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(54) Title: STABILIZING ANHYDROUS ORAL CARE COMPOSITIONS COMPRISING SODIUM BICARBONATE AND STANNOUS FLUORIDE

(57) Abstract: The present application discloses an anhydrous oral care composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

STABILIZING ANHYDROUS ORAL CARE COMPOSITIONS COMPRISING SODIUM BICARBONATE AND STANNOUS FLUORIDE

FIELD OF THE INVENTION

[0001] The present application relates to an oral care composition, and, more particularly, to an anhydrous oral care composition comprising a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone that provides both (i) formulation stabilization by controlling the rheology and (ii) stabilization and availability of active Stannous and Fluoride ions over the shelf life.

BACKGROUND OF THE INVENTION

[0002] Toothpaste formulations generally contain one or more active ingredients that may provide specific or wide range of benefits. Sodium fluoride is a common active ingredient in toothpastes that provide specific concentration of available fluoride that is essential for enamel protection. Stannous fluoride is another commonly used active ingredient that provides stannous ions that is useful for preventing enamel erosion, gum disease, gingivitis, and infections from oral microbes and simultaneously furnishing fluoride ions necessary for enamel protection and enamel health. Sodium bicarbonate is used in many toothpastes primarily for their cleaning benefit.

[0003] However, for these active ingredients to perform their specific roles, it is crucial that maximum availability of each ingredient is maintained throughout the shelf life of the toothpaste while minimizing loss of active ingredient in the toothpaste formulation as unavailable or defunct reaction products of undesired physicochemical reactions with other components present in the toothpaste. Combining multiple active ingredients in a single toothpaste formulation to provide multiple benefits invariably presents the challenge of stabilizing each ingredient in the toothpaste formulation while maintaining availability of active ingredients and overall long-term toothpaste formulation stability.

[0004] Particularly sensitive to such inter-component interaction and deactivation thereby is Stannous fluoride. The active Sn^{+2} ion concentration required for anti-bacterial benefits can be rapidly lost due to reaction of Stannous with water and other oxidents present in aqueous or low water containing toothpastes leading to formation of unavailable or inactive Sn^{+4} species. Completely anhydrous toothpaste formulations containing no water or very low (about 5 wt% to about 10% wt.%) water containing formulations, in combination with suitable chelating agents like sodium gluconate or polyacrylates may prevent decomposition and loss of Stannous

ions in Stannous fluoride containing toothpastes. However, Stannous stabilization through anhydrous formulations is generally achieved at the expense of sacrificing or compromising toothpaste consistency rheology, standup and aesthetics since the most efficient rheology modifiers used in toothpaste formulations are effective only in presence of water.

[0005] US Publication 2012/207,686 filed by Colgate Palmolive Co. disclose single phase dentifrice compositions comprising an oral vehicle, a source of fluoride ions and a source of stannous ions wherein, the vehicle includes a polymer system comprising cross-linked polyvinylpyrrolidone.

[0006] US Patent 10,098,829 filed by Colgate Palmolive Co. disclose single phase dentifrice compositions comprising an oral vehicle, a source of fluoride ions and a source of stannous ions wherein, the vehicle includes a polymer system comprising cross-linked polyvinylpyrrolidone.

[0007] US Patent 10,314,771 filed by University of Tennessee Research teaches an oral composition, comprising crosslinked polyvinylpyrrolidone (PVP) and xylitol, sodium fluoride, and an alkalinizing agent comprising sodium bicarbonate.

[0008] PCT Application 2021/067,683 filed by ISP Investments LLC discloses an anhydrous carbomer based toothpaste composition comprising a strongly swellable, lightly to moderately crosslinked polyvinyl pyrrolidone, a fluoride-providing compound selected from sodium fluoride, and stannous fluoride.

[0009] US Publication 2013/209,376 filed by ISP Investments LLC discloses an oral care composition comprising a source of fluoride ions and a thickening agent, wherein the thickening agent comprises a strongly swellable, lightly to moderately crosslinked polyvinyl pyrrolidone.

[0010] US Publication 2022/401,395 filed by ISP Investments LLC discloses an Oral care composition (I) comprises: at least one oral care ingredient; and a thickening agent, where the thickening agent comprises a strongly swellable, lightly to moderately crosslinked polyvinyl pyrrolidone.

[0011] In view of the foregoing, the issue of stabilization of stannous ions and ensuring availability of active level of stannous and fluoride ions simultaneously over the shelf life of the oral care composition is challenging and can become more difficult if an additional active ingredient like sodium bicarbonate is present in the formulation.

[0012] Accordingly, it is an object of the present application to provide an anhydrous oral care composition comprising a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone as a that provides both (i) formulation stabilization by controlling the

rheology and (ii) stabilization and availability of active stannous and fluoride ions over the shelf life, wherein the oral care formulation comprises both stannous fluoride and sodium bicarbonate as active ingredients.

[0013] The foregoing and other objects and features of the invention will be made apparent from the following description.

SUMMARY OF THE INVENTION

[0014] The primary aspect of the present application is to provide an anhydrous oral care composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

[0015] Another aspect of the present application is to provide a method to improve oral health comprising, applying an effective amount of anhydrous oral care composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient; to an oral cavity surface, wherein the method is effective at delivering active stannous ions and fluoride ions to the oral cavity surface over the shelf life of the oral care composition.

[0016] Another aspect of the present application is to provide an anhydrous toothpaste composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

[0017] In another aspect of the present application, the strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone used in the anhydrous toothpaste composition is characterized by an aqueous gel volume of about 15 to 150 ml/g of polymer and a Brookfield viscosity of at least 10,000 cps for a 5% aqueous solution at 25° C.

