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(54) Title: CHEWING GUM PRODUCT WITH DENTAL HEALTH BENEFITS (57) Abstract The present invention provides a chewing gum product which has a content of two or more active ingredients for improved dental health. In one embodiment a present invention chewing gum product has a content of ingredients which include a gum base, dispersed particles of organic-encapsulated sodium bicarbonate, a peroxygen compound, a bulking sweetener, and a flavorant.		

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CHEWING GUM PRODUCT WITH DENTAL HEALTH BENEFITSCROSS-REFERENCE TO RELATED APPLICATION

The subject matter of this patent
5 application is related to that disclosed in
copending patent application S.N. (Docket 35595;
C&D-95-30), filed ; incorporated by
reference.

BACKGROUND OF THE INVENTION

10 Dental research has developed substantial
evidence that dental plaque is the predominant
etiological factor responsible for both periodontal
disease and dental caries. Dental caries is the
localized, progressive decay of the teeth. It
15 results from tooth demineralization brought about by
acids formed when bacteria in dental plaque ferment
carbohydrate foods present in the mouth.

Dental plaque is a deposit which
accumulates on the teeth and adjacent surfaces in
20 the oral cavity. The plaque is a product of
microbial growth, primarily derived from food
residues in the mouth. Mucoproteins and minerals
present from the saliva and dead cells in the mouth
also assist in plaque formation.

Plaque is removed to some extent by effective brushing of the teeth, but the less accessible and more sheltered areas of the mouth which cannot be readily reached by a toothbrush, are particularly susceptible to plaque and eventual calculus growth. Left unhindered, the plaque increases in size and more tenaciously adheres to the teeth. The bacterial metabolism within the plaque on the tooth surface results in the production of acids, toxins and enzymes which are deleterious to the neighboring oral tissues. There is evidence pointing to plaque as being the direct cause of dental caries, due to the generation of acids within the plaque structure.

To protect a normal tooth, a thin layer of dental enamel forms a protective coating over the tooth. This coating consists mainly of calcium, phosphate, and other ions in a hydroxyapatite-like structure. The enamel contains 2-5 percent carbonate, which makes the enamel susceptible to acid dissolution.

The interaction of three factors is believed to result in dental caries: a susceptible tooth surface; microflora; and suitable substrate for the microflora. Although several acidogenic microorganisms that are present in the mouth can initiate carious lesions, *Streptococcus mutans* is believed to be the primary pathogen.

It is known that foods containing fermentable carbohydrates can promote dental caries. Tooth decay begins when the *Streptococcus mutans*, that residue principally in the plaque that adheres to a tooth surface, metabolize the fermentable carbohydrates consumed by the host. During the metabolism of the fermentable carbohydrates by the bacteria, lactic acid and other organic acids are secreted as a by-product. These acids reduce the pH of the surrounding plaque/tooth environment.

When the pH of the plaque/tooth environment drops below a critical level of 5.5 to 5.7, hydroxyapatite (calcium phosphate hydroxide, $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$), the key component of tooth enamel, begins to dissolve. Typically, the dissolution begins below the tooth's porous surface.

With repeated acid attacks, caused by the further metabolism of fermentable carbohydrates by the bacteria, subsurface lesions expand. If the lesions expand to the point that the enamel surface breaks, a cavity is formed and the process is no longer reversible.

The natural remineralization process involves, in part, the flow of saliva over the plaque. The saliva can raise the pH of the environment. Additionally, calcium and phosphate

ions in the saliva precipitate out to replace the hydroxyapatite that was dissolved by the organic acids created during the metabolism of the fermentable carbohydrates.

5 Typically, this remineralization process only occurs at significant levels when the pH is above the critical level. If the saliva does not sufficiently raise the pH, significant remineralization will not occur. The
10 remineralization process may be enhanced by fluoride in the oral cavity that speeds up new crystal growth and makes a fluorapatite-like material that is precipitated on the surface of the crystals inside the carie lesion.

15 The most important single factor contributing to periodontal disease is the accumulation of plaque and dental calculus (e.g., salivary tartar) on the teeth. These deposits result in tissue inflammation of the
20 surrounding gingiva, and, as the condition increases in severity, the supporting bone is also affected. These reactions lead to the destruction of the supporting structures and the subsequent mass loss of teeth which are usually free of decay.

25 Although brushing the teeth with a toothbrush and dentifrice is a widely recognized technique for maintaining dental health, the average American brushes only about once a day for

approximately one minute. Therefore, a great need exists for finding additional methods for improving daily oral hygiene. Chewing gum has over the years been advocated as a possible excellent adjunct for
5 cleaning the teeth, because people find chewing of gum very pleasurable and chew gum for much longer periods of time than they brush their teeth. Chewing gum is especially advantageous for use in circumstances where toothbrushing is not possible or
10 convenient, such as after lunch, while traveling, or while working.

