

Chewable Gum Compositions

Field of the Invention

Presented herein are chewable gum compositions. The chewable gum compositions described herein provide breath freshening and/or teeth cleaning effects, and may be used for ameliorating, reducing, treating, or preventing conditions in the oral cavity, such as halitosis and/or gingivitis.

Background of the Invention

Oral malodor (halitosis, Feter ex ora) is a common and disturbing condition that is prevalent in the general population. Aylıkç1, B. U. & Colak, H., *Halitosis: From diagnosis to management*, 4 JOURNAL OF NATURAL SCIENCE, BIOLOGY, AND MEDICINE, 14–23 (2013).

Halitosis is formed by volatile molecules formed as a result of pathological or nonpathological causes, primarily originating in the oral cavity. Studies have pointed to bacterial putrefactive activity as one of the primary causes of this condition. Numerous types of bacteria are responsible for the malodor production, including, for example,

Porphyromonas gingivalis, *Fusobacterium nucleatum*, and *Prevotella intermedia*. These bacteria reside in various locations within the oral cavity and can break down organic materials, including peptides and proteins present in saliva, fluids, or food debris into constituent molecules that are malodorous. For example, amino acids (*e.g.* methionine, cysteine, tryptophan, lysine) may be catabolized to various malodorous volatile compounds, such as methylmercaptan, hydrogen sulfide, indole, skatole, and cadaverine.

It is further recognized that with poor oral hygiene, food debris and dental bacterial plaque can accumulate on the teeth and tongue, and cause caries and periodontal diseases like gingivitis and periodontitis. The inflammation of gingival and periodontal tissues creates typical sources for oral malodors and plaque-related periodontal disease can increase the severity of halitosis. Other forms of periodontal disease, such as acute necrotizing ulcerative gingivitis, pericoronitis, Vincent's disease, or aggressive forms of periodontitis, can also increase unpleasant breath odor.

It is apparent that there continues to be a long-felt need for compositions that can be used to ameliorate, reduce, treat, or prevent any of the foregoing conditions and disease in the oral cavity. It is therefore an object of the present invention to provide compositions for treating malodor and/or other plaque-related conditions and diseases in the oral cavity.

Summary of the Application

The present application provides a chewable gum composition comprising a gum base and a scaling agent. In some embodiments, the chewable gum composition may be a chewing gum, a bubble gum, or a chewable product that substantially disintegrates and may be ingested. In some embodiments, the chewable gum composition comprises 10 to 40 weight percent of gum base. In some embodiments, the scaling agent is a mild scaling agent, *e.g.*, microcrystalline cellulose. In some embodiments, the chewable gum composition as described herein comprises 1 to 20 weight percent of the scaling agent.

In some embodiments, the chewable gum composition of the present application further comprises at least one phenolic compound, for example, selected from a polyphenol, a resveratrol, and combinations thereof. In some embodiments, the at least one phenolic compound is provided as a component of an extract from a natural source (*e.g.*, obtained from wine grapes). In some embodiments, the chewable gum composition comprises 0.1 to 5 weight percent of the extract from a natural source.

In some embodiments, the chewable gum composition of the present application further comprises at least one probiotic. In some embodiments, the at least one probiotic is selected from *Lactobacillus Reuteri*, *Lactobacillus Plantarum*, and combinations thereof. In some embodiments, the chewable gum composition comprises 0.01 to 5 weight percent of the probiotic.

In some embodiments, the chewable gum composition of the present application further comprises at least one emulsifier. In some embodiments, the at least one emulsifier is selected from glycerin ester of fatty acids, lecithin, glyceryl lacto palmitate, mono- and diglyceride, lecithin, sorbitan monostearate, triglycerole monostearate, triglycerol monoshortening, polysorbate 65, octaglycerol monoleate, polysorbate 60, polysorbate 80, diglyceride, and combinations thereof. In some embodiments, the at least one emulsifier is glycerin ester of fatty acids. In some embodiments, the chewable gum composition as described herein comprises up to 5 weight percent of the emulsifier.

In some embodiments, the chewable gum composition of the present application further comprises at least one filler. In some embodiments, the at least one filler is selected from D-sorbitol, D-maltitol, isomalt, and combinations thereof. In some embodiments, the filler is D-sorbitol in combination with D- maltitol or isomalt. In some embodiments, the

chewable gum composition as described herein comprises up to 50 weight percent of the filler.

In some embodiments, the chewable gum composition of the present application further comprises at least one anti-caking agent. In some embodiments, the at least one anti-caking agent is selected from silicon dioxide, colloidal silicon dioxide, talc, and combinations thereof. In some embodiments, the at least one anti-caking agent is silicon dioxide. In some embodiments, the chewable gum composition as described herein comprises up to 5 weight percent of the anti-caking agent.

In some embodiments, the chewable gum composition of the present application further comprises at least one sweetener. In some embodiments, the at least one sweetener is selected from saccharin acid, saccharin salts, cyclamate salts, acesulfame-K, L-aspartyl-L-phenylalanine methyl ester, L-D-aspartyl-N-(2,2,4,4-tetramethyl-3-thietazyl)-D-alaninamide hydrate, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose, sugar, maltose, partially hydrolyzed starch or corn syrup solids, sorbitol, mannitol maltitol, talin, dihydrochalcone, glycyrrhizin, stevia rebaudiana (stevioside), sucralose, and combinations thereof. In some embodiments, the at least one sweetener is stevioside. In some embodiments, the chewable gum composition as described herein comprises up to 5 weight percent of the sweetener.

In some embodiments, the chewable gum composition of the present application further comprises at least one flavoring agent. In some embodiments, the at least one flavoring agent is selected from a natural flavoring agent and a synthetic flavoring agent, and combinations thereof. In some embodiments, the flavoring agent is a combination of L-menthol and eucalyptus flavor, and optionally peppermint flavor. In some embodiments, the chewable gum composition as described herein comprises up to 5 weight percent of the flavoring agent.

In some embodiments, the chewable gum composition of the present application further comprises at least one sugar replacement. In some embodiments, the at least one sugar replacement is crystalline xylitol. In some embodiments, the chewable gum composition as described herein comprises up to 30 weight percent of the sugar replacement.

In some embodiments, the chewable gum composition of the present application further comprises at least one salt flavoring agent. In some embodiments, the at least one salt flavoring agent is sodium chloride. In some embodiments, the chewable gum composition as

described herein comprises up to 5 weight percent of the salt flavoring agent, *e.g.*, sodium chloride.

In some embodiments, the chewable gum composition of the present application further comprises at least one softener. In some embodiments, the at least one softener is selected from glycerin, lecithin, and combinations thereof. In some embodiments, the at least one softener is glycerin. In some embodiments, the chewable gum composition as described herein comprises up to 5 weight percent of the softener.