[0018] In another aspect of the present application, the anhydrous oral care composition ensures availability of active stannous ions and fluoride ions over the shelf life.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Before explaining at least one aspect of the disclosed and/or claimed inventive concept(s) in detail, it is to be understood that the disclosed and/or claimed inventive concept(s) is not limited in its application to the details of construction and the arrangement of the components or steps or methodologies set forth in the following description or illustrated in the drawings. The disclosed and/or claimed inventive concept(s) is capable of other aspects or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

[0020] As utilized in accordance with the disclosure, the following terms, unless otherwise indicated, shall be understood to have the following meanings.

[0021] Unless otherwise defined herein, technical terms used in connection with the disclosed and/or claimed inventive concept(s) shall have the meanings that are commonly understood by those of ordinary skill in the art. Further, unless otherwise required by context, singular terms shall include pluralities and plural terms shall include the singular.

[0022] The singular forms "a," "an," and "the" include plural forms unless the context clearly dictates otherwise specified or clearly implied to the contrary by the context in which the reference is made. The term “Comprising” and “Comprises of” includes the more restrictive claims such as “Consisting essentially of” and “Consisting of”.

[0023] For purposes of the following detailed description, other than in any operating examples, or where otherwise indicated, numbers that express, for example, quantities of ingredients used in the specification and claims are to be understood as being modified in all instances by the term "about". The numerical parameters set forth in the specification and attached claims are approximations that may vary depending upon the desired properties to be obtained in carrying out the invention.

[0024] All percentages, parts, proportions, and ratios as used herein, are by weight of the total composition, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore; do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified.

[0025] All publications, articles, papers, patents, patent publications, and other references cited herein are hereby incorporated herein in their entirety for all purposes to the extent consistent with the disclosure herein.

[0026] The use of the term "at least one" will be understood to include one as well as any quantity more than one, including but not limited to, 1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50, 100, etc. The term "at least one" may extend up to 100 or 1000 or more depending on the term to which it is attached. In addition, the quantities of 100/1000 are not to be considered limiting as lower or higher limits may also produce satisfactory results.

[0027] As used herein, the words "comprising" (and any form of comprising, such as "comprise" and "comprises"), "having" (and any form of having, such as "have" and "has"), "including" (and any form of including, such as "includes" and "include") or "containing" (and any form of containing, such as "contains" and "contain") are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

[0028] The term "each independently selected from the group consisting of" means when a group appears more than once in a structure, that group may be selected independently each time it appears.

[0029] As used herein, the term "anhydrous" means non-aqueous or substantially free of water. The individual components of the anhydrous composition may contain limited amount of water that can cumulatively ranges from about 2 wt.% to about 5 wt.% of the overall composition. Nevertheless, the formulation does not contain water as a component and remains substantially free of water.

[0030] The term "strongly swellable, lightly to moderately crosslinked PVP", unless otherwise noted, specifically refers to polymer essentially consisting of lightly- to moderately-crosslinked poly(N-vinyl-2-pyrrolidone) having at least one of the following characteristics: (1) an aqueous swelling parameter defined by its gel volume from about 15 mL/g to about 300 mL/g, more particularly from about 15 mL/g to about 250 mL/g, and in other cases from about 15 mL/g to about 150 mL/g, or (2) a Brookfield viscosity of 5% crosslinked PVP in a liquid carrier comprising water at 25° C of at least 2,000 cP, more particularly of at least about 5,000 cP, and in certain cases of at least about 10,000 cP. Disclosure for these parameter ranges is provided in U.S. Pat. No. 5,073,614 *(incorporated herein by reference)*.

[0031] Unless otherwise specified, "strongly swellable, lightly to moderately crosslinked PVP" does not refer to swellable but water-insoluble crosslinked PVP, such as the type sold into commercial trade under the trade name Polyclar by International Specialty Products, which differs from the above described crosslinked PVP.

[0032] As used herein, the term "oral cavity" means an individual's teeth, gums, other oral soft tissues including all periodontal regions including teeth down to the gingival margins and/or the periodontal pockets.

[0033] In a non-limiting embodiment, the present application discloses an anhydrous oral care composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

[0034] According to another embodiment of the present application, the strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone used in an anhydrous toothpaste composition is characterized by an aqueous gel volume of about 15 to 150 ml/g of polymer and a Brookfield viscosity of at least 10,000 cps for a 5% aqueous solution at 25° C.

[0035] According to another embodiment, the amount of the crosslinked polyvinyl pyrrolidone of the present application ranges from about 0.01 wt.% to about 0.50 wt.% or from about 0.50 wt.% to about 1 wt.% or from about 1 wt.% to about 1.50 wt.% or from about 1.50 wt.% to about 2 wt.% or from about 2 wt.% to about 2.50 wt.% or from about 2.50 wt.% to about 3 wt.% or from about 3 wt.% to about 3.50 wt.% or from about 3.50 wt.% to about 4 wt.%.

[0036] According to another embodiment, the amount of sodium bicarbonate of the present application ranges from about 10 wt.% to about 15 wt.% or from about 15 wt.% to about 20 wt.% or from about 20 wt.% to about 25 wt.% or from about 25 wt.% to about 30 wt.% or from about 30 wt.% to about 35 wt.% or from about 35 wt.% to about 40 wt.% or from about 40 wt.% to about 45 wt.% or from about 45 wt.% to about 50 wt.% or from about 50 wt.% to about 55 wt.% or from about 55 wt.% to about 60 wt.%.

[0037] According to another embodiment of the present application, the fluoride ion source is selected from the group consisting of sodium fluoride, stannous fluoride, sodium monofluorophosphate, organic aminofluorides, potassium fluoride, ammonium fluoride, calcium fluoride, copper fluoride, zinc fluoride, barium fluoride, sodium fluorosilicate, ammonium fluorosilicate, sodium fluorozirconate, ammonium fluorozirconate, aluminum mono-and di-fluorophosphate, fluorinated sodium calcium pyrophosphate and combinations thereof.