In general, chewing gum comprises a neutral and tasteless masticatory chewing gum base and one or more non-masticatory active ingredients
15 mixed into the base. As used herein, an "active ingredient" is an ingredient such as a sweetener; a flavorant agent which determines flavor and taste characteristics of the gum; a body-treating ingredient such as a medicinal drug or
20 pharmaceutical agent which is released at a gradual rate and ingested during chewing; or a breath-freshening ingredient which treats or reduces oral malodor. In addition, the chewing gum may contain water-soluble and usually sweet non-masticatory
25 bulking agents, a coloring agent, or a plasticizing agent which is employed to improve the texture of the gum.

Certain active chewing gum ingredients benefit from or require encapsulation in order to achieve a gradual and controlled release of the ingredients during chewing or to promote their stability in chewing gum.

U.S. 5,139,794 describes a chewing gum which has a content of an encapsulated sodium chloride ingredient. The coating on the sodium chloride particles provides a prolonged flavor-enhancing effect without imparting a salty taste.

Of background interest with respect to the present invention are publications which disclose chewing gum products containing a bicarbonate salt such as sodium bicarbonate. Prior art references include United States Patent Numbers 4,148,872; 4,150,112, 4,156,715; 4,156,716; 4,157,385; 4,159,315; 4,160,054; 4,160,820; 4,170,633; 4,269,860; 4,639,368; 4,867,989; 4,952,407; 4,997,667; 5,077,051; and the like.

Other publications of background interest are those which disclose chewing gum products containing a peroxygen ingredient which provides antibacterial activity. Prior art references include United States Patent Numbers 2,218,172; 2,290,862; 4,302,441; 5,110,583; and the like.

There is continuing interest in the development of novel chewing gum products which provide dental health benefits during normal usage.

Accordingly, it is an object of this
5 invention to provide a chewing gum product which can serve as a convenient adjunct for improved dental health.

It is another object of this invention to provide a chewing gum product which has a content of
10 encapsulated therapeutic ingredient for oral hygiene which is sustain-released over a prolonged period under oral chewing conditions.

It is a further object of this invention to provide a chewing gum product which counteracts
15 bacteria-generated acids, enhances saliva flow, and exhibits antibacterial and plaque-inhibiting activities.

Other objects and advantages of the present invention shall become apparent from the
20 accompanying description and examples.

DESCRIPTION OF THE INVENTION

One or more objects of the present invention are accomplished by the provision of a chewing gum product comprising between about
5 15-80 weight percent of a gum base, between about 1-30 weight percent of dispersed particles of an alkali metal bicarbonate ingredient, and between about 0.5-12 weight percent of a peroxygen ingredient.

10 In another embodiment this invention provides a chewing gum product comprising between about 15-80 weight percent of a gum base, between about 1-30 weight percent of dispersed particles of an organic-encapsulated alkali metal bicarbonate
15 ingredient, and between about 0.5-12 weight percent of a peroxygen ingredient.

In another embodiment this invention provides a chewing gum product comprising
(1) between about 15-80 weight percent of a gum
20 base; (2) between about 1-30 weight percent of dispersed particles of an organic-encapsulated alkali metal bicarbonate ingredient; (3) between about 0-25 weight percent of alkali metal bicarbonate powder ingredient; (4) between about
25 0.5-12 weight percent of a peroxygen ingredient; (5) between about 5-70 weight percent of a water-soluble bulking ingredient; (6) between about

0-5 weight percent of a flavorant ingredient;
(7) between about 0-0.2 weight percent of a colorant
ingredient; (8) between about 0-20 weight percent of
an abrasive ingredient; (9) between about 0-3 weight
5 percent of a surfactant ingredient; (10) between
about 0-3 weight percent of a fluoridating
ingredient; and (11) between about 0-15 weight
percent of glycerin or lecithin or a mixture
thereof.

10 A present invention chewing gum may be any
variety of different chewing gum types including low
and high moisture, sugar or sugarless, wax-
containing or wax-free, low calorie, and the like,
and can contain other health agents.

15 A chewing gum product generally consists
of a water-insoluble gum base, a water-soluble
portion, and flavors. The water-soluble portion
dissipates over a period of time, and the gum base
portion is retained during mastication.

20 A conventional chewing gum base usually
contains an elastomer, an elastomer solvent, and
various other ingredients such as fillers,
softeners, plasticizers and emulsifiers. Gum base
raw materials are described in United States Patent
25 Numbers 2,366,589; 3,821,417; 3,984,574; 4,041,179;
4,170,633; 4,400,372; 4,590,075; and 5,378,131;

incorporated by reference. The history and development of chewing gum products is elaborated in "Chewing Gum" by A. H. Suck, (Haarman & Reimer, Second Edition), incorporated by reference.

