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(54) Titre : COMPOSITION DE GOMME A MACHER REMPLIE DE LIQUIDE
(54) Title: LIQUID-FILLED CHEWING GUM COMPOSITION

(57) **Abrégé/Abstract:**

The present invention provides a chewing or bubble gum composition which includes a liquid fill composition and a gum region which includes a gum base surrounding the liquid fill, wherein the gum region includes a polyol composition including at least one polyol and having a water solubility of less than 72% by weight at 25°C. The composition may also include a coating region which surrounds the gum region.



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(54) Title: LIQUID-FILLED CHEWING GUM COMPOSITION

(57) Abstract: The present invention provides a chewing or bubble gum composition which includes a liquid fill composition and a gum region which includes a gum base surrounding the liquid fill, wherein the gum region includes a polyol composition including at least one polyol and having a water solubility of less than 72% by weight at 25°C. The composition may also include a coating region which surrounds the gum region.



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LIQUID-FILLED CHEWING GUM COMPOSITION

FIELD

The present invention includes compositions for a multi-layer liquid center-filled chewing gum, which maintains its liquidity for a substantial period of time. The individual gum pieces which include the compositions of the present invention include a liquid center
5 surrounded by a gum region and optionally may be further coated with an external coating layer.

BACKGROUND

Liquid or center-filled gum and other confectionery products are in popular demand
10 today. Typically, these products have a solid exterior portion and a soft or liquid-type center. The outer portion can be chewing gum or bubble gum of some type, while the liquid center portion can be a flavored material typically having a syrup-like consistency.

There are also products having a chewing gum or bubble gum core with a hard sugar
15 or sugarless shell on the exterior. These products include, for example well-known pellet gum products sold under the brand names Chiclets®, Clorets®, and Dentyne-Ice®. Both liquid filled and coated gum products are in popular demand.

Conventional center-filled gum products having a liquid-filled center portion, a
20 second layer of chewing gum or bubble gum material surrounding the liquid, and a hard outer shell or coating suffer from undesirable migration of the liquid into the gum base region. This results in a product which is not commercially acceptable. Loss of the center-fill not only impacts the initial organoleptic qualities of the gum, i.e., initial liquid “burst”, but also may alter the physical appearance and overall shelf-life stability of the product.

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One possible cause of the loss in liquidity of the center-fill is from moisture migration from the center-fill to the surrounding gum layer. This problem has most frequently been addressed by alteration of the center-fill composition.

30 Patents which included a specifically formulated center-fill composition to overcome the loss of liquidity problem include: U.S. Patent No. 4,466,983 to Cifrese et al., wherein the center-fill included a hydrogenated starch hydrolysate; U.S. Patent No. 4,250,196 to Friello which provides a center-fill which includes a combination of water and hydrogenated starch

hydrolysate; and U.S. Patent No. 4,252,829 to Terrevazzi ("Terrevazzi") which discloses a center-fill formulation including propylene glycol and sorbitol.

Other attempts to address the loss of liquidity have provided formulations which are intended to control the water content of the center-fill. Specifically, U.S. Patent No. 4,683,138 to Glass et al provides a low- moisture liquid center-filled gum composition.

One common factor of the commercially available center-fill gum compositions is the size of the gum piece. On average, the weight of such chewing gum pieces is approximately five grams, such as those disclosed in Terravazzi. Until the present invention, smaller center-filled gum pieces, i.e., less than three grams per piece, have not been made and thus the problems associated with center-filled gum have not existed with such smaller pieces. Smaller gum pieces, such as 2-3 gram sizes and configurations such as pellet gums, have more surface area relative to the liquid-fill and thus, maintaining liquidity of the center-fill and preventing migration into and through the surrounding gum region becomes more critical and challenging.

There is a need for new gum compositions, and particularly hard or crunchy coated gums, which provide the desired hard shell coating layer in combination with a center-fill gum, while resisting loss of liquidity. This is also a need for a center-filled gum, which retains its liquid center during manufacturing and during its shelf-life, and which can be made in a reduced piece-size without loss of the liquid-center fill properties.

SUMMARY

In some embodiments, there are compositions and products containing liquid center-filled compositions which retain their liquidity over time and resist the migration of the liquid center-fill into the region surrounding the liquid center-fill and/or the solidification of the center-fill over time.

In some embodiments there is a center-fill composition which resists loss of liquidity of the center-fill. In some embodiments, the composition may include a gum region surrounding a center-fill composition, the gum region including a gum base. The gum region may include a polyol composition having a water solubility of less than 72% by weight at 25°C. A hard shell coating which surrounds the gum region may also be included in the composition.

In some embodiments, a gum composition includes a center-fill composition, a gum layer surrounding said center-fill composition, and a coating surrounding said gum layer, wherein the gum layer includes a moisture barrier component including a polyol composition having a densely packed crystalline structure.

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In some embodiments, a method of preparing a multi-layer center-fill gum includes the steps of:

- (a) extruding a liquid-filled rope of a chewing gum layer including a polyol which includes maltitol in an amount from about 30% to about 80% by weight of said gum layer;
- 10 (b) sizing said rope;
- (c) feeding said rope into a tablet-forming mechanism;
- (d) cooling said rope;
- (e) forming individual pieces of said liquid-filled rope;
- (f) cooling said individual pieces; and
- 15 (g) coating said individual pieces with a hard coating.

In some embodiments a gum composition may be prepared as follows:

- (a) extruding a liquid-filled rope of a chewing gum layer including a polyol which includes maltitol in an amount from about 30% to about 80% by weight of said gum layer;
- 20 (b) sizing said rope;
- (c) feeding said rope into a tablet-forming mechanism;
- (d) cooling said rope;
- (e) forming individual pieces of said liquid-filled rope;
- (f) cooling said individual pieces; and
- 25 (g) coating said individual pieces with a hard coating.

In some embodiments a gum composition may include a center-fill composition and a gum layer surrounding said center-fill composition, wherein the gum layer includes a polyol composition including maltitol and a polyol selected from erythritol, xylitol, sorbitol, mannitol, isomalt, lactitol and combinations thereof, wherein said maltitol and said other polyol are in sufficient amounts to provide said composition with a water solubility of less than 72% at 25°C.

In some embodiments a composition may include maltitol and a polyol selected from erythritol, xylitol, sorbitol, mannitol, isomalt, lactitol and combinations thereof, wherein said

maltitol and said other polyol are in sufficient amounts to provide said composition with a water solubility of less than 72% at 25°C.

In some embodiments a gum composition may include a center-fill layer including
5 greater than zero up to about 10% by weight of said chewing gum composition, a gum layer including from about 55% to about 65% by weight of said chewing gum composition, and a coating including from about 25% to about 35% by weight of said chewing gum composition; wherein said gum composition further includes a gum piece of about three grams or less.

10 In some embodiments a gum composition may include a center-fill composition, a gum layer surrounding said center-fill composition, a coating layer surrounding said gum layer; wherein said center-fill composition has a water activity less than or equal to said gum layer. Alternatively, in some embodiments, the water activity of the center-fill may be greater than that of the surrounding gum layer.

15 In some embodiments a gum composition may include a center-fill composition, a gum layer surrounding said center-fill composition, a coating layer surrounding said gum layer; wherein said gum layer includes a polyol composition including maltitol; and said gum region further includes a gum base selected from styrene-butadiene copolymers (SBR),
20 polyisobutylene, isobutylene-isoprene copolymers, polyethylene, polyvinyl acetate (PVA) and combinations thereof.

The gum compositions of some embodiments may include:

- (a) a liquid-fill composition; and
25 (b) a gum region surrounding said liquid-fill composition,
said gum region comprising a gum base;

wherein:

said gum region further comprises a polyol composition having a water solubility of less than 72% by weight at 25°C; said polyol composition comprising at least one polyol. The gum
30 region will have a first water activity and the liquid fill composition has a second water activity. Depending on the desired characteristics of the gum composition, the first water activity may be greater than, approximately equal to, or less than the second water activity.

DETAILED DESCRIPTION

As used herein the transitional term "comprising," (also "comprises," etc.) which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps, regardless of its use in the preamble or the body of a claim.

As used herein, the terms "bubble gum" and "chewing gum" are used interchangeably and are both meant to include any gum compositions.

As used herein, the terms "liquid-fill" and "center-fill" are used interchangeably and refer to the innermost region of the compositions. The term "center-fill" does not imply symmetry of a gum piece, only that the "center-fill" is within another region of the gum piece. In some embodiments, more than one center-fill or liquid fill may be present.

As used herein, the term "liquid" refers to compositions which will readily flow or maintain fluid properties at room temperature and pressure.

Embodiments described herein provide a multi-component composition which includes at least one liquid fill region and a gum region which includes a gum base. The individual gum piece may also include an outer gum coating or shell, which typically provides a crunchiness to the piece when initially chewed. The individual gum pieces may form a variety of shapes including pellet, tablet, ball, pillow, chunk, stick and slab, among others.

