.005-0.2
Preservative	0-0.2	0.001-0.2	0.02-0.15	0.04-0.12
Acidulate	0-1	0.01-1	0.1-0.5	0.15-0.3
Flavoring Agent	0-2	0.01-2	0.02-2	0.03-1
Colorant	0-1	0.0001-1	0.001-0.2	0.002-0.1

Ingredient	Example 5	Example 6	Example 7	Example 8
Water	30-60	40-55	45-55	47.5-50
Sugar	0.5-30	2-25	3-20	5-15
Corn Syrup and/or HFCS	10-50	15-45	20-43	25-40

Ingredient	Example 5	Example 6	Example 7	Example 8
Modified Starch	0.5-10	1-8	2-7	3-5
Polysorbate	0.01-3	0.05-1.5	0.1-1	0.15-0.5
Glycerides	0.01-3	0.05-1.5	0.1-1	0.15-0.4
Protein and/or Protein source	0-1.5	0-1	0.001-0.5	0.005-0.1
Preservative	0-0.15	0-0.14	0.01-0.14	0.05-0.12
Acidulate	0-1	0-1	0.05-0.6	0.1-0.3
Flavoring Agent	0-2	0-1.5	0.01-1	0.05-0.5
Colorant	0-1	0-0.5	0.002-0.2	0.005-0.15

Ingredient	Example 9
Water	48-51
Sugar	5-8
Corn Syrup	22-26
HFCS	12-17
Acetylated adipat di-starch	3-5
Polysorbate 60	0.15-0.35
Mono & DiGlycerides	0.1-0.3
Skim Milk Powder	0.006-0.1
Potassium Sorbate	0.05-0.2
Malic Acid	0.1-0.4
Flavoring Agent	0.02-0.3
Colorant	0.001-0.1

[0042] In Example 9, the content of the Polysorbate 60 is greater than the content of the mono and diglycerides, and the water content is greater than the sweetener content, and the pH of the moisture-retentive composition is less than 7.

[0043] In another non-limiting embodiment of the invention, there is provided a method for making a moisture-retentive composition for baked goods that includes the steps of:

[0044] A. Mixing a first portion of water, a modified starch, and optionally a protein and/or protein source to form a starch premixture;

[0045] B. Mixing a second portion of water and at least one sweetener to form a sweetener premixture;

[0046] C. Mixing the starch premixture and the sweetener premixture to form a starch-sweetener mixture;

[0047] D. Heating the starch-sweetener mixture;

[0048] E. Mixing emulsifier and optionally a third portion of water with the starch-sweetener mixture to form a starch-sweetener-emulsifier mixture;

[0049] F. Optionally adding a preservative, acidulate, flavoring agent and colorant to the starch-sweetener-emulsifier mixture to form the final moisture-retentive composition.

[0050] In another non-limiting embodiment of the invention, there is provided a method for making a moisture-retentive composition for baked goods that includes the steps of:

[0051] A. Disperse Premix A (modified starch and protein and/or protein source) in water to form a starch mixture;

[0052] B. Add second portion of water followed by sugar and blend until the sugar dissolved;

[0053] C. Add corn syrup and high-fructose corn syrup and blend in;

[0054] D. Add corn syrup and high fructose corn syrup to the mixture and blend in;

[0055] E. Add third portion of water and blend in;

[0056] F. Cook mixture;

[0057] G. After cook temperature is reached, add the emulsifiers, bend in and turn off heat; and

[0058] H. Add preservative and acidulant.

[0059] I. Optionally add flavoring agent and colorant to the starch-sweetener-emulsifier.

[0060] In one non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition such as a fruit gel that can be stored uncovered in a refrigerated display rack for at least four days and typically at least ten days while remaining moist and by providing a protective shield for the food product that preserves the freshness of the food product.

[0061] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that functions as an excellent protective layer for cream/iced cake and other types of food products and thus facilitates in extending the shelf life of the food product.

[0062] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that has a thin viscosity, is flowable, and delivers a good coating on a food product.

[0063] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that can successfully coat a food product using less material than prior art flavored gels.

[0064] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes a novel composition of one or more emulsifiers.

[0065] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes water, sweetener, modified starch, and emulsifier.

[0066] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that has a low solids composition.

[0067] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that can optionally include one or more additional ingredients such as, but not limited to, hydrocolloid, gum, preservative, acidulates, flavoring agent, and colorant.

[0068] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes about 25-65 wt.% water.

[0069] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the water content of the moisture-retentive composition is greater than any other component of the moisture-retentive composition.

[0070] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes one or more types of sweetener.

[0071] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes about 25-49.9 wt.% sweetener.

[0072] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the weight ratio of water to sweetener is about 1.01-1.5:1.

[0073] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the sweetener includes a combination of sugar syrup and sugar.

[0074] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the sweetener includes a combination of sugar syrup and sugar, and the weight percent of sugar is less than the weight percent of sugar syrup.

[0075] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes about 0.01-5 wt.% emulsifier.

[0076] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes both polysorbate and mono-, di-, and/or polyglycerides of fatty acids.

[0077] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes polysorbate 60, monoglycerides of fatty acids, and diglycerides of fatty acids.

[0078] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the moisture-retentive composition includes polysorbate, and mono-, di-, and/or polyglycerides of fatty acids, and the weight percent content of polysorbate is greater than the content of the weight percent content of mono-, di-, and/or polyglycerides of fatty acids.

[0079] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes one or more modified starches.

[0080] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that includes acetylated adipat di-starch, and/or modified corn starch.

[0081] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the one or more modified starches are present in the moisture-retentive composition in an amount of at least about 0.1-10 wt. %.

[0082] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the weight percent content of modified starch in the moisture-retentive composition is greater than the weight percent content of emulsifier in the moisture-retentive composition.

[0083] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the weight ratio of modified starch to emulsifier in the moisture-retentive composition is about 1.1-25:1.

[0084] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that include one or more acidulates.

[0085] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the one or more acidulates (when used) are present in the moisture-retentive composition in an amount of about 0.01-1 wt. %.

[0086] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the pH of the moisture-retentive composition is less than 7, and typically less than about 4.5.

[0087] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that optionally includes one or more stabilizers.

[0088] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the one or more stabilizers (when used) are present in the moisture-retentive composition in an amount of about 0.01-2 wt. %.

[0089] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that optionally includes one or more proteins or protein sources.

[0090] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the one or more proteins

(when used) are present in the moisture-retentive composition in an amount of about 0.0001-2 wt.%.

[0091] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that optionally includes one or more preservatives.

[0092] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the one or more preservatives (when used) are present in the moisture-retentive composition in an amount of about 0.001-0.2 wt.%.

[0093] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that optionally includes one or more flavoring agents.

[0094] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the flavoring agent (when used) is present in the moisture-retentive composition in an amount of about 0.01-2 wt.%.

[0095] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that optionally includes one or more colorants.

[0096] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition wherein the colorant (when used) is present in the moisture-retentive composition in an amount of about 0.0001-1 wt.%.