5 Chewing gum base elastomers for stick gum and dragees include chicle, jelutong, balata, crown gum, guttapercha, sorva, butadiene-styrene copolymer, polyisobutylene, isobutylene-isoprene copolymer, polyethylene, and the like, and mixtures
10 thereof.

Chewing gum base elastomer solvents include pentaerythritol ester of wood rosin, glycerol ester of polymerized rosin, partially hydrogenated methyl ester of rosin, and the like.

15 Chewing gum base waxes include natural wax, polyethylene wax, paraffin wax, beeswax, carnauba wax, microcrystalline wax, and the like.

Chewing gum base compositions for stick gum and dragees are commercially available under
20 tradenames such as Paloja T, Firm Paloja T and Nova T (L. A. Dreyfus Corp.). Bubble gum bases are available as Paloja Bubble T, Ladco Bubble T and Grande Bubble T (L. A. Dreyfus Corp.).

The alkali metal bicarbonate of the
25 encapsulated and unencapsulated particles is sodium bicarbonate or potassium bicarbonate or a mixture thereof.

In another embodiment a present invention chewing gum product contains between about 1-30 weight percent of dispersed particles of an organic-encapsulated alkali metal bicarbonate ingredient, and between about 0.5-25 weight percent of particulate alkali metal bicarbonate ingredient which is not encapsulated.

The encapsulated alkali metal bicarbonate can contain between about 0.1-20 weight percent of alkali metal carbonate, based on the weight of encapsulated alkali metal bicarbonate. Similarly, the unencapsulated alkali metal bicarbonate can contain between about 0.1-20 weight percent of alkali metal carbonate, based on the weight of unencapsulated alkali metal bicarbonate.

During mastication of a chewing gum product containing both encapsulated and unencapsulated alkali metal bicarbonate ingredients, the product provides both immediate and long lasting oral hygiene benefits. There is a clean taste and breath refreshment, and a prolonged deodorizing effect on mouth odor.

The unencapsulated alkali metal bicarbonate ingredient typically can have an average particle size between about 10-250 microns. In a preferred embodiment, the alkali metal bicarbonate is in micronized form, and has an average particle size between about 0.5-20 microns.

The average particle size of the encapsulated alkali metal bicarbonate ingredient can range between about 20-200 microns. The organic encapsulant of the coated particles typically
5 comprises between about 5-60 weight percent of the encapsulated alkali metal bicarbonate particles.

The organic encapsulant of the coated particles is selected from hydrophilic and hydrophobic (water-insoluble) film-forming agents,
10 and mixtures thereof, such as hydrocolloids and polysaccharides.

The term "hydrophilic" as employed herein refers to an encapsulant film-forming agent which has a water-solubility of at least about two grams
15 per one hundred grams of water at 25°C.

The organic encapsulant can consist of 100% hydrophilic encapsulant, or 100% water-insoluble encapsulant, or any mixture thereof. The rate of alkali metal bicarbonate release during
20 mastication of a chewing gum product is directly related to the hydrophilicity of the encapsulant coating on the alkali metal bicarbonate particles. A hydrophilic encapsulant coating will sustain-release the core alkali metal bicarbonate content
25 over a period of about 20 minutes. A water-insoluble encapsulant coating will sustain-release

the alkali metal bicarbonate over a period of about 35 minutes. An organic encapsulant can comprise a hydrophilic polymer having a content between about 5-80 weight percent of a water-insoluble polymer.

5 Suitable hydrophilic encapsulants for coating the alkali metal bicarbonate particles include gum arabic, gum karaya, gum tragacanth, guar gum, locust bean gum, xanthan gum, carrageenan, alginate salt, casein, dextran, pectin, agar,
10 sorbitol, 2-hydroxyethyl starch, 2-aminoethyl starch, maltodextrin, amyloextrin, 2-hydroxyethyl cellulose, methyl cellulose, carboxymethyl cellulose salt, cellulose sulfate salt, polyvinylpyrrolidone, polyethylene oxide, polyvinyl alcohol/acetate, and
15 the like. Polyvinyl acetate is illustrative of a water-insoluble polymer which can be included as an additional coating component to moderate the hydrophilicity of a hydrophilic polymer coating.

 Suitable water-insoluble encapsulants
20 include polyvinyl acetate, polyacrylamide, polyvinyl chloride, polystyrene, polyethylene, polyurethane, polymethacrylate, paraffin wax, carnauba wax, beeswax, stearyl alcohol, zein, shellac, edible fat, and the like. Encapsulants utilized in chewing gum
25 products are disclosed in U.S. 4,673,577, U.S. 5,139,794 and U.S. 4,933,190, incorporated by reference.

The encapsulant can be applied to the alkali metal bicarbonate particles by conventional coating means, such as rotating disk, fluidized bed, spray drying, freeze drying, tumbling, coacervation, and the like.

