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(72) **Inventeurs/Inventors:**
COLLE, ROBERTO, IT;
SARRICA, ANDREA, IT;
DELEO, MAURIZIO, IT

(73) **Propriétaire/Owner:**
PERFETTI VAN MELLE S.P.A., IT

(74) **Agent:** KIRBY EADES GALE BAKER

(54) **Titre : GOMMES A MACHER**
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(57) **Abrégé/Abstract:**
The present invention relates to chewing gum containing a synergic combination of zinc and vegetable extracts containing polyphenols. Said chewing gum is useful in treating the symptoms of halitosis.

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(71) Applicant: **PERFETTI VAN MELLE S.P.A.** [IT/IT]; Via XXV Aprile, 7, I-20020 LAINATE (Milano) (IT).

(72) Inventors: **COLLE, Roberto**; c/o PERFETTI VAN MELLE S.P.A., Via XXV Aprile, 7, I-20020 Lainate (MI) (IT). **SARRICA, Andrea**; c/o PERFETTI VAN MELLE S.P.A., Via XXV Aprile, 7, I-20020 Lainate (MI) (IT). **DELEO, Maurizio**; c/o PERFETTI VAN MELLE S.P.A., Via XXV Aprile, 7, I-20020 Lainate (MI) (IT).

(74) Agent: **MINOJA, Fabrizio**; BIANCHETTI BRACCO MINOJA S.r.l., Via Plinio, 63, I-20129 Milano (IT).

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(54) Title: CHEWING GUMS

(57) Abstract: The present invention relates to chewing gum containing a synergic combination of zinc and vegetable extracts containing polyphenols. Said chewing gum is useful in treating the symptoms of halitosis.

CHEWING GUMS

The present invention relates to chewing gums.

Prior art

Halitosis is a condition that restricts the sufferer's social life. It is estimated that 15% to 40% of the population suffers from moderate halitosis (Rosing CK et al., Braz Oral Res 2011;25(5):466-71). Bad breath is usually caused by the presence of volatile sulphur compounds (VSC) (Kleinberg I et al., Crit Rev Oral Biol. Med. 1990;1(4):247-59). Said compounds are generated by catabolism of proteins by the oral bacteria (De Boever EH et al., J Am. Dent. Assoc 1995;126(10):1384-93). The nose can perceive very low concentrations of VSC as an unpleasant odour; in clinical practice it is considered that 75 ppb (parts per billion) of VSC in the air exhaled is the minimum threshold for a classification of moderate halitosis (van den Broek AM. et al., J Dent. 2007;35:627-635).

Some foods, such as garlic and Brussels sprouts, can increase halitosis (Tangerman A,. Halitosis in medicine: a review. *Int. Dent J.* 2002;52 Suppl. 3:201-206). Moreover, "morning breath" may be present at the beginning of the day, mainly caused by stagnation of the saliva produced during the night (Rosenberg M.J. Am. Dent. Assoc. 1996;127:475-482). Most research and patented inventions concentrate on antibacterial treatment of the causes of halitosis at particular times of day (morning) or after eating particular foods (such as mouthwashes based on garlic or methionine).

Vegetable extracts are used and described due to some properties against halitosis; for example, coated products in the form of corrugated sugar-free pastilles containing vegetable extracts can be found on the market (Hali Control™ containing 0.36% green coffee beans and 0.36% burdock).

Sweets and chewing gum containing green tea extracts are known to reduce halitosis generated by garlic-based mouthwashes (H. Yasuda, et al., Nippon

Shishubyo Gakkai Kaishi, 37,141,1995). Chewing gum and tablets containing magnolia bark extract (MBE) are also known to reduce the salivary concentration of some bacteria, considered to be among the causes of halitosis (Greenberg M et al., J. Agric. Food Chem. 2007;55(23):9465-9). However, chewing gums for use against the symptoms of halitosis, which are not generated artificially and use synergic formulations of said vegetable extracts with zinc salts, are not known.

An article has been published about the ability of mouthwashes based on zinc salts to reduce the volatile sulphur compounds generated artificially after rinsing the mouth with cysteine, an aminoacid containing sulphur. In said article, the effective amount of zinc (administered as zinc acetate dihydrate) ranged from a minimum of 3 mg to a maximum of 30 mg (Young, A et al., (2003). Eur. J. Oral Sci. 111(5): 400-404).

One study of chewable tablets containing 6.8 mg of Zn, in the form of various salts, concluded that the effect against VSC, generated artificially by a cysteine mouthwash, is independent of the solubility constants of the salts (Young, A., G. Jonski et al. (2002), Eur. J. Oral Sci. 110(1): 31-34).