[0097] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that can optionally include one or more other ingredients such as vitamins, minerals, thickeners, antioxidants, sequestrant, etc.

[0098] In another and/or alternative non-limiting objective of the present invention, there is the provision of an improved moisture-retentive composition that can be formed by a method that includes the steps of a) mixing a first portion of water, a starch, and optionally a protein and/or protein source to form a starch premixture; b) mixing a second portion of water and at least one sweetener to form a sweetener premixture; c) mixing the starch premixture and the sweetener premixture to form a starch-sweetener mixture; d) heating the starch-sweetener mixture; e) mixing a third portion of water and emulsifier with the starch-sweetener mixture to form a starch-

sweetener-emulsifier mixture; and f) optionally adding a preservative, acidulate, flavoring agent and colorant to the starch-sweetener-emulsifier mixture to form the final moisture-retentive composition.

[0099] These and other objects and advantages will become apparent to those skilled in the art upon reading and following the description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[00100] Reference may now be made to the drawings which illustrates a non-limiting embodiment of the invention wherein:

[00101] FIG. 1 is a flow chart illustrating an exemplary non-limiting method in accordance with an embodiment of the present invention.

[00102] FIG. 2A and 2B are pictures of a cake coated with a prior art fruit gel that has been exposed to refrigerated conditions for three days.

[00103] FIG. 3 is a picture of a cake that has been coated with the moisture-retentive composition of the present invention and exposed to refrigerated conditions for nine days.

[00104] FIG. 4 is a graph illustrating the firmness data of Table 1 of moisture-retentive compositions of the present invention and three commercially available fruit gels.

[00105] FIG. 5 is a graph illustrating the firmness data of Table 2 of moisture-retentive compositions of the present invention that include different emulsifiers.

DESCRIPTION OF NON-LIMITING EMBODIMENTS

[00106] The present invention is directed to moisture-retentive compositions such as fruit gels. The moisture-retentive composition is a low solid and stabilizer base (e.g., starch, hydrocolloid, etc.) product that has a consistency that flows to enrobe and decorate cakes and other types of food products. The moisture-retentive composition is formulated to gel with different toppings so as to add flavor to the coated food product. The food products that are coated with the moisture-retentive composition can be stored uncovered in a refrigerated environment for at least four days and typically up to at least ten days while remaining moist by providing a protective shield for the food product. FIG. 3 illustrates a cake that has been coated with the moisture-retentive composition of the present invention and exposed to refrigerated conditions for nine days. The moisture-retentive coating has not begun to gel or turn rubbery and still provides an excellent

coating on the cake after nine days and also preserves the freshness of the cake that has been coated. Prior art fruit gel formulations gel and turn rubbery only after about one to three days when exposed to refrigerated conditions as illustrated in FIGS. 2A and 2B. When the fruit gel begins to gel and turn rubbery, the fruit gel coating on the cake deteriorates, affecting eating quality, and exposes the cake directly to atmosphere, thereby resulting in the accelerated drying of the cake. Also, the appearance of the gelled and rubbery fruit gel become undesirable, thereby typically requiring the cake to be discarded. The moisture-retentive composition of the present invention is a significant improvement over prior art fruit gels in that the shelf-life of the moisture-retentive composition greatly exceeds those of prior art fruit gel and enables the coated food product to have a longer shelf life in refrigerated conditions.

[00107] Although specific terms are used in the following description for the sake of clarity, these terms are intended to refer only to the particular structure of the embodiments selected for illustration in the drawings, and are not intended to define or limit the scope of the disclosure. In the drawings and the following description below, it is to be understood that like numeric designations refer to components of like function.

[00108] The singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise.

[00109] As used in the specification and in the claims, the term “comprising” may include the embodiments “consisting of” and “consisting essentially of.” The terms “comprise(s),” “include(s),” “having,” “has,” “can,” “contain(s),” and variants thereof, as used herein, are intended to be open-ended transitional phrases, terms, or words that require the presence of the named ingredients/steps and permit the presence of other ingredients/steps. However, such description should be construed as also describing compositions or processes as “consisting of” and “consisting essentially of” the enumerated ingredients/steps, which allows the presence of only the named ingredients/steps, along with any unavoidable impurities that might result therefrom, and excludes other ingredients/steps.

[00110] Numerical values in the specification and claims of this application should be understood to include numerical values which are the same when reduced to the same number of significant figures and numerical values which differ from the stated value by less than the experimental error of conventional measurement technique of the type described in the present application to determine the value.

[00111] All ranges disclosed herein are inclusive of the recited endpoint and independently combinable (for example, the range of “from 2 grams to 10 grams” is inclusive of the endpoints, 2 grams and 10 grams, and all the intermediate values).

[00112] The terms “about” and “approximately” can be used to include any numerical value that can vary without changing the basic function of that value. When used with a range, “about” and “approximately” also disclose the range defined by the absolute values of the two endpoints, e.g. “about 2 to about 4” also discloses the range “from 2 to 4.”

[00113] The moisture-retentive composition of the present invention includes water, sweetener, modified starch, and two or more emulsifiers. The moisture-retentive composition may be useful as a topping for baked goods. In some embodiments, the topping is a fruit gel.

[00114] The water may be present in the moisture-retentive composition in an amount of from about 40 wt.% to about 60 wt.%, and typically about 45 wt.% to about 55 wt.%.

[00115] The modified starch or modified starch and hydrocolloid combination may be present in the moisture-retentive composition in an amount of from about 1 wt.% to about 7 wt.%, and typically from about 2 wt.% to about 6 wt.%. The modified starch or hydrocolloid may function as a thickening agent or a gelling agent. A non-limiting example of a starch is Clearam™ CH2020.

[00116] The hydrocolloid (when used) may be selected from xanthan gum, guar gum, gum Arabic, alginate, pectin, carrageenan, gelatin, gellan, and agar. The content of the hydrocolloid (when used) is generally 0.001-7 wt.% (and all values and ranges therebetween). The hydrocolloid (when used) can be used a partial substitute for the modified starch. When modified starch and hydrocolloid are used, the content of hydrocolloid is generally less than the content of modified starch.

[00117] The sweetener may be present in the moisture-retentive composition in an amount of from about 35 wt.% to about 49.9 wt.%, and typically from about 40 wt.% to about 48 wt.%. The sweetener may include one or more of the following: glucose, sucrose, dextrose, galactose, corn syrup, sorbitol, and high-fructose corn syrup. In some non-limiting embodiments, the sweetener is a mixture of sucrose, corn syrup, and high-fructose corn syrup.

[00118] The monoglycerides and diglycerides may be present in the moisture-retentive composition in a total amount (i.e., not individually) of from about 0.05 wt.% to about 0.4 wt.%, and typically from about 0.1 wt.% to about 0.3 wt.%. Mono- and diglycerides of fatty acids refer

to a food additive containing diglycerides and monoglycerides. This mixture may sometimes be referred to as “partial glycerides”.