In some embodiments, the chewable gum composition of the present application further comprises at least one lubricant. In some embodiments, the at least one lubricant is selected from calcium stearate, magnesium stearate, stearic acid, sodium stearyl fumarate, vegetable based fatty acids, and combinations thereof. In some embodiments, the at least one lubricant is magnesium stearate. In some embodiments, the chewable gum composition as described herein comprises up to 10 weight percent of the lubricant.

In some embodiments, the chewable gum composition as described herein is a tablet, a stick, or a dragee. In some embodiments, the chewable gum composition may be used for treating malodor (or halitosis) and/or reducing the amount of accumulated plaque in the oral cavity and/or treating a plaque-related periodontal disease (*e.g.*, gingivitis) in a subject.

The novel features of the disclosure are set forth with particularity in the claims. A better understanding of the features and advantages of the present disclosure will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the disclosure are utilized, and the accompanying drawings.

Brief Description of the Drawings

Fig. 1 shows photographs of bacterial plaque build-up in the mouth of a subject before and after being treating with a chewable gum composition according to an embodiment of the invention or with ordinary chewing gum. Bacterial plaque was initially stained using IC-Disclosing solution, and is indicated by red stain. Fig. 1A shows pictures of plaque build-up in the subject's mouth before and after 20 minutes of chewing ordinary chewing gum. Fig. 1B shows pictures of plaque build-up in the subject's mouth before and after 20 minutes of chewing a chewable gum composition according to an embodiment. Fig. 1C shows zoomed images side-by-side comparing the right, center, and left side of the subjects' mouths after 20 minutes of chewing the respective gum compositions.

Fig. 2 shows photographs of bacterial plaque build-up in the mouth of a subject before and after being treating with a chewable gum composition according to an embodiment of the invention or with ordinary chewing gum. Bacterial plaque was initially stained using IC-Disclosing solution, and is indicated by red stain. Fig. 2A shows pictures of plaque build-up in the subject's mouth before and after 20 minutes of chewing ordinary chewing gum. Fig. 2B shows pictures of plaque build-up in the subject's mouth before and after 20 minutes of chewing Batch 1 (as set forth in Table 2) of a chewable gum composition according to an embodiment.

Detailed Description

The present application provides a chewable gum composition. The term "chewable gum" as used herein encompasses various embodiments of compositions that are chewed in the mouth (oral cavity). In some embodiments, the chewable gum composition is an edible composition meant to be ingested. In such embodiments the composition may disintegrate, dissolve, or otherwise reduce in size, as a result of chewing and/or presence in the mouth, and ultimately be ingested. In some embodiments, the composition is chewed while being retained in the mouth for an extended period of time, usually lasting minutes or tens of minutes or longer, and ultimately, generally, is not ingested. In any of these embodiments, the chewable gum composition contacts the teeth for a time sufficient to ameliorate, reduce, treat, or prevent any of the conditions and diseases in the oral cavity discussed herein.

In the present application and the claims appended hereto, the amounts of any component included in compositions according to the invention is generally provided as a weight percentage, e.g., as a part by weight expressed as a percentage of the entire weight of the composition. The weight percentage is sometimes expressed as a particular value and sometimes as a range between one value and another value. Any such values described herein, whether given as a single value, as one or more endpoints for a range, or the range itself, describe the numeric value and also approximations of that numeric value, even if the antecedent term "about" is not explicitly used. As those of ordinary skill in the art are aware, weight percentages of the components in gum compositions may vary from (greater than or less than) a nominal amount by 1%, by 2%, by 5%, and even by 10% without substantively changing the properties of a given composition, although commercially desirable properties may have a smaller tolerance.

When a range is described using an upper endpoint (e.g., up to certain value), a lower endpoint (e.g., at least a certain value), or an upper and lower endpoint, it should be understood to describe each value up to, more than, or within the endpoint(s) described, including the endpoint value itself and approximations thereof. Where the amount of a component is expressed as being “up to” a certain value, unless the context indicates otherwise, it should be understood that such component may be included in a finite amount or that such component might not be present in the composition, i.e., the amount may be zero. Such component may be optionally included in a particular composition.

When a component is described as serving a particular function or being one of a particular class of components, it should be understood that such component is not thereby limited. Such component might, for example, serve more than one function or represent more than one class of component in an embodiment. Moreover, such component might not serve the particular function referred to in an embodiment, in which case the function should be understood as merely a convenient label.

(1) Components in the Compositions

The chewable gum compositions described herein comprise a gum base and a scaling agent. The gum base may be any gum base known to those of skill in the art and usable in chewable gum compositions that may be administered to a subject. The choice of a gum base may vary depending upon various factors such as the type of base desired, the consistency of gum desired and the other components used to make the final chewable gum product. The gum base may be a natural or a synthetic gum base as known in the art, and one or more gum base may be present. The amount of water-insoluble gum base may vary according to the embodiments, including whether or not the composition is intended to be ingested. Also, depending on the amount and type of gum base selected, and ratio with respect to other components, including other gum bases, the composition may be formulated as a chewing gum or as a bubble gum. In some embodiments the gum base may be obtained from any commercial supplier of food grade gum base, such as, for example, Gum Base Co. S.p.A. (Lainate MI, Italy). Numerous other commercial suppliers are available. Though the content of commercially available gum base is often a trade secret, the material is generally compliant with standards set forth in the Food Chemical Codex and/or in national regulations.

The amount of gum base employed may vary depending upon various factors such as the type of base used, the consistency and texture of the gum desired, and the other

components used in the composition to make the final gum product. In general, the gum base will be present in an amount from about 10% to about 40%, by weight of the chewable gum composition. In some embodiments, the gum base will be present in an amount selected from about 15% to about 35% by weight. In some embodiments, the gum base will be present in an amount selected from about 20% to about 30% by weight. In some embodiment, the gum base will be present in an amount selected from 20%, 21%, 22%, 23%, 24%, 25%, 26%, 27%, 28%, 29%, and 30% by weight. In certain embodiment, the gum base will be present in 22% by weight. In certain embodiment, the gum base will be present in 23% by weight. In certain embodiment, the gum base will be present in 24% by weight.

As used herein, a scaling agent is an agent provided as a component in a chewable gum composition that has the effect of scaling or polishing tooth surfaces when the composition is chewed by a subject. In some embodiments, a scaling agent is able to clean tooth surfaces, and may reduce or remove deposits such as plaque, calculus (tartar), and food debris from the tooth surfaces. In certain embodiments, the scaling agent is a food-grade substance. In some embodiments, the scaling agent is microcrystalline cellulose. In certain embodiments, the scaling agent is microcrystalline cellulose that has an average particle size that is smaller than 500 μm . In some embodiments, the scaling agent is microcrystalline cellulose that has an average particle size that is smaller than 250 μm . In some embodiments, the scaling agent is microcrystalline cellulose that has an average particle size that is smaller than 150 μm . In some embodiments, the scaling agent is microcrystalline cellulose that has an average particle size that is smaller than 100 μm . In some embodiments, the scaling agent is microcrystalline cellulose that has an average particle size that is smaller than 75 μm . In some embodiments the microcrystalline cellulose may be obtained from any commercial supplier of a suitable grade of product, such as, for example, Compregel® microcrystalline cellulose, from Mingtai Chemical Co., Ltd. (Bah-Der City, Taiwan).