The peroxygen ingredient of a present invention chewing gum product can be selected from solid inorganic and organic peroxide powders. Suitable inorganic peroxides include alkali metal peroxides, alkaline earth metal peroxides, alkali metal percarbonates, alkaline earth metal percarbonates, ammonium percarbonate, zinc percarbonate, and the like, and corresponding types of metal persulfates and metal perborates.

Suitable organic peroxides include urea peroxide, glyceryl peroxide, benzoyl peroxide, and the like. A listing of inorganic and organic peroxides which are suitable for dentifrice compositions is disclosed in U.S. 4,971,782, incorporated by reference.

In another embodiment a present invention chewing gum product has a content between about 5-70 weight percent of a water-soluble bulking ingredient.

The term "water-soluble" as employed herein refers to a chewing gum ingredient which has a solubility of at least about five grams per one hundred grams of water at 25°C.

The water-soluble bulking ingredient in a chewing gum product typically includes bulk sweeteners, high-potency sweeteners, flavorants, softeners, emulsifiers, colorants, fillers, and
5 other constituents which contribute desirable attributes.

Between about 0.1-15 weight percent of a softener ingredient can be added to enhance the chewability and mouth feel of the chewing gum. The
10 softener ingredient can comprise glycerin or lecithin or a mixture thereof, which additionally functions as a humectant.

The bulking ingredient can comprise between about 5-70 weight percent of a bulking
15 sweetener. Bulking sweeteners can consist of sugar and/or sugarless constituents. Sugar sweeteners are illustrated by saccharides such as sucrose, glucose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids, and the
20 like.

Sugarless sweeteners are illustrated by polyhydric alcohols such as sorbitol, mannitol, xylitol, hydrogenated starch hydrolysates, maltitol, and the like.

25 Between about 0.025-2 weight percent of a high intensity sweetener ingredient can be utilized alone or in combination with a bulk sweetener. High intensity sweeteners are illustrated by aspartame,

saccharin, cyclamate, thaumatin, dihydrochalcones, acesulfame K compounds, and the like. Long lasting sweeteners can be achieved by encapsulating a portion or all of a high intensity sweetener ingredient. A higher content of high intensity sweetener can be employed when it is encapsulated. Encapsulants and coating techniques can be used which are similar to those described herein for an encapsulated alkali metal bicarbonate ingredient.

Between about 0.02-5 weight percent of a flavorant ingredient is usually incorporated in a present invention chewing gum product. Suitable flavorants include menthol, peppermint oil, spearmint oil, wintergreen oil, cinnamon oil, anise, and the like. The flavorant can be encapsulated, as described in United States Patent Numbers 3,826,847; 5,128,155; 5,266,335; incorporated by reference.

A present invention chewing gum product optionally can contain between about 0.001-0.2 weight percent of a colorant ingredient, such as FD&C-type dyes and lakes. The colorant can be in the form of particles which give the gum matrix a speckled appearance. The speckled effect also can be incorporated in a surface coating, such as the coating on dragee gum products. Speckled gum products are described in U.S. 4,744,991, incorporated by reference.

Between about 1-20 weight percent of an abrasive ingredient also can be included in a present invention chewing gum product to provide a dentifrice cleaning action, in addition to the abrasive activity of the alkali metal bicarbonate ingredient. Suitable abrasives include a powder form of phosphate and silica compounds such as calcium phosphate, silica xerogel, and the like. Other types of suitable abrasives are described in U.S. 4,170,633 and U.S. 4,891,211, incorporated by reference.

The compatibility of the ingredients in a chewing gum product, and the enhancement of flavor, can be accomplished by the inclusion of between about 0.001-3 weight percent of a surfactant ingredient in the chewing gum product.

Suitable anionic surfactants include alkali metal and ammonium C_8 - C_{30} aliphatic-containing carboxylate, sulfonate, sulfate and phosphate salts, such as sodium dioctyl sulfosuccinate, sodium lauryl sulfate, sodium dodecylbenzenesulfonate, ammonium lignosulfonate, and the like.

Suitable nonionic surfactants include condensation products of alkylene oxide with fatty alcohols, amines and alkylphenols, such as ethoxylated sorbitan monostearate, ethoxylated glycerol monostearate, and the like.

Suitable cationic surfactants include cetyltrimethylammonium bromide, cetylpyridinium chloride, benzyldimethylstearylammonium chloride, and the like. This type of surfactant additionally
5 imparts antibacterial activity to a chewing gum product.

Other surfactants which are suitable for inclusion in a chewing gum product are described in U.S. 3,930,026, incorporated by reference.

10 A present invention chewing gum product also can contain between about 0.05-3 weight percent of a fluoridating ingredient for the prevention of dental caries. Fluoridating agents are illustrated by sodium and potassium fluoride, ammonium fluoride,
15 stannous fluoride, stannous chlorofluoride, potassium stannous fluoride, sodium and potassium monofluorophosphate, ammonium monofluorophosphate, and the like.