[0038] According to another embodiment, the amount of fluoride ion source of the present application ranges from about 0.01 wt.% to about 0.50 wt.% or from about 0.50 wt.% to about 1 wt.% or from about 1 wt.% to about 1.50 wt.% or from about 1.50 wt.% to about 2 wt.% or

from about 2 wt.% to about 2.50 wt.% or from about 2.50 wt.% to about 3 wt.% or from about 3 wt.% to about 3.50 wt.% or from about 3.50 wt.% to about 4 wt.%.

[0039] According to another embodiment of the present application, the stannous ion source is selected from the group consisting of stannous fluoride, stannous sulfate, stannous chloride, stannous pyrophosphate, stannous formate, stannous acetate, stannous gluconate, stannous lactate, stannous tartrate, stannous oxalate, stannous malonate, stannous citrate, and combinations thereof.

[0040] According to another embodiment, the amount of stannous ion source of the present application ranges from about 0.01 wt.% to about 0.50 wt.% or from about 0.50 wt.% to about 1 wt.% or from about 1 wt.% to about 1.50 wt.% or from about 1.50 wt.% to about 2 wt.% or from about 2 wt.% to about 2.50 wt.% or from about 2.50 wt.% to about 3 wt.% or from about 3 wt.% to about 3.50 wt.% or from about 3.50 wt.% to about 4 wt.%.

[0041] According to another aspect of the present application, the anhydrous oral care composition ensures availability of active stannous ions and fluoride ions over the shelf life.

[0042] According to another embodiment of the present application, the oral care ingredient is selected from the group consisting of carriers, stain removers, thickening agents, surfactants, sweeteners, coloring agents, flavoring agents, humectants, polishing agents, defoamers, buffering agents, softeners, astringents, preservatives, and combinations thereof.

[0043] According to another embodiment, the amount of oral care ingredient of the present application ranges from about 0.01 wt.% to about 5 wt.% or about 5 wt.% to about 10 wt.% or about 10 wt.% to about 15 wt.% or from about 15 wt.% to about 20 wt.% or from about 20 wt.% to about 25 wt.% or from about 25 wt.% to about 30 wt.% or from about 30 wt.% to about 35 wt.% or from about 35 wt.% to about 40 wt.% or from about 40 wt.% to about 45 wt.% or from about 45 wt.% to about 50 wt.% or from about 50 wt.% to about 55 wt.% or from about 55 wt.% to about 60 wt.% or from about 60 wt.% to about 65 wt.%. or from about 65 wt.% to about 70 wt.%. or from about 70 wt.% to about 75 wt.%.

[0044] According to another embodiment of the present application, the carrier is selected from the group consisting of polyethylene glycol, polypropylene glycol, copolymers of ethylene oxide and propylene oxide, PEG/PPG 116/66 copolymer, glycerin, mannitol, lactam/pyrrolidone based polymers, pyrrolidone co-polymers, α-olefin maleic acid/ester co-polymers, α-olefin polymers, carbohydrate-based polymers, natural polymers, natural gums, and combinations thereof.

[0045] According to another embodiment of the present application, the stain remover is selected from the group consisting of sodium tripolyphosphate, sodium tetrapolyphosphate, sodium hexametaphosphates, and combinations thereof.

[0046] According to another embodiment of the present application, the thickening agent is selected the group consisting of, natural and synthetic clays, carrageenans, xanthan gum, alkali metal-carboxymethyl cellulose, hydroxyalkyl cellulose, hydroxypropylmethyl cellulose, precipitated silicone dioxide, hydrated silica, thickening silica, silicone gel, alkali metal carboxymethyl hydroxyethyl cellulose, polyethylene glycol, polypropylene glycol, copolymers of ethylene oxide and propylene oxide, lactam/pyrrolidone based polymers, pyrrolidone co-polymers, carboxyvinyl polymers, α-olefin polymers, polyacrylates, carbohydrate-based polymers, natural polymers, natural gums, and combinations thereof.

[0047] In another embodiment, the thickening agents include water-soluble cellulose ethers such as sodium carboxymethylcellulose, sodium carboxymethyl hydroxyethyl cellulose and, hydroxyethyl cellulose, or polyvinylpyrrolidone. Other suitable thickening agents include carboxyvinyl polymers, carrageenan, laponite and other natural gums such as gum karaya, xanthan gum, guar gum, gum arabic, and gum tragacanth. Colloidal magnesium aluminum silicate or finely divided silica can also be used as part of the thickening agent to further improve the texture.

[0048] According to another embodiment of the present application, the surfactant is selected from the group consisting of anionic surfactants, cationic surfactants, nonionic surfactants, zwitterionic surfactants, and combinations thereof.

[0049] In another embodiment of the present application, anionic surfactants include water-soluble salts of alkyl sulfates having from 8 to 20 carbon atoms in the alkyl radical (e.g., sodium alkyl sulfate) and the water-soluble salts of sulfonated monoglycerides of fatty acids having from 8 to 20 carbon atoms, such as sodium lauryl sulfate and sodium coconut monoglyceride sulfonate. Other suitable anionic surfactants are sarcosinates, such as sodium lauroyl sarcosinate, taurates, sodium lauryl sulfoacetate, sodium lauroyl isethionate, sodium lauryl carboxylate, and sodium dodecyl benzenesulfonate, and mixtures thereof.

[0050] In another embodiment of the present application, the surfactant is selected from the group consisting of sarcosinate surfactants, isethionate surfactants and taurate surfactants. Surfactants are alkali metal or ammonium salts of these surfactants, sodium and potassium salts of lauroyl sarcosinate, myristoyl sarcosinate, palmitoyl sarcosinate, stearyl sarcosinate, and oleoyl sarcosinate.

[0051] Examples of suitable cationic surfactants include derivatives of aliphatic quaternary ammonium compounds having one long alkyl chain containing from about 8 to 18 carbon atoms such as lauryl trimethylammonium chloride, cetyl pyridinium chloride, cetyl trimethylammonium bromide, di-isobutylphenoxyethyl-dimethylbenzylammonium chloride, coconut alkyltrimethylammonium nitrite, cetyl pyridinium fluoride, etc.