The amount of scaling agent employed may vary depending upon various factors such as the type of base used, the consistency and texture of the gum desired, and the other components used in the composition to make the final gum product. In general, the scaling agent may be present in an amount from about 1% to about 20%, by weight of the chewable gum composition. In some embodiments, the scaling agent is present in an amount from about 5% to about 15% by weight. In some embodiments, the scaling agent is present in an amount from about 7.5% to about 15% by weight. In some embodiments, the scaling agent is

present in an amount of 10% by weight. In some embodiments, the scaling agent is present in an amount of 12.5% by weight.

In some embodiments, the chewable gum composition of the present application further comprises at least one polyphenolic compound. Polyphenols (also sometimes referred to as polyhydroxyphenols) suitable for use in the present application include those that are: 1) generally moderately water-soluble compounds; 2) with molecular weight of 500–4000 Da; 3) with 12 or more phenolic hydroxyl groups; and 4) with 5–7 aromatic rings per 1000 Da. In some embodiments, polyphenols suitable for use herein include those compounds that are derived from the shikimate/phenylpropanoid and/or the polyketide pathway, featuring more than one phenolic unit and deprived of nitrogen-based functions. Suitable polyphenols may meet one or both of the foregoing criteria. In some embodiments, the at least one polyphenolic compound is selected from a non-flavonoid polyphenolic compound (also referred to as a phenolic acid), a flavonoid, a stilbenoid, and combinations thereof. In some embodiments, the at least one polyphenolic compound is a flavonoid.

In some embodiments, the at least one phenolic compound is a stilbenoid. In some embodiments, the stilbenoid is resveratrol. Resveratrol and other stilbenoids are phytoalexins, produced by several plant species (particularly red grapes and Japanese knotweed) when under attack by pathogenic organisms such as fungi and or bacteria. In some embodiments, the chewable gum composition described herein comprises a combination of a flavonoid and a stilbenoid, and in other embodiments, it comprises a combination of a phenolic acid, a flavonoid, and a stilbenoid.

In some embodiments, the at least one polyphenolic compound is provided as a component as an extract from a natural source. The natural source may be a plant, such as a fruit, vegetable, cereal, leguminous plant, herbs, or tea (such as green tea). Fruits, when used as the natural source, include any fruit varieties including (but not limited to) grapes (such as wine grapes), olives, and apples. Particular parts of the plant may be used to provide the extract, including the skins, seeds, pulp, juice, or any combinations thereof. For instance, the extract may be prepared from grape skins, grape seeds, grape pulp, grape juice, olive pulp, etc.

In some embodiments, the at least one polyphenolic compound is provided as a component as a grape extract. In some embodiments, the grape extract is a full spectrum grape extract. The grape extract can be produced from any grape variety. In some

embodiments, the grape extract is produced from a variety of grapes suitable for making red wine. The grape extract can be obtained from any source and can be freeze dried or fresh, as a solid or a liquid.

The amount of the polyphenolic compound employed may vary in the final gum product. In general, when providing the polyphenolic compound as a component as an extract from a natural source, such extract may be present in an amount from about 0.1% to about 5%, by weight of the chewable gum composition. In some embodiments, such extract providing the polyphenolic compound is present in an amount from about 0.5% to about 2.5% by weight. In some embodiments, such extract providing the polyphenolic compound is present in an amount from about 1% to about 1.5% by weight. In some embodiments, such extract providing the polyphenolic compound is present in an amount of about 1.7% by weight. When providing the at least one polyphenolic compound as a substantially pure compound, amounts of the polyphenolic compound comparable to the amount present in any of the foregoing ranges for a natural extract may be used.

In some embodiments, the chewable gum composition of the present application further comprises at least one probiotic. Probiotic as used herein includes a bacteria that is beneficial to the health of the subject and, when accumulated in sufficient quantities, is beneficial in maintaining oral health. Specific examples of probiotics suitable for use herein include, but are not limited to, *Bacillus coagulans*, *Bacillus subtilis*, *Bacillus laterosporus*, *Bacillus laevolacticus*, *Sporolactobacillus inulinus*, *Lactobacillus acidophilus*, *Lactobacillus curvatus*, *Lactobacillus reuteri*, *Lactobacillus plantarum*, *Lactobacillus jensenii*, *Lactobacillus casei*, *Lactobacillus fermentum*, *Lactobacillus rhamnosus*, *Lactobacillus johnsonii*, *Lactobacillus salivarius*, *Lactococcus lactis*, *Pediococcus acidilacti*, *Pediococcus pentosaceus*, *Pediococcus urinae*, *Leuconostoc mesenteroides*, *Bacillus coagulans*, *Bacillus subtilis*, *Lateral spore Bacillus laterosporus*, *Bacillus laevolacticus*, *Sporolactobacillus inulinus*, *Bifidobacterium bifidum*, *Bifidobacterium animalis* (*Bifidobacterium animalis*), *Bifidobacterium breve*, *Bifidobacterium infantis*, *Bifidobacterium lactis*, *Bifidobacterium longum* and a combination of any of the foregoing. In some embodiments, the at least one probiotic is selected from *Lactobacillus reuteri*, *Lactobacillus plantarum*, and combinations thereof. In some embodiments, the probiotic is a combination of *Lactobacillus reuteri* and *Lactobacillus plantarum*.

The amount of the probiotic employed may vary in the final gum product. In general, the probiotic such as those described herein may be present in an amount from about 0.01%

to about 5%, by weight of the chewable gum composition. In some embodiments, the probiotic is present in an amount from about 0.05% to about 2.5% by weight. In some embodiments, the probiotic is present in an amount from about 0.1% to about 1.5% by weight. In some embodiments, the probiotic is present in an amount from about 0.3% to about 1% by weight. In some embodiment, the probiotic is a combination of 0.5% (by weight) *Lactobacillus reuteri* and 0.3% (by weight) *Lactobacillus plantarum*.

In some embodiments, the chewable gum composition of the present application further comprises at least one emulsifier. In some embodiments, the at least one emulsifier is selected from glycerin ester of fatty acids, lecithin, glyceryl lacto palmitate, mono- and diglyceride, lecithin, sorbitan monostearate, triglycerole monostearate, tryglcerol monoshortening, polysorbate 65, octaglycerol monooleate, polysorbate 60, polysorbate 80, diglyeride, and combinations thereof. In some embodiments, the at least one emulsifier is glycerin ester of fatty acids.