[00119] The polysorbate may be present in the moisture-retentive composition in an amount of from about 0.05 wt.% to about 0.4 wt.%, typically from about 0.1 wt.% to about 0.3 wt.%. Polysorbates are oily liquids derived from ethoxylated sorbitan (a sorbitol derivative) esterified with fatty acids. In some embodiments, the polysorbate is selected from Polysorbate 20 (polyoxyethylene (20) sorbitan monolaurate), Polysorbate 40 (polyoxyethylene (20) sorbitan monopalmate), Polysorbate 60 (polyoxyethylene (20) sorbitan monostearate), Polysorbate 80 (polyoxyethylene (20) sorbitan monooleate), and mixtures of one or more of the enumerated polysorbates. In some particular embodiments, the polysorbate is Polysorbate 60, also known as 2-[2-[3,4-bis(2-methoxyethoxy)oxolan-2-yl]-2-(2-methoxyethoxy)ethoxy]ethyl octadecanoate.

[00120] The moisture-retentive composition may include a fruit flavoring in an amount of up to about 1 wt.%, and typically from about 0.05 wt.% to about 0.2 wt.%. The fruit flavoring may be selected from passion fruit flavoring, strawberry flavoring, blueberry flavoring, cantaloupe flavoring, orange flavoring, and mixtures of one or more of the enumerated flavorings.

[00121] The moisture-retentive composition may further include an acidulate in an amount of up to 1 wt.%, and typically from about 0.15 wt.% to about 0.35 wt.%. The acidulate may be selected from citric acid, malic acid, lactic acid, tartaric acid, fumaric acid, acetic acid, phosphoric acid, and mixtures of one or more of the enumerated acids. In one non-limiting formulation, the pH of the moisture-retentive composition is no more than about 4.5.

[00122] The moisture-retentive composition may further include a colorant in an amount of up to 0.1 wt.%, and typically from about 0.002 wt.% to about 0.007 wt.%. In some embodiments, the colorant is selected from tartrazine, sunset yellow, and mixtures thereof.

[00123] The moisture-retentive composition may further include a preservative in an amount of up to about 0.2 wt.%, and typically from about 0.01 wt.% to about 0.1 wt.%. In some embodiments, the preservative is selected from potassium sorbate, sodium benzoate, and mixtures thereof.

[00124] The moisture-retentive composition may further include a protein and/or protein source in an amount of up to about 1 wt.%, and typically from about 0.005 wt.% to about 0.02 wt.%. In some embodiments, the protein and/or protein source is selected from skim milk, reduced fat milk, whole milk, and kefir.

[00125] The moisture-retentive composition generally has a low solids content. In some embodiments, the suspended solids content is less than about 48 wt.%, typically from about 30 wt.% to about 47 wt.%, more typically from about 35 wt.% to about 46 wt.%, and still more typically from about 38 wt.% to about 43 wt.%.

[00126] FIG. 1 illustrates a non-limiting example of a method for making the moisture-retentive composition in accordance with one non-limiting embodiment of the present invention. The method 100 includes: mixing a first portion of water, a starch, optionally a hydrocolloid, and optionally a protein (e.g., dairy product, etc.) to form a starch premixture 110; mixing a second portion of water and at least one sweetener to form a sweetener premixture 120; mixing the starch premixture and the sweetener premixture to form an unstabilized mixture 130; heating the unstabilized mixture 140; mixing a third portion of water, monoglycerides and diglycerides, and a polysorbate with the unstabilized mixture to form a stabilized mixture 150; optionally adding one or more of a preservative, an acid, a fruit flavoring, and a coloring agent to the stabilized mixture 160; and adding a fourth portion of water to the stabilized mixture to form the composition 170.

[00127] The moisture-retentive composition of the present invention may be used in or as icings, fillings, and/or glazes.

[00128] The moisture-retentive composition of the present invention disclosure may exhibit the following beneficial properties:

[00129] desirable level of gelling;

[00130] better flow (e.g., faster and smoother);

[00131] desirable viscosity;

[00132] desirable shininess level;

[00133] better coating (e.g., even coating on iced cakes);

[00134] reduced amount necessary to coat baked goods;

[00135] not turning “rubbery” quickly in refrigerated storage or a display rack;

[00136] pleasant aroma;

[00137] pleasant taste; and

[00138] pleasant mouth feel.

[00139] The moisture-retentive composition of the present invention may form a protective layer on baked goods, thereby extending the shelf life of the goods (e.g., cream/iced cake).

[00140] The moisture-retentive composition of the present invention may also be applied to

cake goods in lesser amounts (e.g., about 130 grams vs. 160 grams of a known composition required to coat a 10-inch cake).

[00141] In some embodiments, the moisture-retentive composition of the present invention has a solids content of less than 45%.

[00142] The following example is provided to illustrate the devices and methods of the present disclosure. The example is merely illustrative and is not intended to limit the disclosure to the materials, conditions, or process parameters set forth therein.

EXAMPLE 1

[00143] 1590.28 kg water at ambient temperature is added to a premix tank. The scraper is turned on at medium speed. 200 kg modified starch (Clearam™ CH2020) and 0.5 kg skim milk powder are added to the premix tank. The tank is turned on at high shear at a low speed of 580 rpm and blended for about ten minutes.

[00144] 500 kg water at ambient temperature is added to a mixing tank. The scraper is turned on (e.g., 26 rpm or 35 rpm). 250 kg sugar is added to the mixing tank and blended until dissolved. 815 kg high-fructose corn syrup and 1235 kg corn syrup are added to the mixing tank and blended. (In a separate example, the sweetener blend includes 350 kg sugar, 750 kg high-fructose corn syrup, and 1200 kg corn syrup).

[00145] The contents of the premix tank are added to the mixing tank and blended for five minutes. The premix tank is then flushed with 30 kg water.

[00146] The contents of the mixing tank are blended for an additional two minutes and then cooked (e.g., steam cooked) at 195°F for three minutes.

[00147] After cooking, 300 kg water, 10 kg monoglycerides and diglycerides, and 11.5 kg Polysorbate 60 are added and blended in. A chiller is turned on.

[00148] 30 kg water at ambient temperature is added to a bucket and blended with 5 kg potassium sorbate. The solution is added to the mixing tank.

[00149] 30 kg water at ambient temperature is added to the bucket and blended with 12.5 kg malic acid. The solution is added to the mixing tank.

[00150] 5 kg passion fruit flavor is added to the mixing tank and mixed.

[00151] 0.2198 kg tartrazine coloring agent is added and washing with 1 kg water is performed. The coloring agent is blended in. The temperature is maintained at about 160°F to about 165°F and blending is performed for about ten minutes.

[00152] The product has a suspended solids content of about 40% and a pH of about 3-3.4.

[00153] The moisture-retentive composition of the present invention retains its moisture and liquid gel state for at least thirteen or more days in a refrigerated display rack. In contrast, comparative compositions turn rubbery and form a skin layer after only one to three days.