[0052] Examples of suitable non-ionic surfactants include the Pluronics, polyethylene oxide condensates of alkyl phenols, products derived from the condensation of ethylene oxide with the reaction product of propylene oxide and ethylene diamine, ethylene oxide condensates of aliphatic alcohols, long chain tertiary amine oxides, long chain tertiary phosphine oxides, long chain dialkyl sulfoxides, alkoxylated hydrocarbons, alkoxylated vegetable oils, alkyl polyglucosides and mixtures of such materials.

[0053] Examples of suitable zwitterionic surfactants include derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radicals can be straight chain or branched, and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and one contains an anionic water-solubilizing group, e.g., carboxy, sulfonate, sulfate, phosphate or phosphonate.

[0054] According to another embodiment of the present application, the surfactant is selected from the group consisting of sodium lauryl sulfate, sodium dodecyl benzene sulfonate, ammonium carboxylates, ammonium sulfonates, polysorbates, polyalkoxylated alkanols, polyalkoxylated alkylphenols, polyalkoxylated esters, ethylene oxide/propylene oxide copolymers, alkyl polyglucosides, phospholipids, alkoxylated ethylene diamine derivatives, and combinations thereof.

[0055] The sweetener of the present application may be selected from a wide range of agents, including natural, artificial, water-soluble sweeteners, water-soluble artificial sweeteners, and/or dipeptide based sweeteners. The representative illustrations encompass water-soluble sweetener such as monosaccharides, disaccharides, and polysaccharides such as xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose, maltose, partially hydrolyzed starch or corn syrup solids and sugar alcohols such as sorbitol, xylitol, mannitol, hydrogenated glucose syrup and mixtures thereof; and water-soluble artificial sweeteners such as the soluble saccharin salts, i.e., sodium or calcium saccharin salts, cyclamate salts, such as the sodium salt and the like, and the free acid form of saccharin; dipeptide based sweetening agents such as L-aspartyl-L-phenyl-alanine methyl ester and materials; dihydrochalcone; glycyrrhizin; *Stevia rebaudiana* (Stevioside); and the synthetic sweetener 3,6-dihydro-6-methyl-1,2,3-oxathiazin-4-one-2,2-dioxide, particularly the potassium (Acesulfame-K), sodium and calcium salts

thereof. The amount of the sweetener will vary with the type of sweetener selected and the desired level of sweetness. Water-soluble sweeteners derived from naturally occurring water-soluble sweeteners, such as a chlorinated derivative of sucrose is known under the product description of sucralose as well as protein based sweeteners such as thaumatococus danielli (Thaumatin I and II) can be used. Sweetening agents are typically used in tooth whitening compositions at levels of from about 0.05% to about 2%, preferably about 0.1% to about 0.5% by weight of the composition.

[0056] According to another embodiment of the present application, the sweetener is selected from the group consisting of sodium saccharine, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose, maltose, sorbitol, xylitol, mannitol, *stevia rebaudiana* extracts, levulose, lactose, saccharin salts, thaumatin, aspartame, D-tryptophan, dihydrochalcones, acesulfame, sucralose, cyclamate salts such as sodium cyclamate, and sodium saccharin, and combinations thereof.

[0057] According to another embodiment of the present application, the coloring agent is selected from the group consisting of titanium dioxide, FD & C (Food, Drugs and Cosmetics) dyes, naturally-derived colors, and combinations thereof.

[0058] Coloring agents such as dyes or pigments, presently certified under the Food Drug & Cosmetic Act for use in Food, Drugs and Cosmetics (FD & C dyes), that can be used in the present application include but not limited to caramel colorant, red colorant Enocianin, Indigo yellow, Quinoline yellow, Quinizarine Green, FD&C Blue #1, FD&C Blue #2, other FD&C Blue colors, FD&C Red No. 3, FD&C Red No. 20, FD&C Red No. 40, other FD&C Red colors, FD&C Yellow No. 6, other FD&C Yellow colors, FD&C Green No. 3, other FD&C Green colors, FD&C Orange No. 5, other FD&C Orange colors, titanium dioxide, iron oxide, and mixtures thereof.

[0059] Suitable flavoring agents include those flavors known to the skilled artisan, such as natural and artificial flavors. These flavorings 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, blueberry, 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.

[0060] Other useful flavorings include aldehydes, esters, and ketones such as cinnamyl acetate, cinnamaldehyde, citral diethylacetal, dihydrocarvyl acetate, eugenyl formate, raspberry ketone 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 publication is incorporated herein by reference. This may include natural as well as synthetic flavors.

[0061] According to another embodiment of the present application, the flavoring agent is selected from the group consisting of anise oil, clove oil, sassafras oil, spearmint oil, peppermint oil, oil of wintergreen, eugenol, and combinations thereof.

[0062] According to another embodiment, it is contemplated to employ at least one or more oral care active ingredients selected from the group consisting of an analgesic, an antibacterial, an anticalculus agents, an antibiotic, a probiotic, an antioxidant, a peptide, an enzyme, a cooling agent , a preservative, a desensitizing agent, a dental remineralization agent, odor or breath freshening agents, warming agents, herbal agents, medicaments, vitamins, taste masking agents, pharmaceutical agent, a therapeutic agent, vitamin, a mineral, warming agent, a sensate, throat-soothing agent, spices, caffeine, drug and mixtures thereof.