A present invention chewing gum product
20 can be produced in accordance with conventional manufacturing processes, such as those described in U.S. 4,329,369, and as demonstrated in the following examples.

A present invention chewing gum product
25 provides a novel combination of properties which function as a convenient adjunct to other oral hygiene vehicles such as toothpastes and mouthwashes.

In a further embodiment this invention provides a method of oral hygiene which comprises orally masticating a present invention chewing gum product in accordance with a regimen which satisfies
5 personal need and convenience.

The encapsulated alkali metal bicarbonate ingredient of a present invention chewing gum product is sustain-released over a prolonged period under gum mastication conditions. The
10 unencapsulated alkali metal bicarbonate ingredient provides more immediate beneficial effects.

A present invention chewing gum product provides dental cleaning action, and counteracts bacteria-generated acids, enhances saliva flow, and
15 exhibits plaque-inhibiting and tartar-control activities.

The alkali metal bicarbonate ingredient of a present invention chewing gum product contributes oral care benefits such as dental cleaning and
20 whitening, and a prolonged period of mouth odor reduction. Other derived advantages are perceptions of breath refreshment and a pleasant mouthfeel during gum chewing.

The peroxygen ingredient provides
25 antibacterial activity, and is beneficial for alleviating the distress associated with gingivitis and periodontitis inflammatory disorders.

The following examples are further illustrative of the present invention. The components and specific ingredients are presented as being typical, and various modifications can be
5 derived in view of the foregoing disclosure within the scope of the invention.

EXAMPLE I

This Example illustrates the particle size distribution of sodium bicarbonate before and after air-jet milling.

5 Commercial grade sodium bicarbonate (3DF, Church & Dwight) is processed by air-jet milling (Particle Size Technology, Inc.), and the particle size distribution of milled samples is determined in comparison with unmilled samples by
10 means of a Microtrac laser-scattering particle size analyzer.

 The 3DF sodium bicarbonate has an average particle size of 31.4 microns, and the micronized 3DF sodium bicarbonate has an average particle size
15 of 9.8 microns.

 The middle 80% of particle size distribution is between 15.4 and 55.8 microns for the 3DF sodium bicarbonate, and between 4.3 and 21.5 microns for the micronized form.

EXAMPLE II

This Example illustrates a fluidized bed procedure for encapsulating a particulate bicarbonate compound with an organic coating in accordance with the present invention.

A fluidized bed vessel is utilized which is equipped with a Wurster air-suspension coater system (WARF) as described in U.S. 4,568,559 and U.S. 4,877,621.

A coating solution is prepared by dissolving polyethylene glycol (45 g, Poly-G 2000, Olin Corp.), and propylene glycol butyl ether (10 g, PPG 14, Americol) in ethanol (500 g)/water (75 g).

Sodium bicarbonate is utilized as the core matrix crystallites. The sodium bicarbonate (Particle Size Technology, Inc.) has an average particle size and particle size distribution having correspondence with an Example I type of micronized powder.

The sodium bicarbonate powder is charged into the coating chamber of the coater system.

Compressed air is introduced into the coating chamber, and the organic coating solution is sprayed on the air-suspended bicarbonate core matrix crystallites, until the coating weight is about 30% of the total dry weight of the coated particles.

The procedure is repeated, except that hydroxypropylmethylcellulose (Methocel 60 HG, Dow Chemical Co.) is employed as the film-forming coating medium.

- 5 The procedure is repeated, except that maltodextrin (Lodex 10; Durkee Foods) or amyloextrin is employed as the coating medium, and 0.5 g of a surfactant is included in the solution (polyoxyethylenesorbitan monolaurate; Tween 20; 10 ICI Americas, Inc.).

- The coated particles consist of a continuous film coating on an inner core of between about 2-10 crystallites of sodium bicarbonate. The coated particles have an average particle size of 15 about 40 microns.

 The procedure is repeated except that a polyvinyl acetate (M.W. 40,000) is employed as the polymeric medium for coating the sodium bicarbonate particles.

EXAMPLE III

This Example illustrates the preparation of a chewing gum product in accordance with the present invention.

- 5 An invention chewing gum product is prepared by processing the following ingredients:

	<u>Wt. %</u>
Cafosa Luxor 225-01 gum base ⁽¹⁾	23.92
sorbitol powder	28.47
10 mannitol powder	14.35
maltitol powder	9.57
sodium bicarbonate, micronized ⁽²⁾	9.57
sodium percarbonate, micronized ⁽³⁾	9.57
polyethylene glycol (PEG-8)	3.01
15 peppermint oil	1.44
sodium saccharin	0.10
Blue #2 Lake	0.006

(1) Cafosa Co.

20 (2) Average particle size of 12 microns (Example I).

(3) Average particle size of 30 microns.