The center-fill gum composition and other compositions described herein may be formed by any technique known in the art which includes the method described by U.S. Patent No. 6,280,780 to Degady et al. ("Degady"). Degady describes an apparatus and method for forming center-filled gum pellets. The method includes first extruding a liquid-filled rope of a chewing gum layer and passing the rope through a sizing mechanism including a series of pairs of pulley-shaped roller members. The roller members "size" the rope or strand of gum material such that it leaves the series of rollers with the desired size and shape for entering a tablet-forming mechanism.

The rope is then led into a tablet-forming mechanism including a pair of rotating chain die members which are endless chain mechanisms and both rotate at the same speed by a motor and gear mechanism. Each of the chain mechanisms include a plurality of open curved die groove members which mate and form die cavities in which the pieces of gum material (pellets or tablets) are formed. While Degady is limited to the formation of pellet or tablet shaped pieces, the gum pieces may be of other shapes as described above. The shape of the die groove members may be altered to provided any desired shape.

The gum may optionally be passed through a cooling tunnel either before entering the tablet-forming mechanism, after exiting the tablet-forming mechanism or both. Cooling of the rope prior to entering the tablet-forming mechanism may be beneficial to prevent rebound of the individual pieces and thus an increase in productivity.

The cooled pieces of gum material are then fed into a storage container for conditioning and further processing. At this point, the cooled pieces of gum material could also be fed directly into a coating tunnel mechanism, such as a rotating tunnel mechanism.

Whether the pieces of formed gum material are first stored, transported in a storage container, or fed directly into a coating tunnel or mechanism, the individual pieces of gum material may subsequently be subjected to a conventional sugar or sugarless coating process in order to form a hard exterior shell on the liquid-filled gum material. Coating processes or mechanisms of this type are known. In general, the coating is applied in numerous thin layers of material in order to form an appropriate uniform coated and finished quality surface on the gum products. The hard coating material, which may include sugar, maltitol, sorbitol or any other polyol, including those described herein, and optionally flavoring, is sprayed onto the pellets of gum material as they pass through a coating mechanism or a coating tunnel and are tumbled and rotated therein. In addition, conditioned air is circulated or forced into the coating tunnel or mechanism in order to dry each of the successive coating layers on the formed products.

The coating composition may range from about 2% to about 60%, more specifically, about 20% to about 40% by weight of an individual gum piece which includes a center-fill, a gum region and a coating; even more specifically, from 25% to 35% and still more specifically around 30%. The coating may include sugar or polyol such as maltitol as the

primary component, but may also include flavors, colors, etc. as described below in the discussion of the gum region.

The center-filled chewing gum provides resistance from moisture migration from the center-fill to the gum region by modifying both the polyol composition and gum base composition present in the gum region. This is in contrast to the aforementioned conventional approaches and which have not fully addressed the problems associated with manufacturing and shelf-stability of liquid center-filled products.

In some embodiments of the invention, there are included smaller piece-sizes. For example, the smallest conventional piece sizes of commercially available gum are generally in pellet forms. These piece-sizes currently range from about 5-7 grams. In some embodiments liquid filled products have been made using substantially smaller piece sizes, i.e., 50-60% smaller by weight, without loss of liquidity or migration of liquid into the gum region or beyond into the coating. Some inventive embodiments provide a liquid-filled gum piece size range which is greater than about 0.5 grams, more specifically greater than 1.5 grams up to about 3 grams, including the addition of an outer hard coating shell. In addition, in some embodiments a gum piece may include a center-fill, a gum region including a gum base and an outer coating. Such gum pieces may be about 2.2 grams total weight per piece.

It has been discovered that pieces of such small size and particularly with gum shapes or configurations having proportionally more liquid-fill surface area as compared to the weight to the liquid per se, have a greater tendency to lose the liquidity of the center due to the interaction of different factors. While not limited to a single theory, these factors include the small amount of liquid-fill in comparison to the surface of the gum region in which the liquid-fill is in direct contact, the interaction of the type of elastomer with the center-fill (i.e. SBR versus non-SBR), the compatibility of the gum region components with the liquid-fill components, and the potential capillary action of the polyol used in the gum region. For example, the structure of sorbitol, which is customarily used in gum formulations in the United States, does not provide a tightly packed crystalline structure, giving almost a sponge-like appearance. Therefore, in order to provide a center-filled gum piece of less than about 3 grams, the present invention alters the gum and gum base to include a polyol composition having a dense, tightly packed crystalline structure which is unlike the sponge-like structure in conventional sorbitol gum region formulations, in order to provide a center-filled gum piece which resists loss of liquidity.

Gum Region

The gum region, also referred to as the second region in the claims, provides a liquid barrier to surround and prevent the liquid-fill from migration and premature release. One or
5 more cavities can be present in the gum region to house the liquid center-fill. The shape of the cavity will be largely dictated by the final configuration of the chewing gum piece. By selection of the ratio of the desired cavity surface area to the liquid-fill weight, optimization of the reduction in potential liquid-fill migration in to the gum region area can be achieved. This is particularly useful when the gum piece size is desired to be substantially smaller than
10 conventional commercialized gum pieces. In particular, liquid-filled pellet gums having sizes of 2 to 3 grams by weight of the entire gum piece have been successfully made. However, smaller gum pieces, as small as about 0.5 grams are contemplated.

As discussed earlier, some embodiments may incorporate a modified polyol
15 composition including at least one polyol incorporated into the gum region as discussed herein. Moreover, the selection of a non-SBR gum base in the gum region, in combination with the modified polyol composition has been found to be particularly useful in achieving stable liquid-filled chewing gum compositions.

20 The gum region may include a gum base. The gum base may include any component known in the chewing gum art. For example, the gum region may include elastomers, bulking agents, waxes, elastomer solvents, emulsifiers, plasticizers, fillers and mixtures thereof. Wherein the gum region is included in a three component composition including a center-fill, a gum region and a coating layer, the gum region may comprise from about 40%
25 to about 97%, more specifically from about 55% to about 65% by weight of the chewing gum piece, even more specifically about 62%.

The gum region may also include a specific polyol composition including at least one polyol which is from about 30% to about 80% by weight of said gum region, and specifically
30 from 50% to about 60%. The polyol composition may include any polyol known in the art including, but not limited to maltitol, sorbitol, erythritol, xylitol, mannitol, isomalt, lactitol and combinations thereof. LycasinTM which is a hydrogenated starch hydrolysate including sorbitol and maltitol, may also be used.

The amount of the polyol composition or combination of polyols used in the gum region will depend on many factors including the type of elastomers used in the gum base and the particular polyols used. For example, wherein the total amount of the polyol composition is in the range of about 40% to about 65% based on the weight of the gum region, the amount of maltitol may be from about 40% to about 60% in addition to an amount of sorbitol from about 0 up to about 10%, more specifically, an amount of maltitol may be from about 45% to about 55% in combination with sorbitol from about 5% to about 10%.

Maltitol is a sweet, water-soluble sugar alcohol useful as a bulking agent in the preparation of beverages and foodstuffs and is more fully described in U.S. Pat. No. 3,708,396. Maltitol is made by hydrogenation of maltose which is the most common reducing disaccharide and is found in starch and other natural products.

The polyol composition which may include one or more different polyols which may be derived from a genetically modified organism ("GMO") or GMO free source. For example, the maltitol may be GMO free maltitol or provided by a hydrogenated starch hydrolysate. For the purposes of this invention, the term "GMO-free" refers to a composition that has been derived from process in which genetically modified organisms are not utilized.

Some embodiments may include a polyol composition including maltitol which has a greater crystalline density than sorbitol. Other polyols which exhibit a greater crystalline density than sorbitol include xylitol and mannitol. The greater the crystalline density of the polyol the better the barrier properties are. Specifically, a polyol of a greater crystalline density results in a structure with fewer pores, which provides less surface area for potential moisture or fluid migration into the gum region from the liquid-fill.

Since sugar (sucrose) is generally accepted as the baseline for comparison of sweeteners, including polyols, the polyol composition of some embodiments is described similarly. For example, the polyol composition of may have a sweetness of greater than about 50% of the sweetness of sucrose. More specifically, the polyol composition of the present invention may have sweetness greater than about 70% the sweetness of sucrose.

The polyol composition of some embodiments may also be described in terms of the solubility of the composition. The solubility of the polyol composition will depend on

the solubility of the one or more polyols included in the composition. For example, if maltitol is the only polyol included in the polyol composition, the solubility of the polyol composition in water will be about 60% at 25°C.

5 Blends of different polyols may also be used. Examples of useful polyols are erythritol, lactitol, xylitol, mannitol, maltitol, sorbitol, isomalt, and combinations thereof. Where a blend of more than one polyol is used, the solubility of the polyol composition will depend on a weighted ratio of the amount of the polyol in the blend and the solubility of each individual polyol which is included. For example, a combination of two or more polyols may
10 have a water solubility range of about 60% to about 72%, if it includes maltitol, which has a water solubility of 60% at 25°C, and sorbitol, which has a water solubility of about 72% at 25°C. Other suitable solubility ranges, which depend on the included two or more polyols include the ranges from about 40% to about 60% at 25°C and 55% to 65% at 25°C. The range of the solubility may vary, depending on the particular polyols used. Alternative
15 suitable solubilities of a polyol combination include those having a solubility less than sucrose (i.e., less than 67%).