[0063] Suitable antibacterial agents include, without limitation, copper (II) compounds such as copper (II) chloride, fluoride, sulfate and hydroxide, zinc ion sources such as zinc acetate, zinc citrate, zinc gluconate, zinc glycinate, zinc oxide, zinc sulfate and sodium zinc citrate, phthalic acid and salts thereof such as magnesium monopotassium phthalate, hexetidine, octenidine, sanguinarine, benzalkonium chloride, domiphen bromide, alkylpyridinium chlorides such as cetylpyridinium chloride (CPC) (including combinations of CPC with zinc and/or enzymes), tetradecylpyridinium chloride and N-tetradecyl-4-ethylpyridinium chloride, iodine, sulfonamides, bisbiguanides such as alexidine, chlorhexidine and chlorhexidine digluconate, piperidino derivatives such as delmopinol and octapinol, magnolia extract, grapeseed extract, raspberry ketone, menthol, geraniol, citral, eucalyptol, eugenol, stannous fluoride, magnolia bark extracts, Chinese traditional medicines, thymol, 4-isopropyl m-cresol(IPMP, o-cymen 5-ol) antibiotics such as amoxicillin, tetracycline, doxycycline, minocycline, metronidazole, neomycin, kanamycin and clindamycin, and the like. A further

illustrative list of useful antibacterial agents is provided in U.S. Pat. No. 5,776,435 to Gaffar et al.

[0064] In another embodiment, suitable anti-microbial agents can include but not limited to halogenated diphenyl ether, 2,4,4′-trichloro-2'-hydroxy-diphenyl ether, 2,2′-dihydroxy-5,5′-dibromo-diphenyl ether, 2,2′-methylenebis-4(4-chloro-6- bromo-phenol), halogenated salicylanilides and halogenated cabanilides, stannous chloride, zinc lactate, zinc citrate, zinc oxide.

[0065] In another embodiment, the anhydrous oral care composition further comprises a film-forming polymer for example, a synthetic anionic polymeric polycarboxylate (SAPP), such as PVM/MA copolymer (Gantrez S-97, Ashland Inc.). Such polymers are described in U.S. Pat. Nos. 5,334,375 and 5,505,933, which are incorporated by reference herein in their entirety. SAPP's have previously been described as useful for dentin sensitivity reduction. Moreover, SAPP's have previously been described as antibacterial-enhancing agents, which enhance delivery of an antibacterial agent to oral surfaces, and which enhance the retention of the antibacterial agent on oral surfaces. It is well within the contemplation of the present application that film-forming polymers, such as PVM/MA copolymer, may be employed in the compositions of the present application as a means of reducing stain formation.

[0066] In another embodiment, whitening agents such as blue covarine, blue colors and dyes, polyphosphates, phytic acid and its' salts, complexed bleaching, or bleaching agents can also be used as coloring agents. Suitable bleaching or whitening agents also include peroxide compounds. Peroxides help to whiten the teeth by releasing hydroxyl radicals capable of breaking down the plaque-stain complex into a form that can be flushed away or removed by abrasives. Useful peroxides should contain an O-O bond, which can break down to provide at least one active species. Examples of preferred peroxide compounds are inorganic peroxides, such as hydrogen peroxide, calcium peroxide, strontium peroxide, zinc peroxide or magnesium peroxide, and organic peroxides including, but not limited to, carbamide peroxide, PVP-hydrogen peroxide complexes and sodium percarbonate.

[0067] In another embodiment, the anhydrous oral care composition further comprises suitable abrasives selected from silica abrasives, such as standard cleaning silicas, high cleaning silicas or any other suitable abrasive silicas. Additional examples of abrasives that can be used in addition to or in place of the silica abrasives include, for example, a calcium phosphate abrasive, e.g., tricalcium phosphate ($Ca_3(PO_4)_2$), hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$), or dicalcium phosphate dihydrate $CaHPO_4.2H_2O$ or calcium pyrophosphate; calcium carbonate abrasive; or abrasives such as sodium metaphosphate, potassium metaphosphate, aluminum

silicate, calcined alumina, bentonite or other siliceous materials, or combinations thereof. The silica component of the present silica substrate is an amorphous precipitated silica. Precipitated silicas include the following products available from the J. M. Huber Corporation, Edison, N.J.:, Zeodent® 103, Zeodent® 113, Zeodent® 114, Zeodent® 115, Zeodent® 118, Zeodent® 119, Zeodent® 165, and Zeodent® 9175.

[0068] Suitable abrasive particles are further selected from the group consisting of tricalcium phosphate, calcium phosphate dehydrate, anhydrous dicalcium phosphate, calcium pyrophosphate, magnesium orthophosphate, trimagnesium phosphate, calcium carbonate, baking soda, sodium hexametaphosphate, magnesium carbonate, magnesium silicate, titanium dioxide, zinc oxide, aluminum silicate, zirconium silicate, hydrated alumina, bentonite, hydrated silica, amorphous silica, silica gel or colloidal silica, alkali metal aluminosilicate complexes, silicon dioxide, alumina, and any combination thereof.

[0069] Yet another embodiment of the present application, discloses a method to improve oral health comprising, applying an effective amount of anhydrous oral care composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient; to an oral cavity surface, wherein the method is effective at delivering active stannous ions and fluoride ions to the oral cavity surface over the shelf life of the oral care composition.

[0070] According to another embodiment of the present application, the oral cavity surface is teeth surface.

[0071] In another aspect of the present application, the anhydrous oral care composition ensures availability of active stannous ions and fluoride ions over the shelf life.

[0072] According to another embodiment of the present application, the oral care composition is formulated as a toothpaste, tooth gel, subgingival gel, mouth-rinse, mouth wash, mousse, foam, denture product, mouth-spray, dissolvable film or chewing gum.

[0073] Another embodiment of the present application provides an anhydrous toothpaste composition comprising: (i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone; (ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate; (iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source; (iv) about

0.01 wt.% to about 5 wt.% of at least one stannous ion source; and, (v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

[0074] In another aspect of the present application, the anhydrous toothpaste composition ensures availability of active stannous ions and fluoride ions over the shelf life.

[0075] In another aspect of the present application, the anhydrous toothpaste composition exhibits stable rheology over the shelf life.