Finally, an *in vivo* study conducted on 11 volunteers found that chewing gum containing 2 mg or 0.5 mg of zinc acetate reduced VSC by 45% and 16% respectively, as against a 14% reduction after chewing a placebo chewing gum. In practice, when 0.5 mg of zinc was used, the effect was indistinguishable from that of the placebo (Waler SM. Acta Odontol. Scand. 1997;55(3):198-200).

Combinations of zinc or vegetable extracts with other ingredients, with an anti-halitosis function, have been illustrated in some patents. They involve incorporating the mixtures into chewing gum.

EP1998736 discloses combinations of magnolia bark extract and essential oils with an antibacterial function.

EP2046274 discloses combinations of magnolia bark extract and some flavouring compounds (in particular menthone and isomenthone) naturally

contained in essential oils. Said combinations are said to be particularly effective in reducing halitosis caused by the consumption of halitosis-causing foods.

EP1901704 and EP1957169 disclose combinations of magnolia bark extract and surfactants.

WO 02091848 discloses the use of herbal extracts, including green tea extracts and magnolia bark extracts, combined with other oral hygiene ingredients such as xylitol (anti-plaque) and zinc (anti-halitosis). However, the optimum amounts for simultaneous use of vegetable extracts and zinc are not illustrated. The two functional ingredients are treated separately. In fact, the purpose of the vegetable extracts is to combat halitosis, whereas the purpose of the other functional ingredients (oral care actives) is to provide further benefits in the oral hygiene area.

The herbal extracts are said to perform their action by means of an antibacterial effect, while an effect on VSC is not reported.

EP1387662 discloses the use of two different metal ions combined with polyphosphates, and optionally MBE. EP1843731 also discloses the use of MBE combined with polyphosphates, but with an anti-tartar function.

WO2006/079343 discloses gums in tablet form containing zinc salts and green tea extracts.

WO2007/067340 reports the use of magnolia extracts, and optionally zinc, in chewing gum.

KR2004/0019145 reports mouthwashes containing zinc salts and green tea. There are no teachings relating to synergic combinations of MBE and zinc in chewing gum, especially as regards the optimum doses able to guarantee long-lasting symptomatic treatment after a single use of the chewing gum by patients suffering from real halitosis, ie. halitosis not caused by mouthwashes containing sulphated amino acids or garlic, and not associated with specific times of day (morning).

Summary

Certain exemplary embodiments provide a chewing gum consisting of at least a first region with gum base and at least a second fully water-soluble region without gum base, said gum comprises a synergic combination of: a) vegetable extracts selected from magnolia bark extract, green tea extract and combinations thereof; and b) zinc ions, at least partly contained in fully water-soluble microgranules.

Description of the invention

It has now been found that it is possible to prepare a chewing gum consisting of at least one first region with gum base and a second, fully water-soluble region without gum base, comprising a synergic combination of an effective amount of vegetable extracts selected from magnolia bark extract, green tea extract and combinations thereof and an effective amount of zinc ions, at least partly contained in microgranules which are fully water-soluble.

The invention allows the use of lower amounts of zinc than is taught in the literature. This generates an organoleptic advantage, as zinc has a marked astringent power, which can improve compliance with the treatment, as well as providing an economic benefit.

The invention can be advantageously used to treat the symptoms of halitosis, namely to reduce the volatile sulphur compounds (VSC) in the exhaled air. In other words, a single portion of chewing gum, suitable to be consumed on one occasion, produces the above-mentioned effect.

"Single portion of chewing gum" means a single piece of chewing gum, or a number of pieces which can be consumed simultaneously. A single piece of chewing gum can be selected from the following formats and weights: a stick weighing 1 g to 3 g, a pellet weighing 1 g to 4 g, a pellet with filling weighing 1 g to 5 g, a bubble gum with liquid filling weighing 1 g to 9 g, or a multi-layer stick weighing 1.5 g to 9 g. A number of pieces which can be consumed simultaneously, to form a single portion, can be selected from the preceding formats; however, if a number of pieces combine to form a single portion, the weight of the single piece is preferably less than 3 g, even more preferably less than 2.5 g and, in some forms of embodiment, less than 1 g. In the embodiment according to the invention, the use of sugar-free chewing gum is particularly advantageous. The absence of fermentable sugars in the composition of the gum prevents the chewing gum from supplying fermentable substrates to micro-organisms connected with VSC

production. At the same time, chewing increases the salivary flow which, through its cleansing action, produces a first effect of reducing VSC.