 The polyol composition may include particles of a variety of sizes. Specifically, the average particle size of the polyol composition ranges from about 30 microns to about 600
20 microns, more specifically from about 30 microns to about 200 microns.

 The amount of the gum base which is present in the gum region may also vary. The gum base may be included in the gum region in an amount from about 25% to about 45% by weight of the gum region. A more specific range of gum base is from about 28% to about
25 42% by weight of the gum region. Even more specifically, the range may be from about 28% to about 35% or from about 28% to about 30%.

 The elastomers (rubbers) employed in the gum base will vary greatly depending upon various factors such as the type of gum base desired, the consistency of gum composition
30 desired and the other components used in the composition to make the final chewing gum product. The elastomer may be any water-insoluble polymer known in the art, and includes those gum polymers utilized for chewing gums and bubble gums. Illustrative examples of suitable polymers in gum bases include both natural and synthetic elastomers. For example, those polymers which are suitable in gum base compositions include, without limitation,
35 natural substances (of vegetable origin) such as chicle, natural rubber, crown gum, nispero,

rosidinha, jelutong, perillo, niger gutta, tunu, balata, guttapercha, lechi capsii, sorva, gutta kay, and the like, and combinations thereof. Examples of synthetic elastomers include, without limitation, styrene-butadiene copolymers (SBR), polyisobutylene, isobutylene-isoprene copolymers, polyethylene, polyvinyl acetate and the like, and combinations thereof.

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Additional useful polymers include: crosslinked polyvinyl pyrrolidone, polymethylmethacrylate; copolymers of lactic acid, polyhydroxyalkanoates, plasticized ethylcellulose, polyvinyl acetatephthalate and combinations thereof.

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The amount of elastomer employed in the gum base may vary depending upon various factors such as the type of gum base used, the consistency of the gum composition desired and the other components used in the composition to make the final chewing gum product. In general, the elastomer will be present in the gum base in an amount from about 10% to about 60% by weight of the gum region, desirably from about 35% to about 40% by weight.

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In some embodiments, the gum base may include wax. It softens the polymeric elastomer mixture and improves the elasticity of the gum base. When present, the waxes employed will have a melting point below about 60°C., and preferably between about 45°C. and about 55°C. The low melting wax may be a paraffin wax. The wax may be present in the gum base in an amount from about 6% to about 10%, and preferably from about 7% to about 9.5%, by weight of the gum base.

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In addition to the low melting point waxes, waxes having a higher melting point may be used in the gum base in amounts up to about 5%, by weight of the gum base. Such high melting waxes include beeswax, vegetable wax, candelilla wax, caruba wax, most petroleum waxes, and the like, and mixtures thereof.

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In addition to the components set out above, the gum base may include a variety of other ingredients, such as components selected from elastomer solvents, emulsifiers, plasticizers, fillers, and mixtures thereof.

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The gum base may contain elastomer solvents to aid in softening the elastomer component. Such elastomer solvents may include those elastomer solvents known in the art, for example, terpinene resins such as polymers of alpha-pinene or beta-pinene, methyl,

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glycerol and pentaerythritol esters of rosins and modified rosins and gums such as hydrogenated, dimerized and polymerized rosins, and mixtures thereof. Examples of elastomer solvents suitable for use herein may include the pentaerythritol ester of partially hydrogenated wood and gum rosin, the pentaerythritol ester of wood and gum rosin, the
5 glycerol ester of wood rosin, the glycerol ester of partially dimerized wood and gum rosin, the glycerol ester of polymerized wood and gum rosin, the glycerol ester of tall oil rosin, the glycerol ester of wood and gum rosin and the partially hydrogenated wood and gum rosin and the partially hydrogenated methyl ester of wood and rosin, and the like, and mixtures thereof. The elastomer solvent may be employed in the gum base in amounts from about 2% to about
10 15%, and preferably from about 7% to about 11%, by weight of the gum base.

The gum base may also include emulsifiers which aid in dispersing the immiscible components into a single stable system. The emulsifiers useful in this invention include glyceryl monostearate, lecithin, fatty acid monoglycerides, diglycerides, propylene glycol
15 monostearate, and the like, and mixtures thereof. The emulsifier may be employed in amounts from about 2% to about 15%, and more specifically, from about 7% to about 11%, by weight of the gum base.

The gum base may also include plasticizers or softeners to provide a variety of
20 desirable textures and consistency properties. Because of the low molecular weight of these ingredients, the plasticizers and softeners are able to penetrate the fundamental structure of the gum base making it plastic and less viscous. Useful plasticizers and softeners include lanolin, palmitic acid, oleic acid, stearic acid, sodium stearate, potassium stearate, glyceryl triacetate, glyceryl lecithin, glyceryl monostearate, propylene glycol monostearate, acetylated
25 monoglyceride, glycerine, and the like, and mixtures thereof. Waxes, for example, natural and synthetic waxes, hydrogenated vegetable oils, petroleum waxes such as polyurethane waxes, polyethylene waxes, paraffin waxes, microcrystalline waxes, fatty waxes, sorbitan monostearate, tallow, propylene glycol, mixtures thereof, and the like, may also be incorporated into the gum base. The plasticizers and softeners are generally employed in the
30 gum base in amounts up to about 20% by weight of the gum base, and more specifically in amounts from about 9% to about 17%, by weight of the gum base.

Plasticizers also include are the hydrogenated vegetable oils and include soybean oil and cottonseed oil which may be employed alone or in combination. These plasticizers
35 provide the gum base with good texture and soft chew characteristics. These plasticizers and

softeners are generally employed in amounts from about 5% to about 14%, and more specifically in amounts from about 5% to about 13.5%, by weight of the gum base.

Anhydrous glycerin may also be employed as a softening agent, such as the commercially available United States Pharmacopeia (USP) grade. Glycerin is a syrupy liquid with a sweet warm taste and has a sweetness of about 60% of that of cane sugar. Because glycerin is hygroscopic, the anhydrous glycerin may be maintained under anhydrous conditions throughout the preparation of the chewing gum composition.

In some embodiments, the gum base of this invention may also include effective amounts of bulking agents such as mineral adjuvants which may serve as fillers and textural agents. Useful mineral adjuvants include calcium carbonate, magnesium carbonate, alumina, aluminum hydroxide, aluminum silicate, talc, tricalcium phosphate, dicalcium phosphate, calcium sulfate and the like, and mixtures thereof. These fillers or adjuvants may be used in the gum base compositions in various amounts. The amount of filler, may be present in an amount from about zero to about 40%, and more specifically from about zero to about 30%, by weight of the gum base. In some embodiments, the amount of filler will be from about zero to about 15%, more specifically from about 3% to about 11%.

A variety of traditional ingredients may be optionally included in the gum base in effective amounts such as coloring agents, antioxidants, preservatives, flavoring agents, and the like. For example, titanium dioxide and other dyes suitable for food, drug and cosmetic applications, known as F. D. & C. dyes, may be utilized. An anti-oxidant such as butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), propyl gallate, and mixtures thereof, may also be included. Other conventional chewing gum additives known to one having ordinary skill in the chewing gum art may also be used in the gum base.

Some embodiments extend to methods of making the center-fill gum compositions. The manner in which the gum base components are mixed is not critical and is performed using standard techniques and apparatus known to those skilled in the art. In a typical method, an elastomer is admixed with an elastomer solvent and/or a plasticizer and/or an emulsifier and agitated for a period of from 1 to 30 minutes. The remaining ingredients, such as the low melting point wax, are then admixed, either in bulk or incrementally, while the gum base mixture is blended again for 1 to 30 minutes.

The gum composition may include amounts of conventional additives selected from the group consisting of sweetening agents (sweeteners), plasticizers, softeners, emulsifiers, waxes, fillers, bulking agents (carriers, extenders, bulk sweeteners), mineral adjuvants, flavoring agents (flavors, flavorings), coloring agents (colorants, colorings), antioxidants, acidulants, thickeners, medicaments, and the like, and mixtures thereof. Some of these additives may serve more than one purpose. For example, in sugarless gum compositions, a sweetener, such as maltitol or other sugar alcohol, may also function as a bulking agent.

The plasticizers, softening agents, mineral adjuvants, waxes and antioxidants discussed above, as being suitable for use in the gum base, may also be used in the chewing gum composition. Examples of other conventional additives which may be used include emulsifiers, such as lecithin and glyceryl monostearate, thickeners, used alone or in combination with other softeners, such as methyl cellulose, alginates, carrageenan, xanthan gum, gelatin, carob, tragacanth, locust bean gum, pectin, alginates, galactomannans such as guar gum, carob bean gum, glucomannan, gelatin, starch, starch derivatives, dextrans and cellulose derivatives such as carboxy methyl cellulose, acidulants such as malic acid, adipic acid, citric acid, tartaric acid, fumaric acid, and mixtures thereof, and fillers, such as those discussed above under the category of mineral adjuvants.