[0076] Further, certain aspects of the present application are illustrated in detail by way of the following examples. The examples are given herein for illustration of the application and are not intended to be limiting thereof.

EXAMPLES

EXAMPLE 1:

[0077] Control anhydrous toothpaste with Stannous fluoride, PEG/PPG 116/66 copolymer and Sodium bicarbonate (Control 1): To a suitably sized Whip Mix vessel, glycerin and PEG 8 were charged, and mixed for 5 min under high agitation with overhead mixer. To this, added PEG/PPG 116/66 copolymer and continued mixing for 5-8 minutes. To this, added the pre-melt PEG-1500 followed by Sodium Saccharine, sodium fluoride, Sodium Tripolyphosphate, and mixed for another 15 minutes. Further, added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 min. To this added Sodium Bicarbonate and mixed under vacuum for 2 minutes using the whip mixer. Then added Sodium lauryl sulfate and flavor, mixed under vacuum with the whip mixer for 2 minutes and finally added Stannous fluoride and mixed under vacuum with the whip mixer for 5-7 minutes.

EXAMPLE 2:

[0078] Control anhydrous toothpaste with Stannous fluoride, Na-Carboxymethyl cellulose and Sodium bicarbonate (Control 2): Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel, added Na-Carboxymethyl cellulose and mixed for 15-20 minutes under high agitation with overhead mixer. To this, added the pre-melt PEG-1500, followed by Sodium Saccharine, sodium fluoride, Sodium Tripolyphosphate, and mixed for 15 minutes. Further, added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 min. To this added Sodium Bicarbonate and mixed, under vacuum for 2 minutes using the whip mixer. Then added Sodium lauryl sulfate and flavor, mixed under vacuum with the whip mixer for 2 minutes and finally added Stannous fluoride and mixed under vacuum with the whip mixer for 5-7 minutes.

EXAMPLE 3:

[0079] Control anhydrous toothpaste with Sodium fluoride, PEG/PPG 116/66 copolymer and Sodium bicarbonate (Control 3): Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel and mixed for 5 minutes under high agitation with overhead mixer. To this added the PEG/PPG 116/66 copolymer continued mixing for 5-8 minutes. To this, added the pre-melt PEG-1500 followed by Sodium saccharine, Sodium fluoride, Sodium tripolyphosphate and mixed for 15 minutes. Then, added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 minutes. To this, added Sodium

Bicarbonate and mixed under vacuum for 2 minutes using the whip mixer. Finally added Sodium lauryl sulfate and flavor and mixed under vacuum with the whip mixer for 2 minutes.

EXAMPLE 4:

[0080] Control anhydrous toothpaste with Stannous fluoride, Na-Carboxymethyl cellulose and Sodium bicarbonate (Control 4): Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel, added Na-Carboxymethyl cellulose and mixed for 15-20 minutes under high agitation with an overhead mixer. To this, added the pre-melt PEG-1500 followed by Sodium Saccharine, Sodium fluoride, Sodium tripolyphosphate and mixed for 15 minutes. Then added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 minutes. To this, added Sodium Bicarbonate and mixed under vacuum for 2 minutes using the whip mixer. Then added Sodium lauryl sulfate and flavor and mixed under vacuum with the whip mixer for 2 minutes. Finally, added Stannous fluoride and mixed under vacuum with the whip mixer for 5-7 minutes.

EXAMPLE 5:

[0081] Anhydrous toothpaste with Sodium fluoride, lightly to moderately crosslinked polyvinylpyrrolidone and Sodium bicarbonate: Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel and mixed for 10 minutes, added lightly to moderately crosslinked polyvinylpyrrolidone and mixed for 30-40 minutes under high agitation with an overhead mixer. To this, added the pre-melt PEG-1500 followed by Sodium Saccharine, sodium fluoride, Sodium Tripolyphosphate, and mixed for 15 minutes. Then added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 minutes. To this, added Sodium Bicarbonate and mixed under vacuum for 2 minutes using the whip mixer. Finally added Sodium lauryl sulfate and flavor and mixed under vacuum with whip mixer for 2 minutes.

EXAMPLE 6:

[0082] Anhydrous toothpaste with Stannous fluoride, lightly to moderately crosslinked polyvinylpyrrolidone and Sodium bicarbonate: Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel and mixed for 10 minutes, added lightly to moderately crosslinked polyvinylpyrrolidone and mixed for 30-40 minutes under high agitation with an overhead mixer. To this, added the pre-melt PEG-1500 followed by Sodium Saccharine, Sodium Tripolyphosphate, and mixed for 15 minutes. Then added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 minutes. To this,

added Sodium Bicarbonate and mixed under vacuum for 2 minutes using the whip mixer. Then added Sodium lauryl sulfate and flavor and mixed under vacuum with whip mixer for 2 minutes. Finally, added Stannous fluoride and mixed under vacuum with the whip mixer for 5-7 minutes.

EXAMPLE 7:

[0083] Anhydrous toothpaste with Stannous fluoride, lightly to moderately crosslinked polyvinylpyrrolidone, Mannitol and Sodium bicarbonate: Glycerin and PEG 8 were charged to a suitably sized Whip Mix vessel and mixed for 10 minutes, added lightly to moderately crosslinked polyvinylpyrrolidone and mixed for 30-40 minutes under high agitation with an overhead mixer. To this, added the pre-melt PEG-1500 followed by Sodium Saccharine, Sodium Tripolyphosphate and mannitol, and mixed for 15 minutes. Then added silicas (thickening silica and abrasive silica), Titanium dioxide and mixed under vacuum with a whip mixer for 5 minutes. To this, added Sodium Bicarbonate and mixed under vacuum for 2 minutes using whip mixer. Then added Sodium lauryl sulfate and flavor, mix under vacuum with whip mixer for 2 minutes. Finally, added Stannous fluoride and mixed under vacuum with the whip mixer for 5-7 minutes. Table 1 provides wt.% of ingredients used in Example 1-7.