The amount of the emulsifier employed may vary in the final gum product. In general, the emulsifier such as those described herein may be present in an amount up to 5% by weight of the chewable gum composition. In some embodiments, the emulsifier is present in an amount up to 2.5% by weight. In some embodiments, the emulsifier is present in an amount up to 1.5% by weight. In some embodiments, the emulsifier is present in an amount up to 1% by weight. In some embodiments, the emulsifier is present in an amount up to 0.75% by weight. In some embodiments, the at least one emulsifier is 0.2% (by weight) glycerin ester of fatty acids. In some embodiments, the at least one emulsifier is 0.5% (by weight) glycerin ester of fatty acids.

In some embodiments, the chewable gum composition of the present application further comprises at least one filler. In some embodiments, the filler is a sugar replacement filler. In some embodiments, the at least one filler is selected from D-sorbitol, D-maltitol, isomalt, and combinations thereof. In some embodiments, the filler is D-sorbitol in combination with D- maltitol and/or isomalt.

The amount of the filler employed may vary in the final gum product. In general, the filler such as those described herein may be present in an amount up to 60% by weight of the chewable gum composition. In some embodiments, the filler is present in an amount up to 50% by weight. In some embodiments, the filler is present in an amount up to 40% by weight. In some embodiments, the filler is present in an amount up to 30% by weight. In

some embodiments, the filler is present in an amount up to 20% by weight. In some
embodiments, the filler is present in an amount up to 10% by weight. In some embodiments,
the filler is a combination of 22.8% (by weight) D-sorbitol and 35% (by weight) isomalt. In
some embodiments, the filler is a combination of 36.75% (by weight) D-sorbitol and 20% (by
5 weight) D-maltitol. In some embodiments, the filler is a combination of 34.8% (by weight)
D-sorbitol and 20% (by weight) D-maltitol. In some embodiments, the filler is a combination
of 32.1% (by weight) D-sorbitol and 25% (by weight) D-maltitol. In some embodiments, the
filler is a combination of 31.45% (by weight) D-sorbitol and 25% (by weight) D-maltitol. In
some embodiments, the filler is a combination of 36.335% (by weight) D-sorbitol and 20%
10 (by weight) D-maltitol. In some embodiments, the filler is a combination of 20% (by weight)
D-sorbitol and 36.35% (by weight) D-maltitol. In some embodiments, the filler is a
combination of 25% (by weight) D-sorbitol and 31.05% (by weight) D-maltitol.

In some embodiments, the chewable gum composition of the present application
further comprises at least one anti-caking agent. In some embodiments, the chewable gum
15 composition can be mixed with an anti-caking agent prior to the grinding step (described
below) to help prevent agglomeration of the subsequently ground chewable gum particles. In
some embodiments, the at least one anti-caking agent is selected from silicon dioxide,
colloidal silicon dioxide, talc, and combinations thereof. In some embodiments, the at least
one anti-caking agent is silicon dioxide.

20 The amount of the anti-caking agent employed may vary in the final gum product. In
general, the anti-caking agent such as those described herein may be present in an amount up
to 5% by weight of the chewable gum composition. In some embodiments, the anti-caking
agent is present in an amount up to 4% by weight. In some embodiments, the anti-caking
agent is present in an amount up to 3% by weight. In some embodiments, the anti-caking
25 agent is present in an amount up to 2% by weight. In some embodiments, the anti-caking
agent is present in an amount up to 1% by weight. In some embodiments, the at least one
anti-caking agent is 0.5% (by weight) silicon dioxide.

In some embodiments, the chewable gum composition of the present application
further comprises at least one sweetener. Sweeteners suitable for use herein include synthetic
30 or natural sweetening agents and natural sugars. In some embodiments, the at least one
sweetener is selected from saccharin acid, saccharin salts, cyclamate salts, acesulfame-K, L-
aspartyl-L-phenylalanine methyl ester, L-D-aspartyl-N-(2,2,4,4-tetramethyl-3-thietazyl)-D-
alaninamide hydrate, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose,

sugar, maltose, partially hydrolyzed starch or corn syrup solids, sorbitol, mannitol maltitol, talin, dihydrochalcone, glycyrrhizin, stevia rebaudiana (stevioside), sucralose, and combinations thereof. In some embodiments, the at least one sweetener is stevioside.

5 The amount of the sweetener employed may vary in the final gum product. In general, the sweetener such as those described herein may be present in an amount up to 5% by weight of the chewable gum composition. In some embodiments, the sweetener is present in an amount up to 4% by weight. In some embodiments, the sweetener is present in an amount up to 3% by weight. In some embodiments, the sweetener is present in an amount up to 2% by weight. In some embodiments, the sweetener is present in an amount up to 1% by weight. In some embodiments, the sweetener is 0.35% (by weight) stevioside. In some
10 embodiments, the sweetener is 0.4% (by weight) stevioside.

In some embodiments, the chewable gum composition of the present application further comprises at least one flavoring agent. The flavoring agents suitable for use herein include both synthetic and natural flavoring agents. Natural flavoring agents include
15 essential oils obtained by distillations, solvent extractions, or cold expressions of fresh or dried flowers, buds, leaves, stems, fruit, seeds, peel, bark, or root. Exemplary essential oils include peppermint oil, spearmint oil, eucalyptus oil, wintergreen oil, niaouli oil, clove oil, cardamom oil, cinnamon oil, bitter almond oil, coriander oil, caraway oil, ginger oil, juniper oil, orange oil, bitter orange oil, lemon oil, grapefruit oil, mandarine oil, bergamot oil, thyme
20 oil, fennel oil and rosemary oil. Natural flavoring agents include either diluted solutions of essential oils or concentrates of flavor components of natural origin from, for example, fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors and brews. Synthetic flavoring agents consisting of mixtures of chemicals comprising hydrocarbons, alcohols, aldehydes, esters, ketones, ethers and oxides
25 blended to match the natural flavor of, for example, fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors or brews. In some embodiments, the flavoring agent is a combination of L-menthol and eucalyptus flavor, and optionally peppermint flavor.

The amount of the flavoring agent employed may vary in the final gum product. In
30 general, the flavoring agent such as those described herein may be present in an amount up to 5% by weight of the chewable gum composition. In some embodiments, the flavoring agent is present in an amount up to 4% by weight. In some embodiments, the flavoring agent is present in an amount up to 3% by weight. In some embodiments, the flavoring agent is

present in an amount up to 2% by weight. In some embodiments, the flavoring agent is a combination of 0.6% (by weight) L-menthol and 0.05% (by weight) eucalyptus flavor. In some embodiments, the flavoring agent is a combination of 0.6% (by weight) L-menthol and 0.1% (by weight) eucalyptus flavor. In some embodiments, the flavoring agent is a combination of 0.6% (by weight) L-menthol, 0.7% (by weight) peppermint flavor, and 0.2% (by weight) eucalyptus flavor. In some embodiments, the flavoring agent is a combination of 0.75% (by weight) L-menthol, 0.7% (by weight) peppermint flavor, and 0.2% (by weight) eucalyptus flavor. In some embodiments, the flavoring agent is a combination of 0.75% (by weight) L-menthol, 0.8% (by weight) peppermint flavor, and 0.2% (by weight) eucalyptus flavor. In some embodiments, the flavoring agent is a combination of 0.75% (by weight) L-menthol, 0.8% (by weight) peppermint flavor, and 0.3% (by weight) eucalyptus flavor.