In some embodiments, the gum region may also contain a bulking agent. Suitable bulking agents may be water-soluble and include sweetening agents selected from, but not limited to, monosaccharides, disaccharides, polysaccharides, sugar alcohols, and mixtures thereof; randomly bonded glucose polymers such as those polymers distributed under the tradename LitesseTM which is the brand name for polydextrose and is manufactured by Danisco Sweeteners, Ltd. of 41-51 Brighton Road, Redhill, Surrey, RH1 6YS, United Kingdom.; isomalt (a racemic mixture of alpha-D-glucopyranosyl-1,6-mannitol and alpha-D-glucopyranosyl-1,6-sorbitol manufactured under the tradename PALATINIT by Palatinit Sussungsmittel GmbH of Gotlieb-Daimler-Strause 12 a, 68165 Mannheim, Germany); maltodextrins; hydrogenated starch hydrolysates; hydrogenated hexoses; hydrogenated disaccharides; minerals, such as calcium carbonate, talc, titanium dioxide, dicalcium phosphate; celluloses; and mixtures thereof.

Suitable sugar bulking agents include monosaccharides, disaccharides and polysaccharides such as xylose, ribulose, glucose (dextrose), mannose, galactose, fructose

(levulose), sucrose (sugar), maltose, invert sugar, partially hydrolyzed starch and corn syrup solids, and mixtures thereof.

Suitable sugar alcohol bulking agents include sorbitol, xylitol, mannitol, galactitol,
5 maltitol, erythritol, isomalt and mixtures thereof.

Suitable hydrogenated starch hydrolysates include those disclosed in U.S. Pat. Nos. 25,959, 3,356,811, 4,279,931 and various hydrogenated glucose syrups and/or powders which contain sorbitol, hydrogenated disaccharides, hydrogenated higher polysaccharides, or
10 mixtures thereof. Hydrogenated starch hydrolysates are primarily prepared by the controlled catalytic hydrogenation of corn syrups. The resulting hydrogenated starch hydrolysates are mixtures of monomeric, dimeric, and polymeric saccharides. The ratios of these different saccharides give different hydrogenated starch hydrolysates different properties. Mixtures of hydrogenated starch hydrolysates, such as LYCASINTM, a commercially available product
15 manufactured by Roquette Freres of France, and HYSTARTM, a commercially available product manufactured by Lonza, Inc., of Fairlawn, N.J., are also useful.

The sweetening agents used may be selected from a wide range of materials including water-soluble sweeteners, water-soluble artificial sweeteners, water-soluble sweeteners
20 derived from naturally occurring water-soluble sweeteners, dipeptide based sweeteners, and protein based sweeteners, including mixtures thereof. Without being limited to particular sweeteners, representative categories and examples include:

(a) water-soluble sweetening agents such as dihydrochalcones, monellin, steviosides, glycyrrhizin, dihydroflavenol, and sugar alcohols such as sorbitol, mannitol, maltitol, xylitol,
25 erythritol, and L-aminodicarboxylic acid aminoalkenoic acid ester amides, such as those disclosed in U.S. Pat. No. 4,619,834, and mixtures thereof;

(b) water-soluble artificial sweeteners such as soluble saccharin salts, i.e., sodium or calcium saccharin salts, cyclamate salts, the sodium, ammonium or calcium salt of 3,4-dihydro-6-methyl-1,2,3-oxathiazine-4-one-2,2-dioxide, the potassium salt of 3,4-dihydro-6-methyl-1,2,3-oxathiazine-4-one-2,2-dioxide (Acesulfame-K), the free acid form of saccharin,
30 and mixtures thereof;

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Desirably, the sweetener is a high intensity sweetener such as aspartame, neotame, sucralose, and acesulfame potassium (Ace-K).

In general, an effective amount of sweetener may be utilized to provide the level of sweetness desired, and this amount may vary with the sweetener selected. In some embodiments the amount of sweetener may be present in amounts from about 0.001% to about 3%, by weight of the gum composition, depending upon the sweetener or combination of sweeteners used. The exact range of amounts for each type of sweetener may be selected by those skilled in the art.

The flavoring agents which may be used include those flavors known to the skilled artisan, such as natural and artificial flavors. These flavorings may be chosen from synthetic flavor oils and flavoring aromatics and/or oils, oleoresins and extracts derived from plants, leaves, flowers, fruits, and so forth, and combinations thereof. Nonlimiting representative flavor oils include spearmint oil, cinnamon oil, oil of wintergreen (methyl salicylate), peppermint oil, clove oil, bay oil, anise oil, eucalyptus oil, thyme oil, cedar leaf oil, oil of nutmeg, allspice, oil of sage, mace, oil of bitter almonds, and cassia oil. Also useful flavorings are artificial, natural and synthetic fruit flavors such as vanilla, and citrus oils including lemon, orange, lime, grapefruit, and fruit essences including apple, pear, peach, grape, strawberry, raspberry, cherry, plum, pineapple, apricot and so forth. These flavoring agents may be used in liquid or solid form and may be used individually or in admixture. Commonly used flavors include mints such as peppermint, menthol, spearmint, artificial vanilla, cinnamon derivatives, and various fruit flavors, whether employed individually or in admixture. Flavors may also provide breath freshening properties, particularly the mint flavors when used in combination with the cooling agents, described herein below.

Other useful flavorings include aldehydes and esters such as cinnamyl acetate, cinnamaldehyde, citral diethylacetal, dihydrocarvyl acetate, eugenyl formate, p-methylamisol, and so forth may be used. Generally any flavoring or food additive such as those described in Chemicals Used in Food Processing, publication 1274, pages 63-258, by the National Academy of Sciences, may be used. This may include natural as well as synthetic flavors.

Further examples of aldehyde flavorings include but are not limited to acetaldehyde (apple), benzaldehyde (cherry, almond), anisic aldehyde (licorice, anise), cinnamic aldehyde (cinnamon), citral, i.e., alpha-citral (lemon, lime), neral, i.e., beta-citral (lemon, lime), decanal (orange, lemon), ethyl vanillin (vanilla, cream), heliotrope, i.e., piperonal (vanilla, cream), vanillin (vanilla, cream), alpha-amyl cinnamaldehyde (spicy fruity flavors),

butyraldehyde (butter, cheese), valeraldehyde (butter, cheese), citronellal (modifies, many types), decanal (citrus fruits), aldehyde C-8 (citrus fruits), aldehyde C-9 (citrus fruits), aldehyde C-12 (citrus fruits), 2-ethyl butyraldehyde (berry fruits), hexenal, i.e., trans-2 (berry fruits), tolyl aldehyde (cherry, almond), veratraldehyde (vanilla), 2,6-dimethyl-5-heptenal, 5 i.e., melonal (melon), 2,6-dimethyloctanal (green fruit), and 2-dodecenal (citrus, mandarin), cherry, grape, blueberry, blackberry, strawberry shortcake, and mixtures thereof.

In some embodiments, the flavoring agent may be employed in either liquid form and/or dried form. When employed in the latter form, suitable drying means such as spray 10 drying the oil may be used. Alternatively, the flavoring agent may be absorbed onto water soluble materials, such as cellulose, starch, sugar, maltodextrin, gum arabic and so forth or may be encapsulated. The actual techniques for preparing such dried forms are well-known.

In some embodiments, the flavoring agents may be used in many distinct physical 15 forms well-known in the art to provide an initial burst of flavor and/or a prolonged sensation of flavor. Without being limited thereto, such physical forms include free forms, such as spray dried, powdered, beaded forms, encapsulated forms, and mixtures thereof.

The amount of flavoring agent employed herein may be a matter of preference subject 20 to such factors as the type of final chewing gum composition, the individual flavor, the gum base employed, and the strength of flavor desired. Thus, the amount of flavoring may be varied in order to obtain the result desired in the final product and such variations are within the capabilities of those skilled in the art without the need for undue experimentation. In gum compositions, the flavoring agent is generally present in amounts from about 0.02% to about 25 5%, and more specifically from about 0.1% to about 2%, and even more specifically, from about 0.8% to about 1.8%, by weight of the chewing gum composition.

Coloring agents may be used in amounts effective to produce the desired color. The coloring agents may include pigments which may be incorporated in amounts up to about 30 6%, by weight of the gum composition. For example, titanium dioxide may be incorporated in amounts up to about 2%, and preferably less than about 1%, by weight of the gum composition. The colorants may also include natural food colors and dyes suitable for food, drug and cosmetic applications. These colorants are known as F.D.& C. dyes and lakes. The materials acceptable for the foregoing uses are preferably water-soluble. Illustrative 35 nonlimiting examples include the indigoid dye known as F.D.& C. Blue No.2, which is the

disodium salt of 5,5-indigotindisulfonic acid. Similarly, the dye known as F.D.& C. Green No.1 comprises a triphenylmethane dye and is the monosodium salt of 4-[4-(N-ethyl-p-sulfoniumbenzylamino) diphenylmethylene]-[1-(N-ethyl -N-p-sulfoniumbenzyl)-delta-2,5-cyclohexadieneimine]. A full recitation of all F.D.& C. colorants and their corresponding chemical structures may be found in the Kirk-Othmer Encyclopedia of Chemical Technology, 3rd Edition, in volume 5 at pages 857-884.

Suitable oils and fats usable in gum compositions include partially hydrogenated vegetable or animal fats, such as coconut oil, palm kernel oil, beef tallow, and lard, among others. These ingredients when used are generally present in amounts up to about 7%, and preferably up to about 3.5%, by weight of the gum composition.