EXAMPLE 2

[00154] 1916 kg water at ambient temperature (e.g., 75-79°F) is added to a premix tank. The scraper is turned on at low speed (e.g., 400-600 rpm) to medium speed (e.g., 900-1300 rpm). 200 kg modified starch (Clearam™ CH2020) and 0.5 kg skim milk powder are added to the premix tank. When at least 30% of the modified starch is added to the water, the scraper speed is initially reduced to a low speed and then increased to a medium speed (e.g., 900-1300 rpm). The modified starch and skim milk powder are mixed in the water at medium speed for about fifteen to thirty minutes.

[00155] In a mixing tank, 175 kg water at ambient temperature is mixed with 350 kg sugar, 1200 kg corn syrup and 750 kg HFCS. The scraper is turned on at low speed (e.g., 20-50 rpm) and the components are mixed until all of the sweetener is blended and dissolved in the water. As can be appreciated, a preformed sweetener blend having a similar sweetener composition can be added to the mixing tank or directly to the modified starch, skim milk and water mixture.

[00156] After the sweetener is blended and dissolved in the water, the modified starch, skim milk and water mixture from the premix tank is added to the sweetener mixture in the mixing tank. The premix tank is then flushed with 30 kg water. All of the components in the mixing tank are mixed together for about two to fifteen minutes.

[00157] The contents in the mixing tank are then cooked at 190-200°F for about two to ten minutes.

[00158] After the cooking temperature is obtained and the soluble solids content is obtained, 300 kg water, 10 kg monoglycerides and diglycerides, and 11 kg Polysorbate 60 are added to the mixing tank and then blended with the components in the mixing tank.

[00159] After the monoglycerides and diglycerides and Polysorbate 60 are blended with the components in the mixing tank, the components in the mixing tank are chilled to a temperature of about 150-175°F.

[00160] 30 kg water at ambient temperature 5 kg potassium sorbate are mixed together in a container. The solution is then added to the mixing tank.

[00161] 5 kg flavoring is added to the mixing tank and mixed together with the contents in the mixing tank.

[00162] 5 kg water at ambient temperature is mixed with 0.22 kg of colorant in a container. The solution is then added to the mixing tank.

[00163] 12.5 kg of malic acid is mixed with 30 kg of water at ambient temperature in a container and the mixture is added to the mixing tank when the temperature of the components in the mixing tank is less than 190°F (e.g., 160-165°F).

[00164] All of the components in the mixing tank are mixed and maintained at a temperature of 150-165°F for about five to twenty minutes.

[00165] The final mixture is then hot filled in a container. Generally, the hot filling process occurs within sixty minutes after the final mixture has been formed.

[00166] The solids content and pH of the mixture is checked prior to packaging the mixture.

[00167] The product has a suspended solids content of about 40-43% and a pH of about 3-5.

[00168] The moisture-retentive composition of the present invention retains its moisture and liquid gel state for at least thirteen days or more in a refrigerated display rack.

[00169] It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained, and since certain changes may be made in the constructions set forth without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. The invention has been described with reference to preferred and alternate embodiments. Modifications and alterations will become apparent to those skilled in the art upon reading and understanding the detailed discussion of the invention provided herein. This invention is intended to include all such modifications and alterations insofar as they come within the scope of the present invention. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a

matter of language, might be said to fall therebetween. The invention has been described with reference to the preferred embodiments. These and other modifications of the preferred embodiments as well as other embodiments of the invention will be obvious from the disclosure herein, whereby the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation. It is intended to include all such modifications and alterations insofar as they come within the scope of the appended claims.

WHAT IS CLAIMED:

1. A moisture-retentive composition for baked goods comprising:
 - water;
 - modified starch and/or a hydrocolloid;
 - sweetener and/or bulking agent; and,
 - one or more emulsifiers or surfactants.

2. A moisture-retentive composition comprising:
 - from about 25 wt.% to about 75 wt.% water;
 - from about 0.1 wt.% to about 10 wt.% modified starch and/or hydrocolloid;
 - from about 15 wt.% to about 70 wt.% sweetener and/or bulking agent; and,
 - from about 0.01 wt.% to about 5 wt.% emulsifier.

3. A moisture-retentive composition for baked goods comprising:
 - water;
 - modified starch and/or hydrocolloid;
 - sweetener;
 - monoglycerides and diglycerides; and,
 - polysorbate.

4. A moisture-retentive composition for baked goods comprising:
 - water;
 - modified starch and/or hydrocolloid;
 - sweetener; and,
 - blend of two or more emulsifier and/or surfactant.

5. A moisture-retentive composition comprising:
 - from about 25 wt.% to about 75 wt.% water;
 - from about 0.1 wt.% to about 10 wt.% of modified starch and/or hydrocolloid;
 - from about 15 wt.% to about 70 wt.% sweetener and/or bulking agent;

from about 0.01 wt.% to about 5 wt.% first emulsifier; and,
from about 0.01 wt.% to about 5 wt.% second emulsifier.

6. A moisture-retentive composition for baked goods comprising:
 - water;
 - modified starch and/or hydrocolloid;
 - sweetener;
 - monoglycerides and diglycerides; and,
 - polysorbate.

7. A moisture-retentive composition comprising:
 - from about 40 wt.% to about 55 wt.% water;
 - from about 2 wt.% to about 6 wt.% of modified starch and/or hydrocolloid;
 - from about 40 wt.% to about 50 wt.% sweetener and/or bulking agent;
 - from about 0.2 wt.% to about 1 wt.% monoglyceride and/or diglyceride;
 - from about 0.2 wt.% to about 1 wt.% polysorbate.

8. A moisture-retentive composition comprising:
 - from about 40 wt.% to about 60 wt.% of water;
 - from about 1 wt.% to about 7 wt.% of a modified starch and/or hydrocolloid;
 - up to about 1 wt.% of a protein and/or a protein source;
 - from about 35 wt.% to about 49.9 wt.% of sweetener;
 - from about 0.05 wt.% to about 0.4 wt.% of monoglycerides and diglycerides;
 - from about 0.05 wt.% to about 0.4 wt.% of a polysorbate;
 - up to about 0.2 wt.% of a preservative;
 - up to about 1 wt.% of an acidulate;
 - up to about 1 wt.% of a fruit flavoring; and
 - up to about 1 wt.% of a colorant.

9. A moisture-retentive composition comprising:
 - from about 45 wt.% to about 55 wt.% of water;
 - from about 2 wt.% to about 6 wt.% of the modified starch and/or the hydrocolloid;
 - from about 0.005 wt.% to about 0.02 wt.% of the protein and/or protein source;
 - from about 40 wt.% to about 49.9 wt.% of sweetener;
 - from about 0.1 wt.% to about 0.3 wt.% of monoglycerides and diglycerides;
 - from about 0.1 wt.% to about 0.3 wt.% of the polysorbate;
 - from about 0.05 wt.% to about 0.2 wt.% of the preservative;
 - from about 0.15 wt.% about 0.35 wt.% of the acidulate;
 - from about 0.05 wt.% to about 0.2 wt.% of the fruit flavoring; and
 - from about 0.002 wt.% to about 0.1 wt.% of the colorant.
10. The moisture-retentive composition as defined in claim 1, wherein said moisture-retentive composition has a firmness value of less than 10 after ten days in refrigerated conditions.
11. The moisture-retentive composition as defined in any one of claims 2-9, wherein said moisture-retentive composition has a firmness value of less than 10 after ten days in refrigerated conditions.
12. The moisture-retentive composition as defined in claim 1, further comprising a fruit flavoring.
13. The moisture-retentive composition as defined in any one of claims 2-11, further comprising a fruit flavoring.
14. The moisture-retentive composition as defined in claim 10, wherein the fruit flavoring is selected from the group consisting of passion fruit flavoring, strawberry flavoring, blueberry flavoring, cantaloupe flavoring, and orange flavoring.