Table 1: Toothpaste formulations

Components	Example 1 (Control 1)	Example 2 (Control 2)	Example 3 (Control 3)	Example 4 (Control 4)	Example 5	Example 6	Example 7
Sodium fluoride	0.00	0.00	0.24	0.24	0.24	0.00	0.00
Stannous fluoride	0.45	0.45	0.00	0.00	0.00	0.45	0.45
Sodium bicarbonate	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Glycerin	38.75	38.75	38.96	38.96	38.96	38.75	33.75
PEG/PPG 116/66 copolymer	0.50	0.00	0.50	0.00	0.00	0.00	0.00
PEG-400	5.00	5.00	5.00	5.00	5.00	5.00	5.00
PEG-1500	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Mannitol	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Lightly to moderately crosslinked polyvinylpyrrolidone	0.00	0.00	0.00	0.00	0.50	0.50	0.50
Sodium tripolyphosphate	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Na-Carboxymethyl cellulose	0.00	0.50	0.00	0.50	0.00	0.00	0.00
Thickening silica	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Abrasive silica	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Sodium lauryl sulfate	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Sodium Saccharine	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Titanium dioxide	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Flavor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

EXAMPLE 8:

[0084] Methods for Measurement of viscosity (initial, 3 month @ room temp) - Cuban test method for toothpaste ribbon stand-up.

[0085] Full toothpaste formulations were packaged into tubes and the toothpaste integrity (stand-up) was measured using the Cuban rack test. In this test, the paste is squeezed from the bottom of the tube through a fixed orifice across a grid of parallel rods, increasingly spaced apart. The test results are expressed as the bar number furthest away from the starting point (numbers are from 1-12) that is still able to support the dentifrice ribbon (e.g., the bar where the ribbon breaks). Higher Cuban rack test values indicate better toothpaste ribbon stand-up.

[0086] The Cuban rack test was performed as follows: The nozzle of the toothpaste tube was held at a 45° angle to the rack device. Pressure was applied and the toothpaste bead was quickly drawn down to the entire length of the rack in a straight line. Generally, this is accomplished in approximately 2- seconds. If the ribbon breaks before the entire rack is traversed, the procedure is repeated. The ribbon was then allowed to stand for 30 seconds and the rod number corresponding to the highest bar value which was able to support the toothpaste ribbon was recorded as the Cuban value. The test was performed four times and the average reading recorded, rounding the number off to the nearest whole number.

[0087] Viscosity Measurements: Viscosity measurements were taken at 23°C using a Brookfield™ Model DV2T viscometer fitted with suitable spindle. All finished toothpastes were measured at 2 RPM using a TD spindle # 94,95 or 96 (depending on the viscosity) in the Heli-path mode with the measurement taken after 1-minute.

[0088] Table 2 provides the results of (i) viscosity measurement and (ii) toothpaste integrity (stand-up test) of test samples prepared from Example 1-7.

Table 2: Toothpaste Rheology and Standup readings

Sample	Brookfield viscosity (cps)		Standup
	Initial	3 month @ RT#	initial
Example 1	482,000	250,000	5
Example 2	243,000	260,000	3
Example 3	393,000	360,000	4
Example 4	227,000	367,000	3
Example 5	3,780,000	869,000	10
Example 6	754,000	756,000	6
Example 7	1,028,000	761,000	7

 # RT = Room Temperature

[0089] Table 3 provides the test results of (i) Stannous ion stabilization and (ii) Stannous ion availability of samples prepared from Example 6-7.

Table 3: Stannous stabilization and availability

	Example 6	**Example 7**
Total Tin (Sn^{+2} + Sn^{+4}); t = 0 @ RT#	3020 ppm (0.403% SnF_2 eqv.)	2949 ppm (0.393% SnF_2 eqv.)
% theoretical	89%	87%
Available Sn^{+2}; t = 0 @ RT#	3011 ppm (0.403% SnF_2 eqv.)	2900 ppm (0.387% SnF_2 eqv.)
% theoretical	89%	85%
Total Tin (Sn^{+2} + Sn^{+4}); t = 3 months @ 45°C	2600 ppm (0.347% SnF_2 eqv.)	2500 ppm (0.334% SnF_2 eqv.)
% theoretical	76%	73%
Available Sn^{+2}; t = 3 months @ 45°C	1716 ppm (0.229% SnF_2 eqv.)	1846 ppm (0.240% SnF_2 eqv.)
% theoretical	50.40%	52.80%
# *RT = Room Temperature;* eqv. = equivalent		

[0090] While this invention has been described in detail with reference to certain embodiments, it should be appreciated that the present invention is not limited to those precise embodiments. Rather, in view of the present disclosure, many modifications and variations would present themselves to those skilled in the art without departing from the scope and spirit of this invention.

What is Claimed is:

1. An anhydrous oral care composition comprising:

i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone;

ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate;

iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source;

iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and,

v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

2. The anhydrous oral care composition according to claim 1, wherein the crosslinked polyvinylpyrrolidone is characterized by an aqueous gel volume of about 15 to 150 ml/g of polymer and a Brookfield viscosity of at least 10,000 cps for a 5% aqueous solution at 25° C.

3. The anhydrous oral care composition according to claim 1, wherein the amount of the crosslinked polyvinyl pyrrolidone ranges from about 0.01 wt.% to about 2 wt.%.

4. The anhydrous oral care composition according to claim 1, wherein the amount of sodium bicarbonate ranges from about 20 wt.% to about 40 wt.%.

5. The anhydrous oral care composition according to claim 1, wherein the fluoride ion source is selected from the group consisting of sodium fluoride, stannous fluoride, sodium monofluorophosphate, organic aminofluorides potassium fluoride, ammonium fluoride, calcium fluoride, copper fluoride, zinc fluoride, barium fluoride, sodium fluorosilicate, ammonium fluorosilicate, sodium fluorozirconate, ammonium fluorozirconate, sodium monofluoro phosphate, aluminum mono-and di-fluorophosphate, fluorinated sodium calcium pyrophosphate and combinations thereof.