Some embodiments may include a method for preparing the improved chewing gum compositions for the gum region, including both chewing gum and bubble gum compositions. The chewing gum compositions may be prepared using standard techniques and equipment known to those skilled in the art. The apparatus useful in accordance with some embodiments comprises mixing and heating apparatus well known in the chewing gum manufacturing arts, and therefore the selection of the specific apparatus will be apparent to the artisan.

With respect to the center-fill layer, the gum region may have a water activity greater than or equal to the water activity of the center-fill composition. However, in compositions wherein a greater water activity is desired in the center or liquid-fill, the water activity of the center-fill composition may be greater than that of the gum region. A higher moisture content will aid in hydration of thickeners like xanthan gum and cellulose when present in the center-fill.

The gum region may have a total moisture content of about 14% by weight of the gum region and more specifically may have a total moisture content from about 9% to about 14% by weight, with a free moisture content of less than about 5%. The center-fill further may have total moisture content including free and bound moisture from about zero up to about 35% by weight of said center-fill, specifically about 22%.

Liquid-fill composition

The center-fill or liquid-fill composition may include any components known in the art for incorporation with a center-fill composition. This may include glycerine in addition to

one or more other polyols in amounts greater than zero up to about 20%, more specifically, up to about 10% by weight of the total chewing gum composition, i.e., including a center-fill composition, a gum region and a coating. More desirably, the center-fill is approximately 8%
5 by weight of the total chewing gum composition. The other polyol component includes desirably maltitol, sorbitol, xylitol, or a combination thereof.

The liquid centers may contain those traditional ingredients well known in the chewing gum and confectionery arts, such as flavoring agents, sweetening agents, and the
10 like, and mixtures thereof, as described above. In addition to confectionery additives, the liquid centers may also contain pharmaceutical additives such as medicaments, breath fresheners, vitamins, minerals, caffeine, fruit juices, and the like, and mixtures thereof. The confectionery and pharmaceutical agents may be used in many distinct physical forms well known in the art to provide an initial burst of sweetness and flavor and/or therapeutic activity
15 or a prolonged sensation of sweetness and flavor and/or therapeutic activity. Without being limited thereto, such physical forms include free forms, such as spray dried, powdered, and beaded forms, and encapsulated forms, and mixtures thereof. Illustrative, but not limiting, examples of liquid centers suitable for use in some embodiments include those centers disclosed in U.S. Pat. Nos. 3,894,154, 4,156,740, 4,157,402, 4,316,915, and 4,466,983.
20 Specific examples of suitable additional components include taurine, guarana, vitamins, ActizolTM, chlorophyll, RecaldentTM tooth whitening technology, and RetsynTM.

The center-fill composition also may include a natural or synthetic gum such as carboxymethylcellulose, pectin, propylene glycol aginate, agar and gum tragacanth. These compositions serve to increase viscosity by reducing the amount of free water in the
25 composition. The viscosity of the center-fill may range from about 300 cp to about 6,000 cp at 25°C. In liquid-fill compositions which have a greater water activity than the surrounding gum region, the viscosity may range from about 3,000 cp to about 6,000 cp at 25°C.

Xanthan gum may also be used to increase the viscosity of the center-fill composition. Increasing viscosity of the liquid also helps prevent the liquid from leaking through the gum
30 piece. Xanthan gum is available under the tradename Keltrol® from Signet Chemical Corporation.

Some embodiments extend to methods of making the improved center-filled chewing gum compositions. The improved compositions may be prepared using standard techniques and equipment known to those skilled in the art. The apparatus useful in accordance with the
 5 embodiments described herein comprises mixing and heating apparatus well known in the chewing gum manufacturing arts, and therefore the selection of the specific apparatus will be apparent to the artisan. Such methods and apparatus are disclosed, for example, in U.S. Pat. Nos. 3,806,290 and 3,857,963.

Coating composition

10 The coating composition, when included in the center-fill compositions, may be applied by any method known in the art including the method described above. The coating composition may be present in an amount from about 2% to about 60%, more specifically from about 25% to about 35% by weight of the total center-filled gum piece, even more specifically about 30% by weight of the gum piece.

15 The outer coating may be hard or crunchy. Typically, the outer coating may include sorbitol, maltitol, xylitol, erythritol, isomalt, and other crystallizable polyols; sucrose may also be used. Furthermore the coating may include several opaque layers, such that the chewing gum composition is not visible through the coating itself, which can optionally be covered with a further one or more transparent layers for aesthetic, textural and protective
 20 purposes. The outer coating may also contain small amounts of water and gum arabic. The coating can be further coated with wax. The coating may be applied in a conventional manner by successive applications of a coating solution, with drying in between each coat. As the coating dries it usually becomes opaque and is usually white, though other colorants may be added. A polyol coating can be further coated with wax. The coating can further include
 25 colored flakes or speckles. If the composition comprises a coating, it is possible that one or more oral care actives can be dispersed throughout the coating. This is especially preferred if one or more oral care actives is incompatible in a single phase composition with another of the actives. Flavors may also be added to yield unique product characteristics.

30 The coating may also be formulated to assist with increasing the thermal stability of the gum piece and preventing leaking of the liquid fill. In some embodiments, the coating may include a gelatin composition. The gelatin composition may be added as a 40% by weight solution and may be present in the coating composition from about 5% to about 10%

by weight of the coating composition, and more specifically about 7% to about 8%. The gel strength of the gelatin may be from about 130 bloom to about 250 bloom.

Other materials may be added to the coating to achieve desired properties. These materials may include without limitations, cellulose such as carboxymethyl cellulose, gelatin, pullulan, alginate, starch, carrageenan, xanthan gum, gum arabic and polyvinyl acetate (PVA).

The coating composition may also include a pre-coating which is added to the individual gum pieces prior to an optional hard coating. The pre-coating may include an application of polyvinyl acetate (PVA). This may be applied as a solution of PVA in a solvent, such as ethyl alcohol. When an outer hard coating is desired, the PVA application may be approximately 3% to 4% by weight of the total coating or about 1% of the total weight of the gum piece (including a liquid-fill, gum region and hard coating).

Additional Components

Additional additives, such as physiological cooling agents, throat-soothing agents, spices, warming agents, tooth-whitening agents, breath-freshening agents, vitamins minerals, caffeine, drugs and other actives may also be included in any or all portions or regions of the chewing gum composition. Such components may be used in amounts sufficient to achieve their intended effects.

With respect to cooling agents, a variety of well known cooling agents may be employed. For example, among the useful cooling agents are included menthol, xylitol, menthane, menthone, ketals, menthone ketals, menthone glycerol ketals, substituted p-menthanes, acyclic carboxamides, substituted cyclohexanamides, substituted cyclohexane carboxamides, substituted ureas and sulfonamides, substituted menthanols, hydroxymethyl and hydroxymethyl derivatives of p-menthane, 2-mercapto-cyclo-decanone, 2-isopropyl-5-methylcyclohexanol, hydroxycarboxylic acids with 2-6 carbon atoms, cyclohexanamides, menthyl acetate, menthyl lactate, menthyl salicylate, N,2,3-trimethyl-2-isopropyl butanamide (WS-23), N-ethyl-p-menthane-3-carboxamide (WS-3), menthyl succinate, 3,1-menthoxypropane 1,2-diol, among others. These and other suitable cooling agents are further described in the following U.S. patents, U.S. 4,230,688 and 4,032,661 to Rowsell et al.; 4,459,425 to Amano et al.; 4,136,163 to Watson et al.; 5,266,592 to Grub et al.; and U.S. Patent No. 6,627,233 to Wolf et

al. These cooling agents may be present in one or more of the outer gum coatings, the gum region surrounding the liquid fill, the liquid fill per se, or in any combination of those three gum areas. Cooling agents, when used in the outer coating composition for the gum, are
5 generally present in amount of 0.01% to about 1.0%. When used in the other portions of the gum, such as the gum region or the center fill, they may be present in amounts of about 0.001 to about 10% by weight of the total chewing gum piece.

Warming components may be selected from a wide variety of compounds known to
10 provide the sensory signal of warming to the user. These compounds offer the perceived sensation of warmth, particularly in the oral cavity, and often enhance the perception of flavors, sweeteners and other organoleptic components. Among the useful warming compounds included are vanillyl alcohol n-butylether (TK-1000) supplied by Takasago
15 Perfumary Company Limited, Tokyo, Japan, vanillyl alcohol n-propylether, vanillyl alcohol isopropylether, vanillyl alcohol isobutylether, vanillyl alcohol n-aminoether, vanillyl alcohol isoamylether, vanillyl alcohol n-hexylether, vanillyl alcohol methylether, vanillyl alcohol ethylether, gingerol, shogaol, paradol, zingerone, capsaicin, dihydrocapsaicin, nordihydrocapsaicin, homocapsaicin, homodihydrocapsaicin, ethanol, isopropyl alcohol, iso-
20 amylalcohol, benzyl alcohol, glycerine, and combinations thereof.