15. The moisture-retentive composition as defined in claim 13, wherein the fruit flavoring is selected from the group consisting of passion fruit flavoring, strawberry flavoring, blueberry flavoring, cantaloupe flavoring, and orange flavoring.
16. The moisture-retentive composition as defined in claim 1, wherein the sweetener comprises at least one sweetening material selected from the group consisting of sucrose, high-fructose corn syrup, and corn syrup.
17. The moisture-retentive composition as defined in any one of claims 2-15, wherein the sweetener comprises at least one sweetening material selected from the group consisting of sucrose, high-fructose corn syrup, and corn syrup.
18. The moisture-retentive composition as defined in claim 16, wherein the sweetener includes a mixture of sucrose, high-fructose corn syrup, and corn syrup.
19. The moisture-retentive composition as defined in claim 17, wherein the sweetener includes a mixture of sucrose, high-fructose corn syrup, and corn syrup.
20. The moisture-retentive composition as defined in claim 1, further comprising an acid.
21. The moisture-retentive composition as defined in any one of claims 2-19, further comprising an acid.
22. The moisture-retentive composition as defined in claim 20, wherein the acid includes malic acid.
23. The moisture-retentive composition as defined in claim 21, wherein the acid includes malic acid.
24. The moisture-retentive composition as defined in claim 1, further comprising a colorant.

25. The moisture-retentive composition as defined in any one of claims 2-23, further comprising a colorant.
26. The moisture-retentive composition as defined in claim 1, further comprising a preservative.
27. The moisture-retentive composition as defined in any one of claims 2-25, further comprising a preservative.
28. The moisture-retentive composition as defined in claim 26, wherein the preservative includes potassium sorbate.
29. The moisture-retentive composition as defined in claim 27, wherein the preservative includes potassium sorbate.
30. The moisture-retentive composition as defined in claim 1, further comprising a protein and/or protein source.
31. The moisture-retentive composition as defined in any one of claims 2-29, further comprising a protein and/or protein source.
32. The moisture-retentive composition as defined in claim 30, wherein the protein and/or protein source includes skim milk.
33. The moisture-retentive composition as defined in claim 31, wherein the protein and/or protein source includes skim milk.
34. The moisture-retentive composition as defined in claim 30, wherein the protein and/or protein source includes skim milk, wherein the polysorbate includes Polysorbate 60, wherein the sweetener includes a mixture of sucrose, corn syrup, and high-fructose corn syrup, wherein the preservative includes potassium sorbate, and wherein the acid includes malic acid.

35. The moisture-retentive composition as defined in any one of claims 31-33, wherein the protein and/or protein source includes skim milk, wherein the polysorbate includes Polysorbate 60, wherein the sweetener includes a mixture of sucrose, corn syrup, and high-fructose corn syrup, wherein the preservative includes potassium sorbate, and wherein the acid includes malic acid.

36. The moisture-retentive composition as defined in claim 1, wherein the emulsifier includes one or more of polyoxyethylene ethers of sorbitan monostearate (polysorbate 60) and polyoxyethylene ethers of sorbitan monooleate (polysorbate 80); span-20, span-40, span-60, span-80; lecithin; hydroxylated lecithin; mono-, di-, or polyglycerides of fatty acids, such as stearin and palmitin mono and diglycerides; polyoxyethylene ethers of fatty esters of polyhydric alcohols, or the polyoxyethylene ethers of sorbitan distearate; fatty esters of polyhydric alcohols such as sorbitan monostearate; polyglycerol esters of mono and diglycerides such as hexaglyceryl distearate; mono- and diesters of glycols such as propylene glycol monostearate, and propylene glycol monopalmitate, succinoylated monoglycerides; and the esters of carboxylic acids such as lactic, citric, and tartaric acids with the mono- and diglycerides of fatty acids such as glycerol lacto palmitate and glycerol lacto stearate, and calcium or sodium stearyl lactylates and all members of the sucrose ester family thereof; all varieties of diacetyltartaric esters of fatty acids; esters of sorbitol (e.g., sorbitan tristearate, etc.); glycerol and fatty acids mixtures (e.g., polyglycerol and vegetapolyricinoleate, etc.); "DATEMS", and the like, and mixtures thereof.

37. The moisture-retentive composition as defined in any one of claims 2-35, wherein the emulsifier includes one or more of polyoxyethylene ethers of sorbitan monostearate (polysorbate 60) and polyoxyethylene ethers of sorbitan monooleate (polysorbate 80); span-20, span-40, span-60, span-80; lecithin; hydroxylated lecithin; mono-, di-, or polyglycerides of fatty acids, such as stearin and palmitin mono and diglycerides; polyoxyethylene ethers of fatty esters of polyhydric alcohols, or the polyoxyethylene ethers of sorbitan distearate; fatty esters of polyhydric alcohols such as sorbitan monostearate; polyglycerol esters of mono and diglycerides such as hexaglyceryl distearate; mono- and diesters of glycols such as propylene glycol monostearate, and propylene glycol monopalmitate, succinoylated monoglycerides; and the esters of carboxylic acids such as lactic, citric, and tartaric acids with the mono- and diglycerides of fatty acids such as glycerol lacto palmitate and glycerol lacto stearate, and calcium or sodium stearyl lactylates and all members

of the sucrose ester family thereof; all varieties of diacetyltartaric esters of fatty acids; esters of sorbitol (e.g., sorbitan tristearate, etc.); glycerol and fatty acids mixtures (e.g., polyglycerol and vegetapolyricinoleate, etc.); "DATEMS", and the like, and mixtures thereof.

38. The moisture-retentive composition as defined in claim 36, wherein said emulsifier includes polysorbate, mono-, di-, and/or polyglycerides of fatty acids.

39. The moisture-retentive composition as defined in claim 37, wherein said emulsifier includes polysorbate, mono-, di-, and/or polyglycerides of fatty acids.

40. The moisture-retentive composition as defined in claim 36, wherein said emulsifier includes polysorbate, monoglycerides of fatty acids and diglycerides of fatty acids.

41. The moisture-retentive composition as defined in claim 37, wherein said emulsifier includes polysorbate, monoglycerides of fatty acids and diglycerides of fatty acids.

42. The moisture-retentive composition as defined in claim 36, wherein said emulsifier includes polysorbate 60, monoglycerides of fatty acids and diglycerides of fatty acids.

43. The moisture-retentive composition as defined in claim 37, wherein said emulsifier includes polysorbate 60, monoglycerides of fatty acids and diglycerides of fatty acids.