The chewing gum comprises flavours and additives such as sweeteners, acidifiers, thickeners, wetting agents, emulsifiers, antioxidants, stabilisers and coating agents.

In particular a chewing gum wherein said first region constitutes a core, and said second region, which is fully water-soluble, constitutes a coating that at least partly covers the first region, is preferable. Said forms are also known as pellets.

Chewing gum can made in various formats, such as cushion, ball, cube and disc shapes.

Methods of obtaining the first region of the chewing gum according to the invention, containing gum base, are known.

The ingredients of the first region of the chewing gum according to the invention, containing gum base, can be selected from gum base, sweeteners such as sugars, polyalcohols, intensive sweeteners, additives such as dyes, acidifiers, emulsifiers, flavours in solid or liquid form, wetting agents, technological adjuvants such as emulsifiers or plasticisers, active pharmacological ingredients, vegetable extracts, functional ingredients such as vitamins or mineral salts, and dyes.

If the form of embodiment according to the invention is a chewing gum in the form of a pellet, the first region is called the core, and the second region, which is fully water-soluble, is called the coating.

The two main types of coating are hard and soft coatings.

In hard coatings, the cores are inserted in a coating pan wherein, once in rotation, they undergo repeated syrup-spraying and drying cycles. Powders can be applied at some of these stages.

The syrups are constituted by mixtures of sugars or polyalcohols, water, binders, and optionally pigments, intensive sweeteners and flavours.

Polyalcohols are used to coat sugar-free chewing gum. The most commonly used polyalcohols include sorbitol, isomalt, maltitol and xylitol.

The preferred binders are hydrocolloids such as gum arabic, gelatin, starches, including modified starches, and mixtures thereof.

The powders can simply consist of polyols in crystals ground to very fine granulates, or mixtures of polyalcohols and binders, such as xylitol and gum arabic, mannitol and gum arabic, or maltitol and gum arabic.

The coating can constitute the second, fully water-soluble region. It is particularly advantageous to incorporate the vegetable extracts according to the invention in said second region. In other forms of embodiment, said second region does not consist of the coating, as illustrated below.

In some forms of embodiment, the vegetable extracts are contained in the first region of the chewing gum.

A coating consisting of maltitol or a mixture of glucopyranosyl-mannitol and glucopyranosyl-sorbitol amounting to more than 70% by dry weight of the coating is particularly advantageous.

In some forms of embodiment of the invention the first region can contain at least one filling, which may be a solid such as hard candy, toffee, chocolate, marzipan or fondant, or may consist of particulate matter containing xylitol or other polyalcohols in crystals, or dextrose in crystals. Alternatively, said filling can take the form of a fluid, such as a syrup. Combinations among the forms described by way of example are possible. The filling can contain one or more polyalcohols, additives, vitamins, mineral salts, including zinc salts, vegetable extracts, including green tea and magnolia bark extracts, dyes, acidifiers and flavours.

The filling is usually inserted in the first region, comprising gum base, during the extrusion stage.

Depending on the type of core and filling material, and on the shape of the piece of chewing gum, the filling can be totally incorporated in the piece of

chewing gum or can be visible from the exterior of the chewing gum on one or more sides.

As an alternative to the pellet shape, the chewing gum according to the invention can be configured so that said first region and said second region are arranged in overlapping, alternating layers. Methods and formulations for said particular configuration are known (US5437879).

Regardless of the form of embodiment of the chewing gum according to the invention, the preferred flavours are those deriving from species of the genera Mentha, Citrus, Spilanthes and menthol, artificial and natural flavours with the function of refreshing and salivation-stimulating agents and combinations thereof. Flavours derived from various species of mint (peppermint, spearmint and the like) and citrus fruit (orange, lemon, grapefruit, lime and the like), artificial or natural flavours with the function of cooling agents, are associated with the sensation of cooling and cleanliness, and their pleasant odour can effectively mask the sensation of bad breath, thus completing the organoleptically perceptible effect of the reduction in the symptoms of halitosis.

Flavours with the function of cooling agents are typically menthol esters, such as menthyl lactate, menthyl succinate and menthyl glutarate; or amides such as N-ethyl-p-menthane-3-carboxamide, 2-isopropyl-N,2,3-trimethylbutyramide, ethyl 3-(p-menthane-3-carboxamido)-acetate, N-para-benzen-acetonitrile menthane carboxamide and N-(2-(pyridin-2-yl)ethyl)-3-para-menthane-3-carboxamide, but there may also be other compounds such as isopulegol and (-)-menthoxypropan-1,2-diol.