The sensation of warming or cooling effects may be prolonged with the use of a hydrophobic sweetener as described in U.S. Patent Application Publication 2003/0072842 A1 to Johnson et al. which is incorporated in its entirety herein by reference. For example, such hydrophobic sweeteners include those of the formulae I-XI referenced therein. Perillartine may also be added as described in U.S. Patent No. 6,159,509.

The breath freshening agents may include in addition to the flavors and cooling agents described hereinabove, a variety of compositions with odor controlling properties. These may include, without limitation, cyclodextrin and magnolia bark extract. The breath freshening agents may further be encapsulated to provide a prolonged breath freshening effect. Examples of malodor-controlling compositions are included in U.S. Patent No.
30 5,300,305 to Stapler et al. and in U.S. Patent Application Publication Nos. 2003/0215417 and 2004/0081713.

As described above, a variety of oral care products may also be included in some embodiments of chewing gums. These may include tooth whiteners, stain removers and anticalculus agents. Examples of these include, but are not limited to hydrolytic agents including proteolytic enzymes, abrasives such as hydrated silica, calcium carbonate, sodium bicarbonate and alumina, other active stain-removing components such as surface-active agents, such as anionic surfactants such as sodium stearate, sodium palminate, sulfated butyl oleate, sodium oleate, salts of fumaric acid, glycerol, hydroxylated lecithin, sodium lauryl sulfate and chelators such as polyphosphates, which are typically employed in dentifrice compositions as tartar control ingredients. Also included are tetrasodium pyrophosphate and sodium tri-polyphosphate, sodium tripolyphosphate, xylitol, hexametaphosphate, and an abrasive silica. Further examples are included in the following U.S. Patents: U.S. Patent Nos. 5,227,154 to Reynolds, 5,378,131 to Greenberg and 6,685,916 to Holme et al.

A variety of drugs, including medications, herbs, and nutritional supplements may also be included in the gum formulations. Examples of useful drugs include ace-inhibitors, antianginal drugs, anti-arrhythmias, anti-asthmatics, anti-cholesterolemics, analgesics, anesthetics, anti-convulsants, anti-depressants, anti-diabetic agents, anti-diarrhea preparations, antidotes, anti-histamines, anti-hypertensive drugs, anti-inflammatory agents, anti-lipid agents, anti-manics, anti-nauseants, anti-stroke agents, anti-thyroid preparations, anti-tumor drugs, anti-viral agents, acne drugs, alkaloids, amino acid preparations, anti-tussives, anti-uricemic drugs, anti-viral drugs, anabolic preparations, systemic and non-systemic anti-infective agents, anti-neoplastics, anti-parkinsonian agents, anti-rheumatic agents, appetite stimulants, biological response modifiers, blood modifiers, bone metabolism regulators, cardiovascular agents, central nervous system stimulates, cholinesterase inhibitors, contraceptives, decongestants, dietary supplements, dopamine receptor agonists, endometriosis management agents, enzymes, erectile dysfunction therapies such as sildenafil citrate, which is currently marketed as Viagra®, fertility agents, gastrointestinal agents, homeopathic remedies, hormones, hypercalcemia and hypocalcemia management agents, immunomodulators, immunosuppressives, migraine preparations, motion sickness treatments, muscle relaxants, obesity management agents, osteoporosis preparations, oxytocics, parasympatholytics, parasympathomimetics, prostaglandins, psychotherapeutic agents, respiratory agents, sedatives, smoking cessation aids such as bromocryptine or nicotine, sympatholytics, tremor preparations, urinary tract agents, vasodilators, laxatives, antacids, ion exchange resins, anti-pyretics, appetite suppressants, expectorants, anti-anxiety agents, anti-

ulcer agents, anti-inflammatory substances, coronary dilators, cerebral dilators, peripheral vasodilators, psycho-tropics, stimulants, anti-hypertensive drugs, vasoconstrictors, migraine treatments, antibiotics, tranquilizers, anti-psychotics, anti-tumor drugs, anti-coagulants, anti-thrombotic drugs, hypnotics, anti-emetics, anti-nauseants, anti-convulsants, neuromuscular
5 drugs, hyper- and hypo-glycemic agents, thyroid and anti-thyroid preparations, diuretics, anti-spasmodics, terine relaxants, anti-obesity drugs, erythropoietic drugs, anti-asthmatics, cough suppressants, mucolytics, DNA and genetic modifying drugs, and combinations thereof.

Examples of active ingredients contemplated for use in the present invention include
10 antacids, H2-antagonists, and analgesics. For example, antacid dosages can be prepared using the ingredients calcium carbonate alone or in combination with magnesium hydroxide, and/or aluminum hydroxide. Moreover, antacids can be used in combination with H2-antagonists.

15 Analgesics include opiates and opiate derivatives, such as Oxycontin, ibuprofen, aspirin, acetaminophen, and combinations thereof that may optionally include caffeine.

Other drug ingredients for use in embodiments include anti-diarrheals such as immodium AD, anti-histamines, anti-tussives, decongestants, vitamins, and breath fresheners.
20 Also contemplated for use herein are anxiolytics such as Xanax; anti-psychotics such as clozaril and Haldol; non-steroidal anti-inflammatories (NSAID's) such as ibuprofen, naproxen sodium, Voltaren and Lodine, anti-histamines such as Claritin, Hismanal, Relafen, and Tavist; anti-emetics such as Kytril and Cesamet; bronchodilators such as Bentolin, Proventil; anti-depressants such as Prozac, Zoloft, and Paxil; anti-migraines such as Imigra,
25 ACE-inhibitors such as Vasotec, Capoten and Zestril; anti-Alzheimer's agents, such as Nicergoline; and CaH-antagonists such as Procardia, Adalat, and Calan.

The popular H2-antagonists which are contemplated for use in the present invention include cimetidine, ranitidine hydrochloride, famotidine, nizatidien, ebrotidine, mifentidine,
30 roxatidine, pisatidine and aceroxatidine.

Active antacid ingredients include, but are not limited to, the following: aluminum hydroxide, dihydroxyaluminum aminoacetate, aminoacetic acid, aluminum phosphate, dihydroxyaluminum sodium carbonate, bicarbonate, bismuth aluminate, bismuth carbonate,
35 bismuth subcarbonate, bismuth subgallate, bismuth subnitrate, bismuth subsilysilate, calcium

carbonate, calcium phosphate, citrate ion (acid or salt), amino acetic acid, hydrate magnesium
aluminate sulfate, magaldrate, magnesium aluminosilicate, magnesium carbonate,
magnesium glycinate, magnesium hydroxide, magnesium oxide, magnesium trisilicate, milk
solids, aluminum mono-ordibasic calcium phosphate, tricalcium phosphate, potassium
5 bicarbonate, sodium tartrate, sodium bicarbonate, magnesium aluminosilicates, tartaric acids
and salts.

A variety of other nutritional supplements may also be included in the gum
compositions. Virtually any vitamin or mineral may be included. For example, vitamin A,
10 vitamin C, vitamin D, vitamin E, vitamin K, vitamin B₆, vitamin B₁₂, thiamine, riboflavin,
biotin, folic acid, niacin, pantothenic acid, sodium, potassium, calcium, magnesium,
phosphorus, sulfur, chlorine, iron, copper, iodine, zinc, selenium, manganese, choline,
chromium, molybdenum, fluorine, cobalt and combinations thereof, may be used.

15 Examples of nutritional supplements are set forth in U.S. Patent Application
Publication Nos. 2003/0157213 A1, 2003/0206993 and 2003/0099741 A1.

Various herbs may also be included such as those with various medicinal or dietary
supplement properties. Herbs are generally aromatic plants or plant parts that can be used
20 medicinally or for flavoring. Suitable herbs can be used singly or in various mixtures.
Commonly used herbs include Echinacea, Goldenseal, Calendula, Aloe, Blood Root,
Grapefruit Seed Extract, Black Cohosh, Cranberry, Ginko Biloba, St. John's Wort, Evening
Primrose Oil, Yohimbe Bark, Green Tea, Maca, Bilberry, Lutein, and combinations thereof.

25 The features and advantages of the present invention are more fully shown by the
following examples which are provided for purposes of illustration, and are not to be
construed as limiting the invention in any way.