25

The sorbitol, mannitol, maltitol, micronized sodium bicarbonate and sodium percarbonate powders are blended with the PEG-8. About one third of the blend is added to the
5 preheated gum base (122°F) in a mixer unit, and the medium is mixed for about 3 minutes.

The remaining liquid solution is added with continuous mixing. The sodium saccharin and colorant are added with mixing, followed by the
10 addition of the flavorant. The ingredient mass is mixed until homogeneous. The resultant chewing gum formulation is rolled, sheeted, sized and packaged as a stick chewing gum product.

EXAMPLE IV

This Example illustrates the preparation of a chewing gum product in accordance with the present invention.

- 5 An invention chewing gum product is prepared by processing the following ingredients:

	<u>Wt. %</u>
Cafosa Luxor 225-01 gum base ⁽¹⁾	23.92
sorbitol liquid (70% solution)	2.39
10 sorbitol powder	31.48
mannitol powder	14.35
maltitol powder	9.57
urea peroxide	4.78
sodium bicarbonate, encapsulated ⁽²⁾	4.78
15 peppermint oil	1.44
glycerin (96%)	7.18
sodium saccharin	0.10
Blue #2 Lake	0.006

20 ⁽¹⁾ Cafosa Co.

⁽²⁾ Polyvinyl acetate coating (Example II).

The sorbitol, mannitol, maltitol, urea peroxide and encapsulated sodium bicarbonate powders are blended. About one third of the blend is added to the preheated gum base (122°F) in a mixer unit,
5 and the medium is mixed for about 3 minutes.

The liquid sorbitol and glycerin are combined to form a solution. About one half of the solution is added slowly to the mixer contents, and the medium is mixed for about 3 minutes.

10 The remaining dry blend and liquid solution portions are added with continuous mixing. The sodium saccharin and colorant are added with mixing, followed by the addition of the flavorant. The ingredient mass is mixed until homogeneous. The
15 resultant chewing gum formulation is rolled, sheeted, sized and packaged as a stick chewing gum product.

The chewing gum product exhibits antibacterial and plaque-inhibiting activities when
20 tested in accordance with the procedures described in U.S. 4,302,441.

EXAMPLE V

This Example illustrates the preparation of a chewing gum product in accordance with the present invention.

- 5 An invention chewing gum product is prepared by processing the following ingredients:

	<u>Wt. %</u>
Cafosa Luxor 225-01 gum base ⁽¹⁾	23.92
sorbitol powder	28.48
10 mannitol powder	14.35
maltitol powder	9.57
sodium bicarbonate, micronized ⁽²⁾	4.78
sodium bicarbonate, encapsulated ⁽³⁾	4.78
sodium percarbonate, micronized ⁽⁴⁾	3.00
15 peppermint oil	1.44
glycerin (96%)	7.18
polyethylene glycol (PEG-8)	2.39
sodium saccharin	0.10
Blue #2 Lake	0.006

20

⁽¹⁾ Cafosa Co.

⁽²⁾ Average particle size of 12 microns (Example I).

⁽³⁾ Polyvinyl acetate coating (Example II).

⁽⁴⁾ Average particle size of 30 microns.

The sorbitol, mannitol, maltitol, micronized sodium bicarbonate, encapsulated sodium bicarbonate and sodium percarbonate powders are blended. About one third of the blend is added to
5 the preheated gum base (122°F) in a mixer unit, and the medium is mixed for about 3 minutes.

The PEG-8 and glycerin are combined to form a solution. About one half of the solution is added slowly to the mixer contents, and the medium
10 is mixed for about 3 minutes.

The remaining dry blend and liquid solution portions are added with continuous mixing. The sodium saccharin and colorant are added with mixing, followed by the addition of the flavorant.
15 The ingredient mass is mixed until homogeneous. The resultant chewing gum formulation is rolled, sheeted, sized and packaged as a stick chewing gum product.

WHAT IS CLAIMED IS:

1. A chewing gum product comprising
between about 15-80 weight percent of a gum base,
between about 1-30 weight percent of dispersed
5 particles of an alkali metal bicarbonate ingredient,
and between about 0.5-12 weight percent of a
peroxygen ingredient.
2. A chewing gum product in accordance
with claim 1 wherein the alkali metal bicarbonate
10 ingredient comprises sodium bicarbonate or potassium
bicarbonate having an average particle size between
about 0.5-20 microns.
3. A chewing gum product in accordance
with claim 1 wherein the peroxygen ingredient is
15 selected from the group consisting of solid
inorganic and organic peroxides.
4. A chewing gum product comprising
between about 15-80 weight percent of a gum base,
between about 1-30 weight percent of dispersed
20 particles of an organic-encapsulated alkali metal
bicarbonate ingredient, and between about
0.5-12 weight percent of a peroxygen ingredient.