In some embodiments, the chewable gum composition of the present application further comprises at least one sugar replacement, *e.g.*, sugar replacement flavoring agent. In some embodiments, the at least one sugar replacement is crystalline xylitol.

The amount of the sugar replacement employed may vary in the final gum product. In general, the sugar replacement such as those described herein may be present in an amount up to 30% by weight of the chewable gum composition. In some embodiments, the sugar replacement is present in an amount up to 20% by weight. In some embodiments, the sugar replacement is present in an amount up to 15% by weight. In some embodiments, the sugar replacement is present in an amount up to 10% by weight. In some embodiments, the sugar replacement is present in an amount up to 5% by weight. In some embodiments, the sugar replacement is 2% by weight crystalline xylitol.

In some embodiments, the chewable gum composition of the present application further comprises at least one salt flavoring agent. In some embodiments, the at least one salt flavoring agent is sodium chloride.

The amount of the salt flavoring agent employed may vary in the final gum product. In general, the salt flavoring agent such as those described herein may be present in an amount up to 5% by weight of the chewable gum composition. In some embodiments, the salt flavoring agent is present in an amount up to 4% by weight. In some embodiments, the salt flavoring agent is present in an amount up to 3% by weight. In some embodiments, the salt flavoring agent is present in an amount up to 2% by weight. In some embodiments, the salt flavoring agent is present in an amount up to 1% by weight. In some embodiments, the

salt flavoring agent is 0.15% by weight sodium chloride. In some embodiments, the salt flavoring agent is 0.2% by weight sodium chloride.

5 In some embodiments, the chewable gum composition of the present application further comprises at least one softener. In some embodiments, the at least one softener is selected from glycerin, lecithin, and combinations thereof. In some embodiments, the at least one softener is glycerin, *e.g.*, food grade glycerin.

10 The amount of the softener employed may vary in the final gum product. In general, the softener such as those described herein may be present in an amount up to 5% by weight of the chewable gum composition. In some embodiments, the softener is present in an amount up to 4% by weight. In some embodiments, the softener is present in an amount up to 3% by weight. In some embodiments, the softener is present in an amount up to 2% by weight. In some embodiments, the softener is present in an amount up to 1% by weight. In some embodiments, the softener is 0.015% by weight glycerin.

15 In some embodiments, the chewable gum composition of the present application further comprises at least one lubricant. In some embodiments, the at least one lubricant is selected from calcium stearate, magnesium stearate, stearic acid, sodium stearyl fumarate, vegetable based fatty acids, and combinations thereof. In some embodiments, the at least one lubricant is magnesium stearate.

20 The amount of the lubricant employed may vary in the final gum product. In general, the softener such as those described herein may be present in an amount up to 10% by weight of the chewable gum composition. In some embodiments, the lubricant is present in an amount up to 7.5% by weight. In some embodiments, the lubricant is present in an amount up to 5% by weight. In some embodiments, the lubricant is present in an amount up to 4% by weight. In some embodiments, the lubricant is present in an amount up to 3% by weight. In some embodiments, the lubricant is present in an amount up to 2% by weight. In some embodiments, the lubricant is 2% by weight magnesium stearate.

25 As used herein, the labels, such as (but not limited to) “emulsifier,” “softener,” “anti-caking agent,” “lubricant,” “flavoring agent,” “sweetener,” “filler,” and “sugar replacement,” are not intended to be limiting in terms of other functions of the agent. An ingredient may serve more than one function in the compositions described herein. For example, and without limitation, a filler can function as a sugar replacement (and vice versa); a sugar replacement

can function as a flavoring agent (and vice versa); a lubricant can function as a softener (and vice versa); and an emulsifier can function as a softener (and vice versa).

In some embodiments, the chewable gum composition as described herein is prepared in the form of a tablet (*e.g.*, a compressed tablet), a stick, or a dragee, and other similar shapes and forms as practiced in the art. Without limitation, a stick may be prepared as a multilayer stick, or a tablet may be prepared as a round, rounded, square, rectangular, or other shaped form. In some embodiments, the chewable gum composition is formulated as a chewing gum or as a bubble gum or as an ingestible product. In some other embodiments, the chewable gum composition may be prepared as, gummies, chewable candies, hard candies, lozenges, an optionally may be encased with hard shell.

(2) Use of Compositions

In another aspect, the chewable gum compositions disclosed herein may be used for oral care. In some embodiments, the chewable gum composition is useful for treating malodor (or halitosis) and/or a plaque-related periodontal disease (*e.g.*, gingivitis).

Oral malodor or halitosis, also commonly referred to as bad breath, is the result of volatile sulfur compounds, carboxylic acids and amines building up in the oral cavity. The malodorous compounds are generated primarily through putrefactive action of oral microorganisms. These microorganisms are commonly found in saliva and dental plaque and may be derived from proteinaceous food particles trapped between the teeth, in the gingival crevice, or adhering to the mucous membranes.

Additionally, oral malodor may be the result of poor oral hygiene, digestive system problems, disease, diet, or a combination of any of these factors. For instance, the build-up of putrid matter which causes malodor can also lead to the formation of plaque, the origin of dental caries, gingivitis, and dental calculus. The inflammation of gingival and periodontal tissues creates typical sources for oral malodors, and plaque-related periodontal disease can increase the severity of halitosis. Other forms of periodontal disease, especially acute and aggressive forms such as acute necrotizing ulcerative gingivitis, pericoronitis, Vincent's disease, or aggressive forms of periodontitis, can also increase unpleasant breath odor.

The chewable gum compositions may be administered to a subject for the purpose of ameliorating, reducing, treating, or preventing any of the conditions or diseases in the oral cavity of the subject, such as halitosis, gingivitis, periodontitis, or other plaque-related conditions or diseases. The purpose of ameliorating, reducing, treating, or preventing applies

to the symptoms exhibited by the subject, the presence of a causative agent, and/or the environment in the oral cavity that would otherwise support the presence of a causative agent.