44. The moisture-retentive composition as defined in claim 36, wherein said emulsifier includes polysorbate, and mono-, di-, and/or polyglycerides of fatty acids, and the weight percent content of polysorbate is greater than the content of the weight percent content of mono-, di-, and/or polyglycerides of fatty acids.

45. The moisture-retentive composition as defined in claim 37, wherein said emulsifier includes polysorbate, and mono-, di-, and/or polyglycerides of fatty acids, and the weight percent content of polysorbate is greater than the content of the weight percent content of mono-, di-, and/or polyglycerides of fatty acids.

46. The moisture-retentive composition as defined in claim 36, wherein said emulsifier includes one or more of methyl-cellulose, sucrose ether (SE), polysorbate, sodium stearyl lactylate (SSL), lecithin, mono and di glyceride (MD), and/or sorbitan monostearate (SMS).

47. The moisture-retentive composition as defined in claim 37, wherein said emulsifier includes one or more of methyl-cellulose, sucrose ether (SE), polysorbate, sodium stearyl lactylate (SSL), lecithin, mono and di glyceride (MD), and/or sorbitan monostearate (SMS).

48. The moisture-retentive composition as defined in claim 1, wherein a total HLB of said emulsifier in said moisture-retentive composition is 8-16.

49. The moisture-retentive composition as defined in any one of claims 2-47, wherein a total HLB of said emulsifier in said moisture-retentive composition is 8-16.

50. The moisture-retentive composition as defined in claim 1, wherein the hydrocolloids include one or more carrageenan, guar gum, alginate, xanthan gum, locust bean gum, arabic gum, gellan gum, pectin, and the like, or semi-synthetic, such as methylcellulose, carboxy-methylcellulose, ethylcellulose, hydroxy-propylmethylcellulose (HPMC), and microcrystalline cellulose.

51. The moisture-retentive composition as defined in any one of claims 2-49, wherein the hydrocolloids include one or more carrageenan, guar gum, alginate, xanthan gum, locust bean gum, arabic gum, gellan gum, pectin, and the like, or semi-synthetic, such as methylcellulose, carboxy-methylcellulose, ethylcellulose, hydroxy-propylmethylcellulose (HPMC), and microcrystalline cellulose.

52. The moisture-retentive composition as defined in claim 1, wherein the modified starch includes one or more maize starch, dextrin, acid-treated starch, alkaline-treated starch, bleached starch, oxidized starch, starches-enzyme-treated, monostarch phosphate, distarch phosphate, phosphated distarch phosphate, acetylated distarch phosphate, starch acetate, acetylated distarch adipate, hydroxypropyl starch, hydroxypropyl distarch phosphate, hydroxypropyl distarch

glycerol, starch sodium octenyl succinate, modified corn starch (e.g. Starch 465, etc.) and acetylated oxidized starch.

53. The moisture-retentive composition as defined in any one of claims 2-51, wherein the modified starch includes one or more maize starch, dextrin, acid-treated starch, alkaline-treated starch, bleached starch, oxidized starch, starches-enzyme-treated, monostarch phosphate, distarch phosphate, phosphated distarch phosphate, acetylated distarch phosphate, starch acetate, acetylated distarch adipate, hydroxypropyl starch, hydroxypropyl distarch phosphate, hydroxypropyl distarch glycerol, starch sodium octenyl succinate, modified corn starch (e.g. Starch 465, etc.) and acetylated oxidized starch.

54. The moisture-retentive composition as defined in claim 52, wherein the modified starch includes acetylated adipat di-starch or modified corn starch.

55. The moisture-retentive composition as defined in claim 53, wherein the modified starch includes acetylated adipat di-starch or modified corn starch.

56. The moisture-retentive composition as defined in claim 1, wherein the sweetener and/or bulking agent includes monosaccharides, disaccharides, polysaccharides, sucrose, fructose, dextrose, maltodextrin, glucose, sugar syrups, corn syrup, glucose syrup, maple syrup, golden syrup, high-fructose corn syrup, polyols, maltitol, sorbitol, xylitol, erythritol, isomalt, aspartame, acetosulfame, alitame, saccharin, cyclamates, and trichloro sucrose.

57. The moisture-retentive composition as defined in any one of claims 2-55, wherein the sweetener and/or bulking agent includes monosaccharides, disaccharides, polysaccharides, sucrose, fructose, dextrose, maltodextrin, glucose, sugar syrups, corn syrup, glucose syrup, maple syrup, golden syrup, high-fructose corn syrup, polyols, maltitol, sorbitol, xylitol, erythritol, isomalt, aspartame, acetosulfame, alitame, saccharin, cyclamates, and trichloro sucrose.

58. The moisture-retentive composition as defined in claim 1, wherein the sweetener and/or bulking agent constitutes about 15-70 wt.% of said moisture-retentive composition.

59. The moisture-retentive composition as defined in any one of claims 2-57, wherein the sweetener and/or bulking agent constitutes about 15-70 wt.% of said moisture-retentive composition.

60. A method for making a moisture-retentive composition product with shelf stability storage at ambient temperature comprising:

mixing the first portion of water, a modified starch, and optionally a protein and/or a protein source to form a starch premixture; mixing a second portion of water and at least one sweetener to form a sweetener premixture; mixing the starch and the sweetener premixture in third portion of water then applying heat to the ungelatinized mixture; when temperature is achieved, add monoglycerides and diglycerides and polysorbate to the gelatinized mixture and blend well; cooling the gelatinized mixture;

adding premixed water and preservative to the gelatinized mixture;

adding premixed water and acidulate to the gelatinized mixture;

optionally adding a fruit flavoring to the stabilized mixture;

optionally adding a colorant to the stabilized mixture; and

blending the mixture to form the topping composition.

61. The method as defined in claim 60, wherein the unstabilized mixture is heated to a temperature of at least about 180°F.

62. The method as defined in claim 60, wherein the topping composition comprises:

from about 25 wt.% to about 75 wt.% water;

from about 0.1 wt.% to about 10 wt.% modified starch and/or hydrocolloid;

from about 15 wt.% to about 70 wt.% sweetener and/or bulking agent; and,

from about 0.01 wt.% to about 5 wt.% emulsifier.

63. The method as defined in claim 60 or 61, wherein the topping composition has a composition as defined in any one of claims 2-59.