5. A chewing gum product in accordance with claim 4 wherein the alkali metal bicarbonate ingredient has a content between about 0.1-20 weight percent of alkali metal carbonate, based on the weight of alkali metal bicarbonate.

6. A chewing gum product in accordance with claim 4 which additionally contains between about 5-70 weight percent of a water-soluble bulking ingredient.

7. A chewing gum product in accordance with claim 4 which additionally contains between about 0.02-5 weight percent of a flavorant ingredient which is encapsulated or unencapsulated or a mixture thereof.

8. A chewing gum product in accordance with claim 4 which additionally contains between about 0.001-0.2 weight percent of a colorant ingredient.

9. A chewing gum product in accordance with claim 4 which additionally contains between about 0.5-25 weight percent of an alkali metal bicarbonate powder ingredient.

10. A chewing gum product in accordance with claim 4 which additionally contains between about 0.5-25 weight percent of an alkali metal bicarbonate powder ingredient, and between about
5 0.1-20 weight percent of alkali metal carbonate, based on the weight of additional alkali metal bicarbonate powder ingredient.

11. A chewing gum product in accordance with claim 4 which additionally contains between
10 about 1-20 weight percent of an abrasive ingredient.

12. A chewing gum product in accordance with claim 4 which additionally contains between about 0.001-3 weight percent of a surfactant ingredient.

15 13. A chewing gum product in accordance with claim 4 which additionally contains between about 0.05-3 weight percent of a fluoridating ingredient.

14. A chewing gum product in accordance
20 with claim 4 which additionally contains between about 0.1-15 weight percent of glycerin or lecithin or a mixture thereof.

15. A chewing gum product in accordance with claim 4 which additionally contains between about 5-70 weight percent of a bulking sweetener ingredient selected from the group consisting of sucrose, glucose, maltitol, xylitol, sorbitol and mannitol and mixtures thereof.

16. A chewing gum product in accordance with claim 4 which additionally contains between about 0.02-5 weight percent of a flavorant ingredient selected from the group consisting of encapsulated and unencapsulated menthol, peppermint oil, spearmint oil, wintergreen oil, cinnamon oil and anise and mixtures thereof.

17. A chewing gum product in accordance with claim 4 which additionally contains between about 0.5-25 weight percent of sodium bicarbonate or potassium bicarbonate having an average particle size between about 0.5-20 microns.

18. A chewing gum product in accordance with claim 4 which additionally contains between about 1-20 weight percent of an abrasive ingredient selected from the group consisting of calcium phosphate and silica compounds and mixtures thereof.

19. A chewing gum product in accordance with claim 4 which additionally contains between about 0.001-3 weight percent of a surfactant ingredient selected from the group consisting of
5 alkali metal and ammonium C₈-C₃₀ aliphatic-containing carboxylate, sulfonate, sulfate and phosphate salts and mixtures thereof.

20. A chewing gum product in accordance with claim 4 which additionally contains between
10 about 0.05-3 weight percent of a fluoridating ingredient selected from the group consisting of alkali metal fluoride, ammonium fluoride, stannous fluoride, stannous chlorofluoride, potassium
stannous fluoride, alkali metal monofluorophosphate,
15 and ammonium monofluorophosphate and mixtures thereof.

21. A chewing gum product in accordance with claim 4 which additionally contains between about 0.025-2 weight percent of a high intensity
20 sweetener.

22. A chewing gum product in accordance with claim 4 wherein the organic encapsulant comprises between about 5-60 weight percent of the surface-coated bicarbonate particle dry weight.

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23. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a hydrophilic polymer or water-insoluble polymer or a mixture thereof.

24. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a hydrophilic polymer having a content between about 5-80 weight percent of a water-insoluble polymer, based on the coating weight.

25. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a polysaccharide.

26. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a hydrocolloid.

27. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a starch.

28. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a food grade shellac.

5 29. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a polyvinyl acetate.

10 30. A chewing gum product in accordance with claim 4 wherein the organic encapsulant on the surface-coated bicarbonate particles is selected from water-insoluble fats and waxes.

15 31. A chewing gum product in accordance with claim 4 wherein the peroxygen ingredient is selected from the group consisting of solid inorganic and organic peroxides.

 32. A chewing gum product in accordance with claim 4 wherein the peroxygen ingredient is sodium or potassium percarbonate.

20 33. A chewing gum product in accordance with claim 4 wherein the peroxygen ingredient is zinc percarbonate.