In one aspect, methods of using the compositions for ameliorating, reducing, treating, or preventing the conditions and diseases described herein include administering to a subject a chewable gum composition, and having the subject actively chew (masticate) or work over using the teeth the composition so as to contact the composition with the various surfaces in the subject's mouth, including the teeth, gums, tongue, and other interior surfaces of the oral cavity. The composition may be consumed in the subject's oral cavity for seconds or tens of seconds, particularly for edible compositions, or minutes or tens of minutes or longer, particularly for chewing gum or bubble gum compositions. The chewable gum compositions may be administered one or more times in a day.

(3) Preparation of Compositions

The chewable gum composition as described herein can be prepared by standard techniques for preparing gum compositions suitable for chewing. If the composition comprises more than one phase, in general, the different phases will be prepared separately, with materials of similar phase partitioning being added in any order. The two phases will then be combined with vigorous stirring to form the multiphase system such as an emulsion or dispersion. Any ingredients in the formulation with high volatility, or which are susceptible to hydrolysis at high temperatures, will usually be added post mixing of the different phases with gentle stirring. Typical confectionery methods are suitable for manufacturing of compositions of the present invention. Finally, if the products are coated, the coating step is typically conducted as a final step. The coating can be applied by panning or spray dried techniques commonly known to those skilled in the art.

(4) Equivalents

Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, numerous equivalents to the compositions and methods of use thereof described herein. Such equivalents are considered to be within the scope of this invention and are covered by the following claims.

The contents of all references, patents and published patent applications cited throughout this Application, as well as their associated figures are hereby incorporated by reference in their entirety.

Examples

The invention is further defined in the following Examples. It should be understood that the Examples are given by way of illustration only. From the above discussion and the Examples, one skilled in the art can ascertain the essential characteristics of the disclosure, and without departing from the spirit and scope thereof, can make various changes and modifications to adapt the disclosure to various uses and conditions. As a result, the disclosure is not limited by the illustrative examples set forth herein.

All temperatures are in degrees Celsius (°C) and are uncorrected.

Unless otherwise noted, commercial reagents used in preparing the example compounds were used as received without additional purification.

Unless otherwise noted, the solvents used in preparing the example compounds were commercial anhydrous grades and were used without further drying or purification.

All starting materials are commercially available, unless stated otherwise.

Materials:

Exemplary ingredients used in preparing chewable gum compositions as described herein are listed in Table 1 below.

Table 1. Exemplary Ingredients.

Ingredient	Distributor	Distributor Cat#	Country of Origin
Gum Base	Gum Base Co.	Pellet type	Italy
Glycerin Ester of Fatty Acids	Kao Corp.	Lot No. 7879	Japan
Silicon Dioxide	Evonik	0490	Taiwan
Microcrystalline cellulose	Ming Tai Chemical Co.	C1710083(M102DT)	Taiwan
Stevioside	ESFood.kr	909	Korea
L - menthol	Tien Yvan Chemical.co	2216515	Singapore
Peppermint Flavor	IFF Korea Inc.	N.A.	Korea
Eucalyptus Flavor	IFF Korea Inc.	N.A.	Korea
Glycerin Food Grade	ESFood.kr	0409	Korea
D - Sorbitol	Samyang Corp.	13-19-3-7	Korea
D - Maltitol Powder	ESFood.kr	1046	Korea
Isomalt	Roquette	N.A.	France

Red Wine Grape Extract	Skyherb	201906071	China
Lactobacillus Reuteri (dead)	Mediogen	20070435176208	Korea
Lactobacillus Plantarum (dead)	Lactomason	2010060148617	Korea
Magnesium stearate	Faci Asia Pacific.Ltd	Cas No. 557040	China
Xylitol Crystalline	ESFood.kr	0729	Finland
Roasted Salt	CJ Cheiljedang Corp.	30195028	Korea

Example 1: General process for preparing a chewable gum composition.

In one exemplary embodiment, chewable gum compositions according to the present disclosure were produced by the following procedure. The gum base was first softened by incubation at 80-85°C for five to six hours. Following incubation, other components were mixed and kneaded as follows:

1. Powder ingredients comprising greater than 5% of the target mixture were first entered into a mixer and mixed for two minutes.
2. Powder ingredients comprising less than 5% of the target mixture were then entered into the mixer and mixed for 5 minutes.
3. Liquid-phase ingredients were then added to the mixer and further mixed for three minutes.
4. The softened gum base was then poured into the mixer and kneaded for 20 to 30 minutes.

After mixing and kneading, a first drying step was performed by transferring the chewable gum composition onto a tray and incubating the chewable gum composition at 20°C for 24 hours under 40% humidity. Next, the chewable gum composition was pulverized into a powder and filtered through a 20 mesh screen. Metal contaminants were then removed from the filtered powder by exposure to a strong magnet. A second drying step was performed by incubating the powder at 20°C for 7 hours under 40% humidity. Following the second drying step, the powder was mixed with magnesium stearate in a mixer at a 49:1 ratio (powder:magnesium stearate). The mixture was then pressed into 2 gram tablets, processed through a dust remover, and visually inspected. Thereafter, the tablets may be packaged.

Example 2: Batch 1.

The ingredients set forth in Table 2 were used in producing Batch 1 of the chewable gum composition according to the procedure outlined in Example 1.

Table 2:

Ingredient	Weight Percent (%)
Gum Base	22
Glycerin Ester of Fatty Acids	0.2
Microcrystalline Cellulose	12.5
Stevioside	0.35
L-menthol	0.6
Eucalyptus Flavor	0.05
D-Sorbitol	22.8
Isomalt	35
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2

5 **Example 3: Batch 2.**

The ingredients set forth in Table 3 were used in producing Batch 2 of the chewable gum composition according to the procedure outlined in Example 1.

Table 3:

Ingredient	Weight Percent (%)
Gum Base	23
Glycerin Ester of Fatty Acids	0.2
Microcrystalline Cellulose	12.5
Stevioside	0.35
L-menthol	0.6
Eucalyptus Flavor	0.1
D-Sorbitol	36.75
D-Maltitol Powder	20
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5

<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2

Example 4: Batch 3.

The ingredients set forth in Table 4 were used in producing Batch 3 of the chewable gum composition according to the procedure outlined in Example 1.

5 Table 4:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.2
Microcrystalline Cellulose	12.5
Stevioside	0.35
L-menthol	0.6
Peppermint Flavor	0.7
Eucalyptus Flavor	0.2
D-Sorbitol	34.8
D-Maltitol Powder	20
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2
Roasted Salt	0.15

Example 5: Batch 4

The ingredients set forth in Table 5 were used in producing Batch 4 of the chewable gum composition according to the procedure outlined in Example 1.

10 Table 5:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.2
Microcrystalline Cellulose	10

Stevioside	0.35
L-menthol	0.75
Peppermint Flavor	0.7
Eucalyptus Flavor	0.2
D-Sorbitol	32.1
D-Maltitol Powder	25
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2
Roasted Salt	0.2

Example 6: Batch 5

The ingredients set forth in Table 6 were used in producing Batch 5 of the chewable gum composition according to the procedure outlined in Example 1.