Flavouring compounds with salivation-stimulating properties such as spilanthol, to which other compounds with sialogogic properties such as pellitorine and sanshool have recently been added, are obtained from the genus Spilanthes.

Zinc is contained in the chewing gum in the form of ions. Hereafter, "zinc" therefore refers to the ionic form.

It is particularly advantageous to include zinc in the first region containing gum base. Inclusion in the zone with gum base results in slow release, which leads to long-lasting efficacy of the gum according to the invention.

The zinc is contained, at least partly, in fully water-soluble microgranules. The fully water-soluble microgranules do not contain polymers used in the manufacture of gum base. Preferably, the microgranules comprise one or more polyalcohols, hydrocolloids, flavours, dyes, sweeteners and other additives, either alone or mixed together. In a preferred form of embodiment the microgranules contain more than 80% sorbitol, less than 2% gum arabic and more than 1% zinc salt. "Microgranules" means a particulate matter, prepared before the manufacture of the gum, having a mean particle size of less than 1000 μm. In particular, a particle size such that at least 90% of the granules are between 800 μm and 300 μm is preferred. Although the microgranules can be introduced into the part with gum base or the fully water-soluble region, they are preferably contained in the region with gum base.

The synergic effect between vegetable extracts and zinc is more efficient when the content of zinc in ions ranges between 0.0005% and 0.05% by weight, and the vegetable extract ranges between 0.02% and 2% (percentages of finished product).

A single portion of chewing gum is particularly effective if it contains zinc ions ranging between 0.012 mg and 1.2 mg, and magnolia bark extract between 0.5 mg and 50 mg. As an alternative to magnolia extract, green tea extract can be used, either alone or mixed with magnolia bark extract.

The chewing gum according to the invention preferably consists of at least one region with gum base and one region without gum base, which is fully water-soluble. The region with gum base comprises zinc ions from 0.005% to 0.04% of the finished product, and the region without gum base contains magnolia bark extract ranging from 0.07% to 0.5% of the finished product.

The zinc can be wholly or partly carried by the microgranules previously described. Preferably at least 10%, and even more preferably at least 20% of the zinc is carried by the microgranules previously described, the rest being carried by salts directly included in the region with gum base.

In order for the zinc to be carried in the form of ions, the zinc ion is preferably present as salt selected from zinc chloride, acetate, lactate, gluconate, butyrate, glycerate, glycolate, formate, lactate, picolinate, propionate, salicylate, tartrate, sulphate, ascorbate, bisglycinate, lysinate, malate, mono-L-methionine sulphate, pidolate and mixtures thereof.

Zinc acetate, lactate and gluconate, and mixtures thereof, are particularly preferred.

It is preferable for the zinc ion to be present as salt selected from those characterized by water-solubility exceeding 0.5 g/100g at 25°C at a neutral pH. They are consequently water-soluble salts, which can be advantageously included in microgranules, while the microgranules can be included in the region with gum base.

In some embodiments of the invention the chewing gum contains an additional zinc salt selected from zinc oleate, stearate, citrate, phosphate, carbonate, borate, oxalate, aspartate, zinc oxide and mixtures thereof.

A single portion of chewing gum preferably contains said additional zinc salt in amounts that provide 0.1 to 10 mg of zinc.

In a preferred form of embodiment, the zinc salt inserted in the microgranules and the zinc salt not inserted in the microgranules are equal.

In an alternative form of embodiment, the zinc salt inserted in the microgranules is different from the zinc salt not inserted in the microgranules.

The chewing gums according to the invention reduce the oral content of volatile sulphur compounds more than a gum lacking said functional ingredients, and more than a gum containing only one of the two. The effect is greater both

after chewing and over time, as will be demonstrated below.

Magnolia bark extract is particularly preferred.

Magnolia bark extract contains two neolignans, magnolol and honokiol, considered to be its active constituents. Analysis of traditional extracts originating from different regions of China demonstrates that the magnolol concentration ranges from a minimum of 0.005% to a maximum of 9.2%, while the honokiol concentration ranges from a minimum of 0.008% to a maximum of 9.7%. The sum of the two is always lower than 20% (Jiang, Y., et al., Phytochem. Anal, 2011, DOI 10.1002/pca.1369).