34. A chewing gum product in accordance with claim 4 wherein the peroxygen ingredient is calcium or magnesium peroxide.

35. A chewing gum product in accordance with claim 4 wherein the peroxygen ingredient is urea peroxide.

36. A chewing gum product comprising (1) between about 15-80 weight percent of a gum base; (2) between about 1-30 weight percent of dispersed particles of an organic-encapsulated alkali metal bicarbonate ingredient; (3) between about 0-25 weight percent of alkali metal bicarbonate powder ingredient; (4) between about 0.5-12 weight percent of a peroxygen ingredient; (5) between about 5-70 weight percent of a water-soluble bulking ingredient; (6) between about 0-5 weight percent of a flavorant ingredient; (7) between about 0-0.2 weight percent of a colorant ingredient; (8) between about 0-20 weight percent of an abrasive ingredient; (9) between about 0-3 weight percent of a surfactant ingredient; (10) between about 0-3 weight percent of a fluoridating ingredient; and (11) between about 0-15 weight percent of glycerin or lecithin or a mixture thereof.

38

37. A chewing gum product in accordance with claim 36 wherein the peroxygen ingredient is selected from the group consisting of solid inorganic and organic peroxides.

5 38. A chewing gum product in accordance with claim 36 wherein the bulking ingredient is a sweetener selected from the group consisting of sucrose, glucose, maltitol, xylitol, sorbitol and mannitol and mixtures thereof.

10 39. A chewing gum product in accordance with claim 36 which contains between about 0.02-5 weight percent of a flavorant ingredient which is encapsulated or unencapsulated or a mixture thereof.

15 40. A chewing gum product in accordance with claim 36 which contains between about 0.001-0.2 weight percent of a colorant ingredient.

 41. A chewing gum product in accordance with claim 36 which contains between about
20 1-20 weight percent of an abrasive ingredient.

 42. A chewing gum product in accordance with claim 36 which contains between about 0.001-3 weight percent of a surfactant ingredient.

39

43. A chewing gum product in accordance with claim 36 which contains between about 0.05-3 weight percent of a fluoridating ingredient.

5 44. A chewing gum product in accordance with claim 36 which additionally contains between about 0.5-25 weight percent of an alkali metal bicarbonate powder ingredient.

45. A chewing gum product in accordance with claim 36 which contains between about
10 0.1-15 weight percent of glycerin or lecithin or a mixture thereof.

46. A chewing gum product in accordance with claim 36 which additionally contains between about 0.025-2 weight percent of a high intensity
15 sweetener selected from the group consisting of aspartame, saccharin, cyclamate, thaumatin, dihydrochalcones and acesulfame K compounds and mixtures thereof.

47. A chewing gum product in accordance
20 with claim 36 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a mixture of starch and polyvinyl acetate.

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48. A method of oral hygiene which comprises orally masticating a claim 36 chewing gum product in accordance with a regimen which satisfies personal need and convenience.

AMENDED CLAIMS

[received by the International Bureau on 28 October 1996 (28.10.96);
original claims 22 and 44 amended; remaining claims unchanged (2 pages)]

19. A chewing gum product in accordance
with claim 4 which additionally contains between
about 0.001-3 weight percent of a surfactant
5 ingredient selected from the group consisting of
alkali metal and ammonium C₈-C₃₀ aliphatic-containing
carboxylate, sulfonate, sulfate and phosphate salts
and mixtures thereof.

20. A chewing gum product in accordance
10 with claim 4 which additionally contains between
about 0.05-3 weight percent of a fluoridating
ingredient selected from the group consisting of
alkali metal fluoride, ammonium fluoride, stannous
fluoride, stannous chlorofluoride, potassium
15 stannous fluoride, alkali metal monofluorophosphate,
and ammonium monofluorophosphate and mixtures
thereof.

21. A chewing gum product in accordance
with claim 4 which additionally contains between
20 about 0.025-2 weight percent of a high intensity
sweetener.

22. A chewing gum product in accordance
with claim 4 wherein the organic encapsulant on the
surface-coated bicarbonate particles comprises
25 between about 5-60 weight percent of the surface-
coated bicarbonate particle dry weight.

43. A chewing gum product in accordance with claim 36 which contains between about 0.05-3 weight percent of a fluoridating ingredient.

5 44. A chewing gum product in accordance with claim 36 which contains between about 0.5-25 weight percent of an alkali metal bicarbonate powder ingredient.

10 45. A chewing gum product in accordance with claim 36 which contains between about 0.1-15 weight percent of glycerin or lecithin or a mixture thereof.

15 46. A chewing gum product in accordance with claim 36 which additionally contains between about 0.025-2 weight percent of a high intensity sweetener selected from the group consisting of aspartame, saccharin, cyclamate, thaumatin, dihydrochalcones and acesulfame K compounds and mixtures thereof.

20 47. A chewing gum product in accordance with claim 36 wherein the organic encapsulant on the surface-coated bicarbonate particles comprises a mixture of starch and polyvinyl acetate.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/13815

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A61K 7/18, 9/68

US CL : 424/52, 440

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 424/52, 440

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,877,603 A (DEGENHARDT ET AL) 31 October 1989 (31.10.89), see entire document.	1-48

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

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

Date of the actual completion of the international search

20 SEPTEMBER 1996

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02 OCT 1996

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