30

EXAMPLES**Examples A-H****Table 1 - Gum Region Composition**

Component	% by weight							
	A	B	C	D	E	F	G	H
Gum base*	28-42	28-42	28-42	28-42	28-42	28-42	28-42	28-42
Lecithin	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05
Maltitol	52-55	45-50	46-50	50-54	52-57	45-55	47-52	50-55
Sorbitol	0	0-10	5-10	0-5	0-5	5-10	0-5	0-5
Lycasin TM	0	0	0.25	0.25	0.25	0.25	0.25	0.25
Flavors	2.50	2.50	2.26	2.26	2.26	2.50	2.50	2.50
Cooling agent	0.08	0.08	0	0	0	0.08	0.08	0.08
Acidulants	1.2	1.2	0	0	0	1.2	1.2	1.2
Intense sweetener	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40

* gum base may include 3% to 11% by weight of a filler such as, for example, talc, dicalcium phosphate, and calcium carbonate (the amount of filler in the gum base is based on the weight percent of the gum region composition, for example, in the above compositions A-H, if a gum region composition includes 5% filler, the amount of gum base will be 5% less than the range recited in the table, i.e., from 23-37%)

Table 2 - Liquid- fill Composition

Component	% by weight							
	A	B	C	D	E	F	G	H
Glycerin	63.00	63.00	63.00	30.00	63.00	63.00	1.50	63.00
Lycasin TM	29.26	29.26	29.49	56.00	29.49	29.17	65.22	29.17
Sorbitol solution	3.25	3.25	3.28	7.50	3.28	3.24	28.60	3.24
Sodium carboxymethyl cellulose	0.08	0.008	0.15	0.25	0.15	0.20	0.20	0.20
Color	0.004	0.004	0.0004	0.004	0.0004	0.004	0.004	0.004
Flavors	1.30	1.30	4.00	4.00	4.00	0.30	1.40	0.30
Cooling agent	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Citric acid	3.00	3.00	0	2.17	0	3.00	3.00	3.00
Intense sweetener	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02

Table 3 - Coating Composition

Component	% by weight							
	A	B	C	D	E	F	G	H
Maltitol	95.02	95.02	95.36	95.36	95.36	95.02	95.02	95.02
Bleached gum Arabic	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
Titanium dioxide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Flavors	1.07	1.07	0.51	0.51	0.51	1.07	1.07	1.07
Cooling agent	0.08	0.08	0.15	0.15	0.15	0.08	0.08	0.08
Intense sweetener	0.08	0.08	0.23	0.23	0.23	0.08	0.08	0.08
Color	0	0	0	0	0	0	0	0
Candelilla wax	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Gum pieces including three regions: liquid fill, gum region and coating are prepared according to the compositions in Tables 1-3 above with each region according to the corresponding components for compositions A-H.

The compositions for the gum regions are prepared by first combining talc, where present, with the gum base under heat at about 85°C. This combination is then mixed with the maltitol, lecithin and other polyols for six minutes. The flavor blends which include a pre-mix of the flavors and cooling agents are added and mixed for 1 minute. Finally, the acids and intense sweeteners are added and mixed for 5 minutes.

The liquid fill composition is then prepared by first preparing a pre-mix of the sodium carboxymethyl cellulose, glycerine, and polyols. This pre-mix is then combined with the colors, flavors, cooling agents, acids and intense sweeteners and mixed.

The gum region and liquid-fill compositions are then extruded together and formed into tablets by the process described above at paragraphs [0027] to [0030] above. The gum pieces each have a total weight of approximately 2.2g. In the final gum pieces, the gum region is about 62% by weight, the liquid-fill is about 8% by weight, and the coating is about 30% by weight.

Gum pieces that are prepared by compositions A-H demonstrate no noticeable loss of liquidity of the liquid-fill after accelerated aging at 37°C for a three week period.

Examples I-P**Table 4 - Gum Region Composition**

Component	% by weight							
	I	J	K	L	M	N	O	P
Gum base - with SBR	28-42	0	28-42	0	28-42	0	28-42	28-42
Gum base - with polyisobutylene	0	28-42	0	28-42	0	28-42	0	0
Lecithin	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05
Maltitol	52-55	45-50	46-50	50-54	52-57	45-55	47-52	50-55
Sorbitol	0	0-10	5-10	0-5	0-5	5-10.00	0-5	0-5
Lycasin TM	0	0	0.25	0.25	0.25	0.25	0.25	0.25
Flavors	2.50	2.50	2.26	2.26	2.26	2.5	2.5	2.5
Cooling agent	0.08	0.08	0	0	0	0.08	0.08	0.08
Acidulants	1.2	1.2	0	0	0	1.2	1.2	1.2
Intense sweetener	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
Caffeine	0	0	0	14.66	0	0	0	0
Vitamin C	0	0	0	0	0	7.00	0	0

Table 5 - Liquid- fill Composition

Component	% by weight							
	I	J	K	L	M	N	O	P
Glycerin	63.00	62.95	63.00	63.00	62.95	63.00	58.00	63.00
Lycasin TM	29.26	29.26	29.49	29.49	29.49	29.17	29.17	29.17
Sorbitol solution	3.25	3.25	3.28	3.28	3.28	3.24	3.24	3.24
Sodium carboxymethyl cellulose	0.08	0.008	0.15	0.15	0.15	0.20	0.20	0.20
Color	0.004	0.004	0.0004	0.0004	0.0004	0.004	0.004	0.004
Flavors	1.30	1.30	4.00	4.00	4.00	0.30	0.30	0.30
Cooling agent	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Citric acid	3.00	3.00	0	0	0	3.00	3.00	3.00
Intense sweetener	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02
Dextromethorphan hydrobromide	0	0	0	0	0	0	5	0
Xanthan gum	0	0.05	0	0	0.05	0	0	0

Table 6 - Coating Composition

Component	% by weight							
	I	J	K	L	M	N	O	P
Maltitol	87.52	95.02	94.36	87.86	95.36	95.02	95.02	94.02
Bleached gum Arabic	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
Titanium dioxide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Flavors	1.07	1.07	0.51	0.51	0.51	1.07	1.07	1.07
Cooling agent	0.08	0.08	0.15	0.15	0.15	0.08	0.08	0.08
Intense sweetener	0.08	0.08	0.23	0.23	0.23	0.08	0.08	0.08
Color	0	0	0	0	0	0	0	0
Candelilla wax	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Gelatin (40% solution)	7.5	0	0	7.5	0	0	0	0
Polyvinyl alcohol	0	0	1.0	0	0	0	0	1.0

- 5 Gum pieces including three regions, i.e., liquid fill, gum region and coating, are prepared according to the compositions in Tables 4-6 above, with each region according to the corresponding component for compositions I-P.

The gum pieces of examples I-P are prepared by the same method set forth for examples A-H, above, with changes as set forth below. The individual gum pieces are approximately 2.2g.

5 For examples J and M, the addition of xanthan gum may be added to the liquid-fill as part of the sodium carboxymethyl cellulose (CMC) pre-mix which may include CMC, glycerin and polyols.

10 For examples L and N, the caffeine and vitamin C, respectively, may be added and mixed with the maltitol, lecithin and other polyols.

For example O, the dextromethorphan hydrobromide may be added with the colors, flavors, cooling agents, acids and intense sweeteners prior to mixing.

15 For examples K and P the polyvinyl acetate (PVA) may be added as a pre-coating prior to the addition of the remaining coating ingredients. This may form a layer of PVA immediately in contact with and completely surrounding the gum region.

Table 7 - Gum Region Composition

Component	% by weight							
	Q	R	S	T	U	V	W	X
Gum base*	28-42	28-42	28-42	28-42	28-42	28-42	28-42	28-42
Lecithin	0.25	0.25	0.05	0.05	0.05	0.05	0.05	0.05
Maltitol	52-55	45-50	46-50	50-54	52-57	45-55	47-52	50-55
Sorbitol	0	0-10	5-10	0-5	0-5	5-10	0-5	0-5
Lycasin TM	0	0	0.25	0.25	0.25	0.25	0.25	0.25
Flavors	2.50	2.50	2.26	2.26	2.26	2.50	2.50	2.50
Cooling agent	0.08	0.08	0	0	0	0.08	0.08	0.08
Acidulants	1.2	1.2	0	0	0	1.2	1.2	1.2
Intense sweetener	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40

20 * gum base may include 3% to 11% by weight of a filler such as, for example, talc, dicalcium phosphate, and calcium carbonate (the amount of filler in the gum base is based on the weight percent of the gum region composition, for example, in the above compositions A-H, if a gum region composition includes 5% filler, the amount of gum base will be 5% less than the range recited in the table, i.e., from 23-37%)

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Table 8(1) - Liquid- fill Composition

Component	% by weight							
	Q1	R1	S1	T1	U1	V1	W1	X1
Glycerin	40	30	1	1.5	1	1.5	1.5	0
Lycasin	52.256	62.328	64.7696	69.2696	94.7696	47.416	0	76.416
Sorbitol solution	3.25	3.25	30	25	0	47.5	94.916	20
Sodium carboxymethyl cellulose	0.08	0.008	0.15	0.15	0.15	0.20	0.20	0.20
Color	0.004	0.004	0.0004	0.0004	0.0004	0.004	0.004	0.004
Flavors ¹	1.30	1.30	4.00	4.00	4.00	0.30	0.30	0.30
Cooling agent	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Citric acid	3.00	3.00	0	0	0	3.00	3.00	3.00
Intense sweetener	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02

¹ peppermint, spearmint, wintergreen**Table 8(2) - Liquid- fill Composition**

Component	% by weight							
	Q2	R2	S2	T2	U2	V2	W2	X2
Glycerin	40	30	1	1.5	1	1.5	1.5	0
Lycasin	52.156	62.228	64.7196	69.2696	94.7696	47.286	0	76.331
Sorbitol solution	3.25	3.25	30	25	0	47.5	94.916	20
Sodium carboxymethyl cellulose	0.08	0.008	0.15	0.15	0.15	0.20	0.20	0.20
Xanthan gum	0.1	0.1	0.05	0	0	0.05	0.1	0.025
Color	0.004	0.004	0.0004	0.0004	0.0004	0.004	0.004	0.004
Fruit flavors ¹	1.30	1.30	4.00	4.00	4.00	0.30	0.30	0.30
Cooling agent	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Citric acid	3.00	3.00	0	0	0	3.00	3.00	3.00
Intense sweetener	0.05	0.05	0.02	0.02	0.02	0.01	0.075	0.08

¹ lime, blackberry

Table 9 - Coating Composition

Component	% by weight							
	Q	R	S	T	U	V	W	X
Maltitol	90.85	94.13	91.67	88.67	94.17	95.33	95.33	95.33
Bleached gum Arabic	6.72	0	7	10	0	0	1.5	1.5
Gelatin	0	4.2	0	0	4.5	3	1.5	1.5
Titanium dioxide	1.12	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Flavors	1.07	1.07	0.51	0.51	0.51	1.07	1.07	1.07
Cooling agent	0.08	0.08	0.15	0.15	0.15	0.08	0.08	0.08
Intense sweetener	0.08	0.08	0.23	0.23	0.23	0.08	0.08	0.08
Color	0	0	0	0	0	0	0	0
Candelilla wax	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Gum pieces including three regions: liquid fill, gum region and coating are prepared according to the compositions in Tables 7-9 above with each region according to the corresponding components for compositions Q-X, with the liquid fill being chosen from either table 8(1) or 8(2).