5 Table 6:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.2
Silicon Dioxide	0.5
Microcrystalline Cellulose	10
Stevioside	0.4
L-menthol	0.75
Peppermint Flavor	0.8
Eucalyptus Flavor	0.2
D-Sorbitol	31.45
D-Maltitol Powder	25
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2

Roasted Salt	0.2
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Example 7: Batch 6

The ingredients set forth in Table 7 were used in producing Batch 6 of the chewable gum composition according to the procedure outlined in Example 1.

5 Table 7:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.2
Silicon Dioxide	0.5
Microcrystalline Cellulose	10
Stevioside	0.4
L-menthol	0.75
Peppermint Flavor	0.8
Eucalyptus Flavor	0.3
Glycerin Food Grade	0.015
D-Sorbitol	36.335
D-Maltitol Powder	20
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2
Roasted Salt	0.2

Example 8: Batch 7.

The ingredients set forth in Table 8 were used in producing Batch 7 of the chewable gum composition according to the procedure outlined in Example 1.

10 Table 8:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.2
Silicon Dioxide	0.5

Microcrystalline Cellulose	10
Stevioside	0.4
L-menthol	0.75
Peppermint Flavor	0.8
Eucalyptus Flavor	0.3
D-Sorbitol	20
D-Maltitol Powder	36.35
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2
Xylitol Crystalline	2
Roasted Salt	0.2

Example 9: Batch 8

The ingredients set forth in Table 9 were used in producing Batch 8 of the chewable gum composition according to the procedure outlined in Example 1.

5 Table 9:

Ingredient	Weight Percent (%)
Gum Base	24
Glycerin Ester of Fatty Acids	0.5
Silicon Dioxide	0.5
Microcrystalline Cellulose	10
Stevioside	0.4
L-menthol	0.75
Peppermint Flavor	0.8
Eucalyptus Flavor	0.3
D-Sorbitol	25
D-Maltitol Powder	31
Red Wine Grape Extract	1.7
<i>Lactobacillus Reuteri</i>	0.5
<i>Lactibacillus Plantarum</i>	0.3
Magnesium Stearate	2

Xylitol Crystalline	2
Roasted Salt	0.2

Example 10: Effects of Chewable Gum Compositions on Oral Malodor.

Oral malodor or halitosis, commonly referred to as bad breath, is the result of volatile sulfur compounds, carboxylic acids and amines building up in the oral cavities. The chewable gum composition set forth in Batch 4 (Table 5) was administered to twenty-two human subjects, and concentrations (in parts-per-billion, hereinafter - ppb) of mouth odor gases were measured before and after the subjects chewed the chewable gum composition for ten minutes. Mouth odor gases were measured using a Twin Breasor II (iSenlab Inc.) apparatus.

Each subject brushed their teeth at least two hours before the test and did not use any oral hygiene product thereafter. Each subject's mouth was first rinsed with water and then each subject's breath was analyzed to determine the concentrations of H₂S and CH₃SH gases present prior to administering the chewable gum composition. The subjects were then administered two 2 gram tablets of the chewable gum composition, and allowed to chew the composition for ten minutes. Each subject's breath was then analyzed to determine the concentrations of H₂S and CH₃SH gases present following use of the chewable gum composition.

Of the twenty-two subjects tested, no subjects exhibited an increase in breath H₂S concentrations, and one subject exhibited an increase in breath CH₃SH concentration. Surprisingly, a single use of the chewable gum composition significantly decreased breath H₂S concentrations all eleven subjects that exhibited a measurable amount of H₂S before administration, and decreased breath CH₃SH concentrations in all ten subjects that exhibited a measurable amount of CH₃SH before administration. These effects were observed in both severe cases (H₂S or CH₃SH concentration $\geq$ 100 ppb prior to use of the chewable gum composition) and non-severe cases (H₂S or CH₃SH concentration $\leq$ 100 ppb prior to use of the chewable gum composition). Table 10 and Table 11 illustrate the observed reduction of mouth odor gas concentrations for H₂S and CH₃SH, respectively. As demonstrated by this study, ten minutes of chewing the chewable gum composition can reduce or eliminate severe and non-severe conditions of mouth odor gases associated with halitosis.

Table 10: H₂S in breath (ppb)

Patient ID	Before Use	After Use
24	777	145
15	400	60
13	124	19
12	103	0
21	147	71
20	67	0
UKJ	66	0
2	32	0
1	7	0
14	6	0
7	3	0
(11 subjects)*	0	0

* For eleven subjects (Patient ID numbers 16, 18, 8, 9, 23, LSH, 17, 22, 11, JJS, and 19), the amount of H₂S in the breath samples before use and after use was below the detection limit.

Table 11: CH₃SH in breath (ppb)

Patient ID	Before Use	After Use
15	155	0
24	94	2
21	13	0
14	8	0
13	2	0
9	1	0
12	1	0
16	1	0
2	1	0
7	1	0
19	1	0
(10 subjects)*	0	0
8	0	1

* For ten subjects (Patient ID numbers 1, 11, 17, 18, 20, 23, 24, JJS, LSH, and UKJ), the amount of CH₃SH in the breath samples before use and after use was below the detection limit

5 **Example 11: Effects of Chewable Gum Compositions on Bacterial Plaque**

With poor oral hygiene, food debris and dental bacterial plaque can accumulate on the teeth and tongue, and cause caries and periodontal diseases like gingivitis and periodontitis. In order to determine the effects of chewable gum compositions on bacterial plaque build-up, bacterial plaque levels were analyzed in a human subject (tested on different days) before and
10 after use of a chewable gum composition according to an embodiment of the invention in comparison with a commercially available chewing gum product in two different experiments.

In a first experiment, the chewable gum composition was prepared by heating and blending the commercially available chewing gum product with microcrystalline cellulose
15 (“MCC”) (M101) (Ming Tai Chemical Co., Taiwan) in a weight ratio of 88:12 (12 wt% MCC). The resulting composition was cooled and shaped for use, and compared against the commercially available chewing gum product.

In a second experiment, a chewable gum composition prepared as Batch 1 (Example
20 2) was used, and compared against the same commercially available chewing gum product used in the first experiment.

Before administration, bacterial plaque build-up was visualized by rinsing the subject’s mouth with IC-Disclosing Solution to stain any plaque deposits with a red color. Photographs of the initial stain pattern observed for the subject “before use” is shown at the left side of Fig. 1A and 1B (first experiment) and Fig. 2A and 2B (second experiment).

25 In the first experiment the subject chewed either 5.4 g of regular chewing gum (Fig. 1A), or 6.0 g of the chewable gum composition described above (Fig. 1B), for 20 minutes. In the second experiment the subject chewed either 5.4 g of regular chewing gum (Fig. 2A), or 6.0 g of the chewable gum composition (Fig. 2B) according to the invention, for 20 minutes. Remaining bacterial plaque levels were then assessed.