The two neolignans are extracted from bark prepared according to methods described (Pharmacopoeia of the PRC, (English edition), 1988, People's Medical Publishing House, Beijing, Cortex Magnoliae Officinalis, p23-24). The extraction can be performed with organic solvents or, more recently, with supercritical carbon dioxide.

An extract obtained by extraction in supercritical carbon dioxide, followed by crystallisation in ethanol, is preferred.

An extract with a magnolol content ranging between 80% and 88%, and a honokiol content ranging between 8% and 18%, wherein the sum of the two neolignans is preferably greater than 85%, and even more preferably greater than 95%, is preferably used.

Magnolia bark extract can be obtained from various plants belonging to the genus Magnolia, including *Magnolia obovata* and *Magnolia officinalis,* and the bark can derive from the branches, trunk and roots of the plant. It is preferable to use extracts obtained from the sub-species *Magnolia officinalis Rehder spp. Biloba.* The extract is preferably obtained from trunk bark.

Magnolia bark extract is present in the coating, and zinc in the core of a sugar-free chewing gum pellet. The magnolia bark extract is preferably present in amounts ranging from 0.5 mg to 50 mg per single portion of chewing gum, and

even more preferably from 1 to 5 mg per single portion. The zinc is inserted, at least partly, in microgranules containing more than 80% sorbitol and less than 2% gum arabic, as described above, and a single portion of chewing gum preferably contains 0.012 mg to 1.2 mg of zinc, even more preferably 0.05 to 0.5 mg of zinc. The zinc concentration in the microgranules containing sorbitol preferably ranges between 0.06% and 6%, even more preferably between 0.5% and 3% (percentages of the weight of the microgranule).

The microgranules can contain edible additives such as dyes, thickeners, acidifiers, sweeteners, flavours, vitamins and other mineral salts.

A single portion of chewing gum made according to the preferred form just described presents a surprising ability to reduce the volatile sulphur compounds in the air exhaled by persons with clinical halitosis, and can therefore be used to treat the symptoms of halitosis.

In fact, in consumers with a minimum VSC value of 75 ppb in the air exhaled immediately before chewing gum, a single portion of chewing gum, chewed for 10 minutes, reduces the mean concentration of volatile sulphur compounds in the exhaled air by a minimum of 40% after chewing, compared with the value before chewing.

Moreover, a single portion of chewing gum, chewed for 10 minutes by consumers with a minimum VSC value of 75 ppb in the exhaled air, reduces the mean concentration of volatile sulphur compounds in the exhaled air by at least 15% one hour after the start of chewing.

VSC is measured with the OralChroma portable gas chromatograph© (OralChromaTM, Abilit Corp., Osaka, Japan), which is readily available on the market.

Chewing gum formulations without zinc, magnolia or both (reference formulations A, B and C) were compared with the formulations according to the invention containing both zinc and magnolia extracts (formulations D, F and E).

The composition of the formulations was otherwise identical. In particular, gums in pellet form were used wherein the zinc was introduced into microgranules in the core (first region), and the magnolia bark extract was introduced into the coating (second region). The amounts of zinc and magnolia bark extract are set out in table 1.

The volatile sulphur compounds were evaluated in 10 volunteers with a minimum VSC level of 75 ppb (regardless of the time of day, and without stimulating VSC production with amino acids or particular foods). The evaluation was conducted, by the method described, before chewing, immediately after chewing a single portion (10 minutes), and after one hour. Table 1 shows the % reductions in VSC compared with the starting condition. At the end of chewing, the volunteers conducted a sensory evaluation of the chewing gum.

Similarly, the ability to reduce VSC was evaluated in a preferred form of embodiment (formulation G) wherein at least 15% zinc (as a percentage of the total zinc) is inserted into microgranules containing more than 80% sorbitol and less than 2% gum arabic, as described above, and preferably, a single portion of chewing gum contains 0.012 mg to 1.2 mg of zinc, even more preferably 0.05 to 0.5 mg of zinc. The zinc carried by the microgranules is inserted as ion of a salt selected from zinc chloride, acetate, lactate, gluconate and mixtures thereof. The remainder of the zinc, below 85% (as a percentage of the total zinc) is carried by one or more of zinc chloride, acetate, lactate, gluconate and mixtures thereof inserted directly into the region containing gum base, or the core, in the case of chewing gum pellets.