The gum pieces of examples Q-X are prepared by the same method set forth for examples A-H, above, with changes as set forth below. The individual gum pieces are approximately 2.2g.

These gum pieces exhibit stability similar to that of compositions A-H.

While there have been described what are presently believed to be the preferred embodiments of the invention, those skilled in the art will realize that changes and modifications may be made thereto without departing from the spirit of the invention, and it is intended to include all such changes and modifications as fall within the true scope of the invention.

CLAIMS:

1. A chewing gum composition comprising:

- (a) a liquid-fill composition; and
- (b) a gum region surrounding said liquid-fill composition,
said gum region comprising a gum base;

wherein:

said gum region further comprises a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region,

wherein after three weeks at 37°C said chewing gum composition exhibits a reduced loss of said liquid-fill composition into said gum region.

2. The composition of claim 1, wherein said liquid-fill comprises a flavor comprising from about 0.1% to about 5% by weight of said liquid fill composition.

3. The compositions of claim 1 wherein said liquid-fill comprises glycerin up to 65%.

4. The composition of claim 1 further comprising;

- (c) a third region; said third region surrounding a portion of said gum region.

5. The composition of claim 4, wherein said third region comprises a coating including gum arabic or gelatin.

6. The composition of claim 1, wherein said maltitol is genetically modified organism-free (GMO-free) maltitol.

7. The composition of claim 1, wherein said composition is free of sorbitol in said gum region.

8. The composition of claim 1, wherein said polyol composition comprises at least two polyols selected from the group consisting of maltitol, sorbitol, mannitol, xylitol, erythritol, lactitol, isomalt, and combinations thereof.

9. The composition of claim 4, wherein:

(a) said liquid-fill composition comprises up to 20% by weight of said chewing gum composition;

(b) said gum region comprises from about 40% to about 97% by weight of said chewing gum composition; and

(c) said third region comprises from about 2% to about 60% by weight of said chewing gum composition.

10. The composition of claim 1, wherein said gum region further comprises a gum base including at least one elastomer selected from the group consisting of natural rubber, styrene-butadiene copolymers (SBR), polyisobutylene, isobutylene-isoprene copolymers, polyethylene, polyvinyl acetate (PVA), crosslinked polyvinyl pyrrolidone, polymethylmethacrylate, copolymers of lactic acid, polyhydroxyalkanoates, plasticized ethylcellulose, polyvinyl acetatephthalate and combinations thereof.

11. The composition of claim 1, wherein said liquid-fill composition comprises glycerine and one or more polyols.

12. The composition of claim 11, wherein polyol in said liquid-fill composition comprises maltitol, sorbitol, or a combination of both.

13. The composition of claim 1, wherein said liquid-fill composition comprises a thickener selected from xanthan gum, carboxy methyl cellulose, carrageenan, pectin, alginates, cellulose derivatives, locust bean gum, galactomannans, guar gum, carob bean gum, glucomannan, gelatin, starch, starch derivatives, dextrans, pullulan, hydrolyzed natural gums, and combinations thereof.

14. The composition of claim 4, wherein said third region comprises a member selected from sugar, maltitol, sorbitol, mannitol, xylitol, erythritol, lactitol, isomalt, and combinations thereof.
15. The composition of claim 4, wherein said third region further comprises gelatin.
16. The composition of claim 1, wherein said gum region has a water activity greater than or equal to the water activity of said liquid-fill composition.
17. The composition of claim 16, wherein said gum region has a total moisture content from zero up to 14% by weight of said gum region.
18. The composition of claim 17, wherein said total moisture content is from about 9% up to 14%.
19. The composition of claim 16, wherein said gum region has a free moisture content of less than 5% by weight of said gum region.
20. The composition of claim 16, wherein said liquid-fill has a free moisture content of up to 35% by weight of said liquid-fill.
21. The composition of claim 1, wherein said polyol composition in said gum region has an average particle size from about 30 microns to about 600 microns.
22. The composition of claim 1, wherein said composition comprises a shape selected from a pellet, tablet, a ball, a stick, and a slab.
23. The composition of claim 1, wherein said composition is an individual chewing gum piece weighing more than about 0.5 grams to less than 3 grams.
24. The composition of claim 1, wherein said composition is an individual chewing gum piece weighing more than 1.5 grams to less than 3 grams.

25. The composition of claim 1, further comprising at least one active selected from the group consisting of caffeine, vitamins, tooth-whitening compositions, flavors, remineralization additives, sweeteners, medicaments, anti-oxidants, breath-freshening agents, and combinations thereof.

26. A chewing gum composition comprising:

- (a) a center-fill composition; and
- (b) a gum region surrounding said center-fill composition;

wherein said gum region includes a moisture barrier component comprising a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region.

27. The composition of claim 26, wherein said polyol composition further comprises a polyol selected from the group consisting of erythritol, xylitol, mannitol, isomalt, lactitol, and combinations thereof.

28. A method of preparing a multi-layer liquid-fill composition comprising the steps of:

- (a) extruding a liquid-filled rope of a gum layer comprising at least one polyol including a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region;
- (b) sizing said rope;
- (c) feeding said rope into a tablet-forming mechanism;
- (d) cooling said rope;
- (e) forming individual pieces of said liquid-filled rope; and
- (f) coating said individual pieces with a hard coating to form an individual gum piece weighing more than 0.5 grams to less than three grams.

29. A chewing gum composition comprising:

- (a) a center-fill comprising greater than zero up to 20% by weight of said chewing gum composition;

(b) a gum region comprising from about 40% to about 97% by weight of said chewing gum composition, said gum region comprising a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region; and

(c) a coating comprising from about 2% to about 60% by weight of said chewing gum composition;

wherein said coating comprises an inner pre-coating layer; and

wherein said chewing gum composition further comprises an individual gum piece weighing more than 0.5 grams to less than three grams.

30. The composition of claim 29, wherein said individual gum piece weighs greater than 1.5 grams to less than about three grams.

31. A chewing gum composition comprising:

(a) a center-fill composition;

(b) a gum region surrounding said center-fill composition;

(c) a coating layer surrounding said gum region;

wherein said gum region comprises a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region;

said gum region further comprises a gum base selected from the group consisting of styrene-butadiene copolymers (SBR), polyisobutylene, isobutylene-isoprene copolymers, polyethylene, polyvinyl acetate (PVA) and combinations thereof; and

wherein said gum composition further comprises an individual gum piece weighing more than 0.5 grams to less than three grams.

32. The composition of claim 31, further comprising crosslinked polyvinyl pyrrolidone, polymethylmethacrylate, copolymers of lactic acid, polyhydroxyalkanoates, plasticized ethylcellulose, polyvinyl acetatephthalate and combinations thereof.

33. A chewing gum composition comprising:

(a) a center-fill comprising up to about 20% by weight of said chewing gum composition;

(b) a gum region comprising from about 55% to about 65% by weight of said chewing gum composition; and

(c) a coating comprising from about 25% to about 35% by weight of said chewing gum composition;

wherein:

said gum composition further comprises an individual gum piece weighing greater than 0.5 grams to less than about three grams;

said gum region comprises a polyol compositions from about 40% to about 60% by weight of said gum region; and

said polyol composition comprises sorbitol in amounts up to about 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region.

34. The composition of claim 1, wherein the composition is in the form of a slab.

35. The composition of claim 1, wherein said liquid-fill composition comprises: hydrogenated starch hydrolysate from about 30% to about 70%.

36. A chewing gum composition comprising:

(a) a liquid-fill composition comprising greater than 25% sorbitol solution by weight of said liquid-fill composition; and

(b) a gum region surrounding said liquid-fill composition,
said gum region comprising a gum base;

wherein:

said gum region further comprises a polyol composition comprising sorbitol in amounts up to 10% by weight of said gum region and maltitol in amounts of about 40% to about 60% by weight of said gum region.