6. The anhydrous oral care composition according to claim 1, wherein the amount of fluoride ion source ranges from about 0.01 wt.% to about 2 wt.%.

7. The anhydrous oral care composition according to claim 1, wherein the stannous ion source is selected from the group consisting of stannous fluoride, stannous sulfate, stannous chloride, stannous pyrophosphate, stannous formate, stannous acetate, stannous gluconate, stannous lactate, stannous tartrate, stannous oxalate, stannous malonate, stannous citrate, and combinations thereof.

8. The anhydrous oral care composition according to claim 1, wherein the amount of stannous ion source ranges from about 0.01 wt.% to about 2 wt.%.

9. The anhydrous oral care composition according to claim 1, wherein the oral care composition ensures availability of active stannous ions and fluoride ions over the shelf life.

10. The anhydrous oral care composition according to claim 1, wherein the oral care ingredient is selected from the group consisting of carriers, stain removers, thickening agents, surfactants, sweeteners, coloring agents, flavoring agents, humectants, polishing agents, defoamers, buffering agents, softeners, astringents, preservatives, and combinations thereof.

11. The anhydrous oral care composition according to claim 10, wherein the carrier is selected from the group consisting of polyethylene glycol, polypropylene glycol, copolymers of ethylene oxide and propylene oxide, PEG/PPG 116/66 copolymer, glycerin, mannitol, lactam/pyrrolidone based polymers, pyrrolidone co-polymers, α-olefin maleic acid/ester co-polymers, α-olefin polymers, carbohydrate-based polymers, natural polymers, natural gums, and combinations thereof.

12. The anhydrous oral care composition according to claim 10, wherein the stain remover is selected from the group consisting of sodium tripolyphosphate, sodium tetrapolyphosphate, sodium hexametaphosphates, and combinations thereof.

13. The anhydrous oral care composition according to claim 10, wherein the thickening agent is selected the group consisting of natural and synthetic clays, carrageenans, xanthan gum, alkali metal-carboxymethyl cellulose, hydroxyalkyl cellulose, hydroxypropylmethyl cellulose, precipitated silicone dioxide, hydrated silica, thickening silica, silicone gel, alkali metal carboxymethyl hydroxyethyl cellulose, polyethylene glycol, polypropylene glycol, copolymers of ethylene oxide and propylene oxide, lactam/pyrrolidone based polymers, pyrrolidone co-polymers, carboxyvinyl polymers, α-olefin polymers, polyacrylates, carbohydrate-based polymers, natural polymers, natural gums, and combinations thereof.

14. The anhydrous oral care composition according to claim 10, wherein the surfactant is selected from the group consisting of anionic surfactants, cationic surfactants, nonionic surfactants, zwitterionic surfactants, and combinations thereof.

15. The anhydrous oral care composition according to claim 10, wherein the surfactant is selected from the group consisting of sodium lauryl sulfate, sodium dodecyl benzene sulfonate, ammonium carboxylates, ammonium sulfonates, polysorbates, polyalkoxylated alkanols, polyalkoxylated alkylphenols, polyalkoxylated esters, ethylene oxide/propylene oxide copolymers, alkyl polyglucosides, phospholipids, alkoxylated ethylene diamine derivatives, and combinations thereof.

16. The anhydrous oral care composition according to claim 10, wherein the sweetener is selected from the group consisting of sodium saccharine, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, sucrose, maltose, sorbitol, xylitol, mannitol, *stevia rebaudiana* extracts, and combinations thereof.

17. The anhydrous oral care composition according to claim 10, wherein the coloring agent is selected from the group consisting of titanium dioxide, FD & C dyes, naturally-derived colors, and combinations thereof.

18. The anhydrous oral care composition according to claim 10, wherein the flavoring agent is selected from the group consisting of anise oil, clove oil, sassafras oil, spearmint oil, peppermint oil, oil of wintergreen, eugenol, and combinations thereof.

19. The anhydrous oral care composition according to claim 1 is an anhydrous toothpaste composition.

20. A method to improve oral health comprising, applying an effective amount of anhydrous oral care composition of claim 1 to an oral cavity surface, wherein the method is effective at delivering active stannous ions and fluoride ions to the oral cavity surface over the shelf life of the oral care composition.

21. The method according to claim 20, wherein the oral cavity surface is teeth surface.

22. An anhydrous toothpaste composition comprising:

i) about 0.01 wt.% to about 5 wt.% of a strongly swellable, lightly to moderately crosslinked polyvinylpyrrolidone;

ii) about 10 wt.% to about 60 wt.% of sodium bicarbonate;

iii) about 0.01 wt.% to about 5 wt.% of at least one fluoride ion source;

iv) about 0.01 wt.% to about 5 wt.% of at least one stannous ion source; and,

v) about 0.01 wt.% to about 75 wt.% of at least one oral care ingredient.

23. The anhydrous toothpaste composition according to claim 22, wherein the crosslinked polyvinylpyrrolidone is characterized by an aqueous gel volume of about 15 to 150 ml/g of polymer and a Brookfield viscosity of at least 10,000 cps for a 5% aqueous solution at 25° C.

24. The anhydrous toothpaste composition according to claim 22, wherein the toothpaste composition ensures availability of active stannous ions and fluoride ions over the shelf life.

25. The anhydrous toothpaste composition according to claim 22, wherein the toothpaste composition exhibits stable rheology over the shelf life.

26. The anhydrous toothpaste composition according to claim 22, wherein the oral care ingredient is selected from the group consisting of carriers, stain removers, thickening agents, surfactants, sweeteners, coloring agents, flavoring agents, humectants, polishing agents, defoamers, buffering agents, softeners, astringents, preservatives, and combinations thereof.