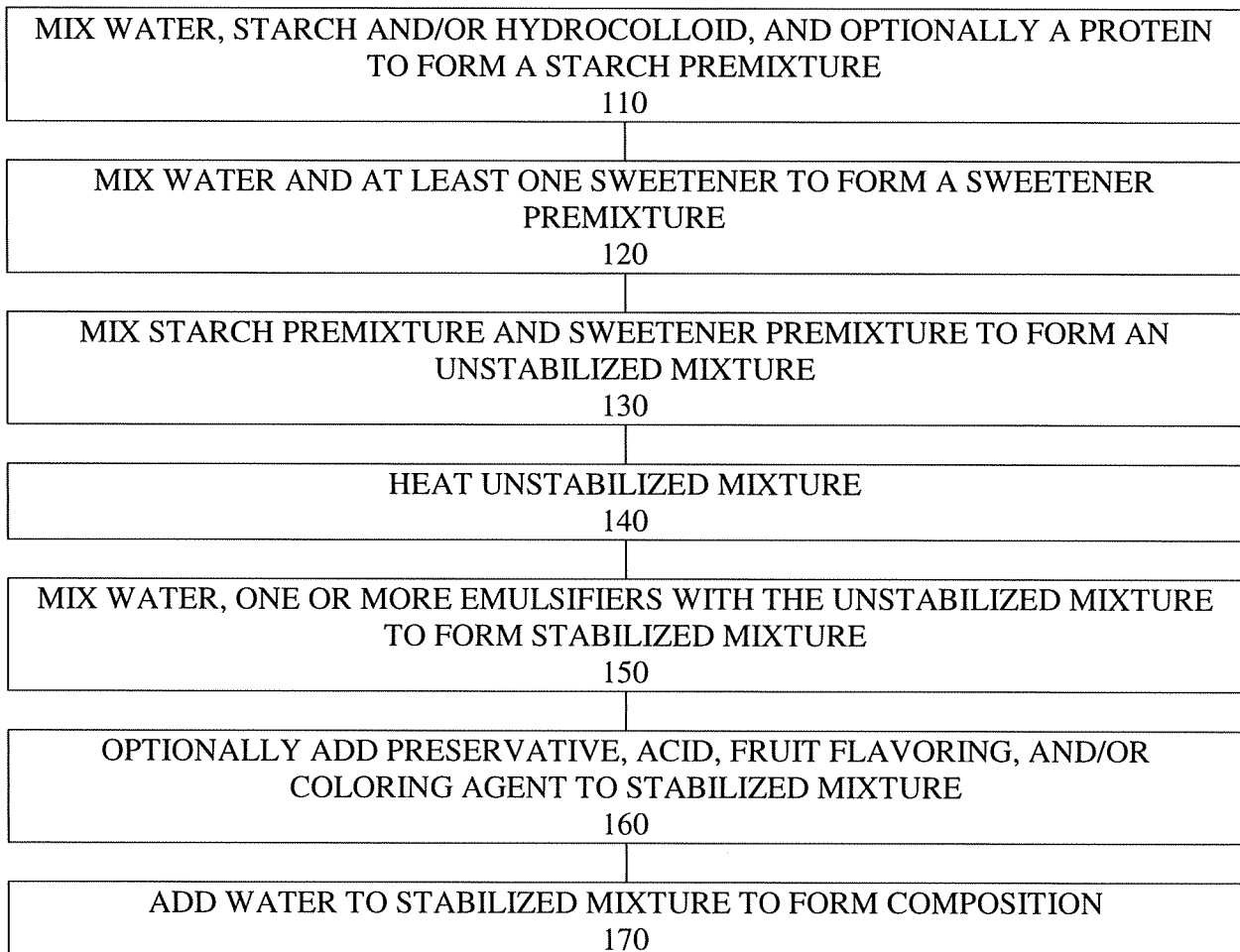


FIG. 1

GELLING



Fig. 2A

RUBBERY



FIG. 2B

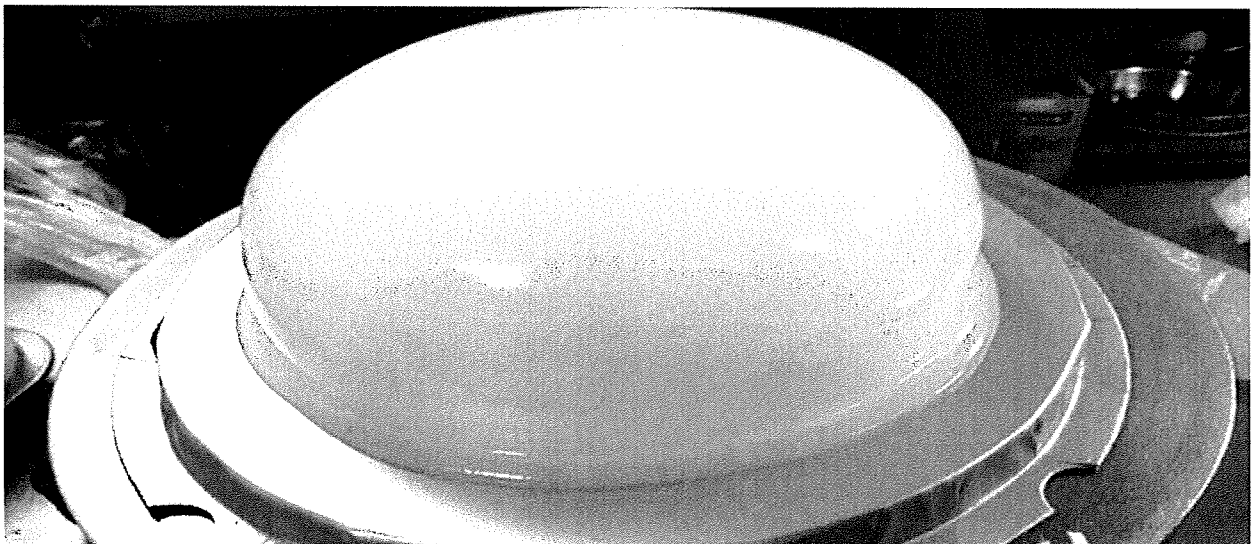


FIG. 3

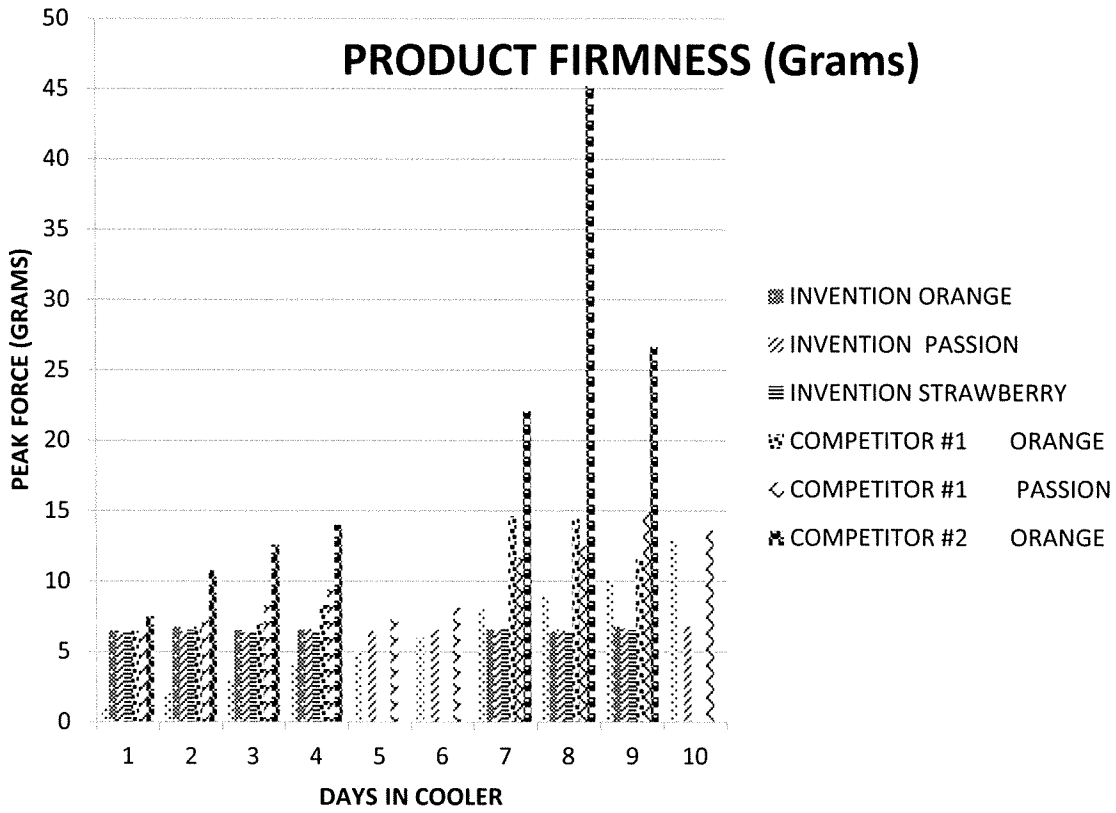


FIG. 4

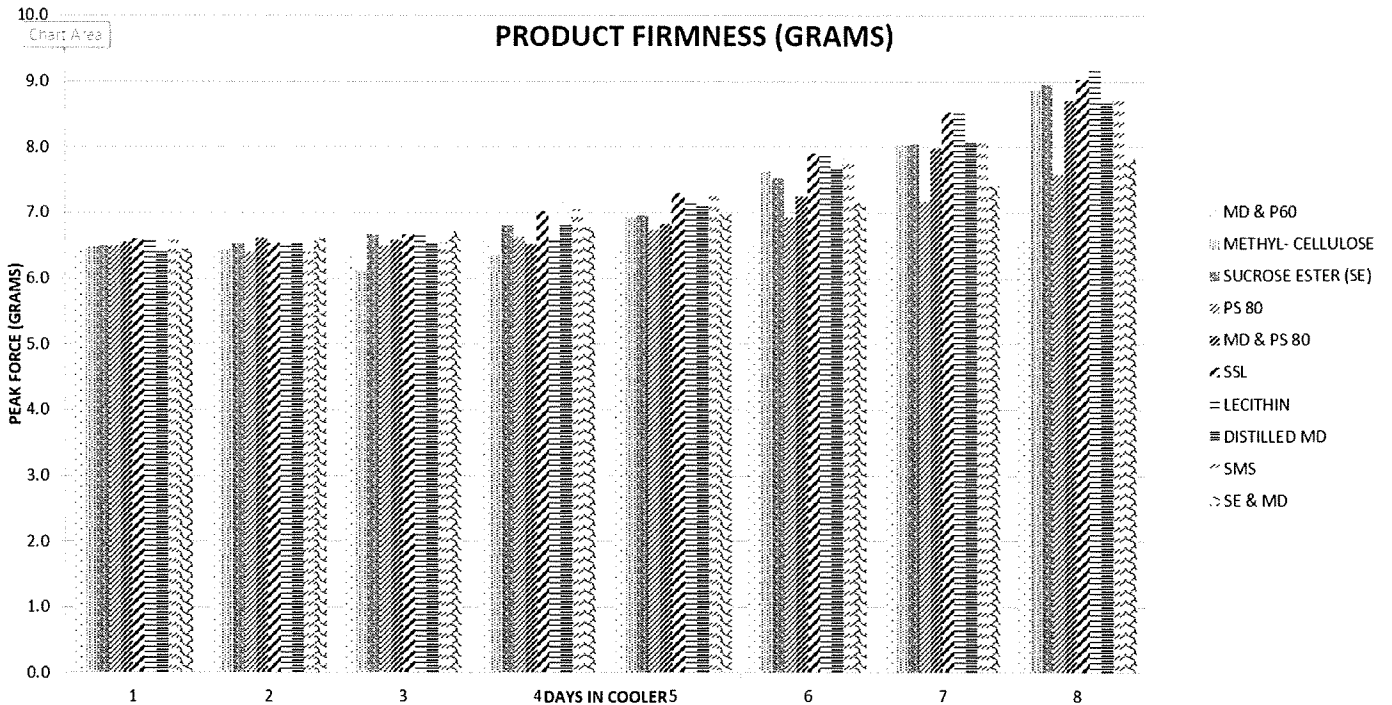


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US19/19740

A. CLASSIFICATION OF SUBJECT MATTER
 IPC - A23L 29/256, 29/206, 29/20, 29/00 (2019.01)
 CPC - A23L 29/256, 29/206, 29/20, 29/00

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)
 See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2008/0026111 A1 (BELLODY, WJ JR. et al.) 31 January 2008; entire document, in particular paragraphs [0030]-[0032], [0053]-[0056], [0083], [0130]-[0131]; claims 1, 36	1-6, 16, 26, 28, 30, 32, 34, 36, 38, 46, 50, 52, 54, 56, 58 --- 7-10, 11/2-9, 12, 14, 18, 20, 22, 24, 40, 42, 44, 60-62
Y	US 4,468,408 A (BOSCO, PM et al.) 28 August 1984; figure 3; column 6, lines 56-60; column 7, lines 62-67; column 9, example I table; column 10, example III table	7, 11/7, 24, 40, 42, 44, 60-62
Y	US 5,063,073 A (KRATOCHVIL, JF) 05 November 1991; column 25, lines 1-68	8-9, 11/8-9, 12, 14
Y	WO 97/34502 A1 (BUSH BOAKE ALLEN INC.) 25 September 1997; page 9, lines 9-15; claims 3-4	18
Y	US 2008/0233232 A1 (LAHRSOW, J) 25 September 2008; paragraph [0024]	20, 22
Y	US 2013/0260001 A1 (SHER, AA et al.) 03 October 2013; paragraphs [0015], [0050]; claim 4	8-9, 11/8-9
Y	US 2011/0177176 A1 (SRIDHAR, V) 21 July 2011; paragraph [0024]	60-62
Y	US 2009/0041919 A1 (PERKS, C et al.) 12 February 2009; paragraphs [0045], [0049]	9, 11/9

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search
 09 April 2019 (09.04.2019)

Date of mailing of the international search report
06 MAY 2019

Name and mailing address of the ISA/
 Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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 Facsimile No. 571-273-8300

Authorized officer
 Shane Thomas
 PCT Helpdesk: 571-272-4300
 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US19/19740

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47-49, 51, 53, 55, 57, 59, 63
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US19/19740

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,876,105 A (WOLF, CL et al.) 24 October 1989; figure 2; column 3, lines 26-29; column 4, lines 58-62; column 7, lines 39-41	10, 11/2-9