30 In each experiment, after chewing ordinary chewing gum, the subject retained a large residual plaque build-up after 20 minutes of chewing (see Fig. 1A, Fig. 2A, “after use”). Surprisingly, after chewing the chewable gum composition according to embodiments of the

invention, the subject exhibited a significant reduction in the amount of stained bacterial plaque (see Fig. 1B, Fig. 2B, “after use”). A side-by-side comparison of the stain patterns after use of each gum in the first experiment is shown in Fig. 1C, for the right side, center, and left side of the subject’s teeth. These results indicate that the present chewable gum compositions are effective to reduce or eliminate bacterial plaque after 20 minutes of chewing.

5

Claims

1. A chewable gum composition comprising a gum base and a scaling agent.
2. The chewable gum composition according to claim 1, wherein the composition comprises 10 to 40 weight percent of the gum base.
- 5 3. The chewable gum composition according to claim 1 or 2, wherein the scaling agent is microcrystalline cellulose.
4. The chewable gum composition according to any one of the preceding claims, wherein the composition comprises 1 to 20 weight percent of the scaling agent.
5. The chewable gum composition according to any one of the preceding claims,
10 wherein the composition further comprises at least one polyphenolic compound selected from a flavonoid and resveratrol and combinations thereof.
6. The chewable gum composition according to claim 5, wherein at least one polyphenolic compound is provided as a component of an extract from a natural source.
- 15 7. The chewable gum composition according to claim 6, wherein the composition comprises 0.1 to 5 weight percent of the extract from a natural source.
8. The chewable gum composition according to claim 7, wherein the extract from a natural source is obtained from wine grapes.
9. The chewable gum composition according to any one of the preceding claims,
20 wherein the composition further comprises a probiotic.

10. The chewable gum composition according to claim 8, wherein at least one probiotic is selected from *Lactobacillus Reuteri* and *Lactobacillus Plantarum*, and combinations thereof.
- 5 11. The chewable gum composition according to any one claims 8 or 9, wherein the composition comprises 0.01 to 5 weight percent of the probiotic.
12. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises an emulsifier.
- 10 13. The chewable gum composition according to claim 12, wherein at least one emulsifier is selected from glycerin ester of fatty acids, lecithin, glyceryl lacto palmitate, mono- and diglyceride, lecithin, sorbitan monostearate, triglycerole monostearate, tryglcerol monoshortening, polysorbate 65, octaglycerol monoleate, polysorbate 60, polysorbate 80, diglyceride and combinations thereof.
14. The chewable gum composition according to claim 12, wherein the emulsifier is at least glycerin ester of fatty acids.
- 15 15. The chewable gum composition according to any one of claims 12-14, wherein the composition comprises up to 5 weight percent of the emulsifier.
16. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises a filler.
- 20 17. The chewable gum composition according to claim 16, wherein at least one filler is selected from D-sorbitol, D-maltitol, isomalt, and combinations thereof.
18. The chewable gum composition according to any one of claims 16 or 17, wherein the filler is D-sorbitol in combination with D- maltitol or isomalt.

19. The chewable gum composition according to any one of claims 16-18, wherein the composition comprises up to 50 weight percent of the filler.
20. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises an anti-caking agent.
- 5 21. The chewable gum composition according to claim 20, wherein at least one anti-caking agent is selected from silicon dioxide, colloidal silicon dioxide, and talc, and combinations thereof.
22. The chewable gum composition according to claim 20, wherein the anti-caking agent is at least silicon dioxide.
- 10 23. The chewable gum composition according to any one of claims 20-22, wherein the composition comprises up to 5 weight percent of the anti-caking agent.
24. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises a sweetener.
25. The chewable gum composition according to claim 24, wherein at least one sweetener
15 is selected from saccharin acid, saccharin salts, cyclamate salts, acesulfame-K, L-aspartyl-L-phenylalanine methyl ester, L-D-aspartyl-N-(2,2,4,4-tetramethyl-3-thietazyl)-D-alaninamide hydrate, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose, sugar, maltose, partially hydrolyzed starch or corn syrup solids, sorbitol, mannitol maltitol, talin, dihydrochalcone, glycyrrhizin, stevia
20 rebaudiana (stevioside), sucralose, and combinations thereof.
26. The chewable gum composition according to any claim 24, wherein the sweetener is at least stevioside.

27. The chewable gum composition according to any one of claims 24-26, wherein the composition comprises up to 5 weight percent of the sweetener.
28. The chewable gum composition according to any one of the preceding claims, wherein the composition optionally further comprises a flavoring agent.
- 5 29. The chewable gum composition according to claim 28, wherein at least one flavoring agent is selected from a natural flavoring agent and a synthetic flavoring agent, and combinations thereof.
30. The chewable gum composition according to claim 28, wherein the flavoring agent is a combination of L-menthol and eucalyptus flavor, and optionally peppermint flavor.
- 10 31. The chewable gum composition according to any one of claims 28-30, wherein the composition comprises up to 5 weight percent of the flavoring agent.
32. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises a sugar replacement.
33. The chewable gum composition according to claim 32, wherein the sugar replacement
15 is at least crystalline xylitol.
34. The chewable gum composition according to any one of claims 32 or 33, wherein the composition comprises up to 30 weight percent of the sugar replacement.
35. The chewable gum composition according to any one of the preceding claims, wherein the composition optionally further comprises a salt flavoring agent.

36. The chewable gum composition according to claim 35, wherein the salt flavoring agent is sodium chloride, and the composition comprises up to 5 weight percent of sodium chloride.
37. The chewable gum composition according to any one of the preceding claims,
5 wherein the composition further comprises a softener.
38. The chewable gum composition according to claim 37, wherein at least one softener is selected from glycerin, lecithin, and combinations thereof.
39. The chewable gum composition according to claim 37, wherein the softener is at least glycerin.
- 10 40. The chewable gum composition according to any one of claims 37-39, wherein the composition comprises up to 5 weight percent of the softener.
41. The chewable gum composition according to any one of the preceding claims, wherein the composition further comprises a lubricant.
42. The chewable gum composition according to claim 41, wherein at least one lubricant
15 is selected from calcium stearate, magnesium stearate, stearic acid, sodium stearyl fumarate, vegetable based fatty acids, and combinations thereof.
43. The chewable gum composition according to claim 41, wherein the lubricant is at least magnesium stearate.
44. The chewable gum composition according to any one of claims 41-43, wherein the
20 composition comprises up to 10 weight percent of the lubricant.

45. The chewable gum composition according to any one of the preceding claims,
wherein the composition is a tablet.

46. A composition according to any one of the preceding claims for treating halitosis.

47. A composition according to any one of the preceding claims for treating or preventing
gingivitis.

5