Table 1 - influence of some formulations on the VSC in the breath

Ingredients	A reference no Zn or MBE	B reference Zn but no MBE	C reference MBE but no Zn	D invention Zn + MBE	E invention Zn + MBE	F invention Zn + MBE	G invention Zn + MBE
Core with Zn (mg/portion)	0	0.1	0	1.2	0.1	0.012	0.3
Coating with vegetable extracts (mg/portion)	0	0	3.5	0.5	3.5	50	3
% VSC after 10 min chewing.	-32	-34	-43	- 45	-51	- 57	-57
% VSC after 1 h.	-7	-22	-5	- 35	-28	- 27	-44
Sensory evaluation	fresh, pleasant mint flavour	similar to A	similar to A	freshness similar to A, astringent flavour	similar to A	freshness similar to A, bitter flavour	similar to A

Table 2 - % synergic effect

	D invention Zn + MBE	E invention Zn + MBE	F invention Zn + MBE	G invention Zn + MBE
% synergy after 10 min	0	46	92	92
% synergy after 1 h	115	62	54	185

The data demonstrate that chewing gum A (reference) has a certain effect of reducing oral VSC, especially after chewing, but this effect is greatly reduced after 1 h. This effect is probably due to stimulation of salivation which, together with the mechanical rubbing action on the teeth, washes away some of the bacteria that cause bad breath. The reference gum containing zinc alone improves the reduction in oral VSC, but mainly in the long term. The reference gum containing magnolia bark extract alone is more effective immediately after chewing, but behaves in a similar way to the gum without magnolia and zinc after 1 hour.

The gums with synergic combinations of zinc and magnolia bark extract (D, E, F and G) markedly reduce the percentage of oral VSC immediately, after 10 minutes' chewing, and after 1 h. The reduction, at both times and in all four formulations (D, E, F and G), is greater than that elicited by the gum without zinc and MBE and by the two gums B and C only containing one of the two functional ingredients, indicating a synergic effect immediately after chewing and in the longer term (see data after 1 h).

By way of further demonstration of the synergic effect of the formulations with zinc and magnolia according to the invention, the percentage synergic effect can be calculated. It can be considered as the percentage reduction of VSC by the gum that exceeds the sum of the VSC-reducing effects of the gums containing only one of the two functional ingredients, less the effect of the chewing gum not containing any functional ingredient. It is particularly important to subtract the effect of the plain chewing gum (Gum A in table 1) whenever the effect of a gum (whether inventive or reference) is added, similarly to the procedure used with background noise. The synergic effect is reported in table 2. Numbers higher than 0 indicate a synergic effect of the combination of zinc and vegetable extract in the inventive formulations.

Doses higher than those used in formulations D and F would produce unpleasant alterations (astringency, bitterness) in the flavour of the formulation,

which could reduce compliance with treatment designed to reduce the symptoms of halitosis.

It is particularly advantageous for the fully water-soluble region without gum base to consist of a coating consisting of over 70% maltitol by dry weight, and preferably over 85% by dry weight (percentages of total coating). In an alternative, but equally advantageous form of embodiment, maltitol is replaced by a mixture of glucopyranosyl-mannitol and glucopyranosyl-sorbitol or a mixture of xylitol and mannitol.

The MBE released from the chewing gum thus formulated in 10 minutes' chewing ranges between 50% and 80% (of the total MBE).

It is advantageous to add zinc, in an amount ranging between 0.0005% and 0.05% of the chewing gum, through microgranules containing more than 80% sorbitol, less than 2% gum arabic and more than 1% zinc salt (percentages of the total microgranule), added to the zone containing gum base. The zinc released from the chewing gum thus formulated in 10 minutes' chewing ranges between 50% and 80% (of the total zinc).

The chewing gum wherein at least 15% zinc (as a percentage of the total zinc) is inserted in microgranules, which are inserted directly in the region containing gum base, as ion of a salt selected from zinc chloride, acetate, lactate, gluconate and mixtures thereof, and the remaining amount of zinc is carried by one or more of zinc chloride, acetate, lactate, gluconate and mixtures thereof inserted directly in the region containing gum base, also possesses a similar release over time.

The embodiment illustrated therefore allows the simultaneous release of comparable amounts of MBE and Zn, which can perform the synergic action in the oral cavity.

The addition of flavours containing spilanthol or pellitorine promotes the release of active agents, and is particularly indicated in combination with mint

flavours.

The invention also relates to a method of treating the symptoms of halitosis in humans, comprising the following steps:

1) placing in the oral cavity of a patient with halitosis a piece of chewing gum consisting of at least:

a) a first region with gum base having a zinc content ranging from 0.0005% to 0.05% of the chewing gum, provided by microgranules, said microgranules containing more than 80% sorbitol, less than 2% gum arabic and more than 1% zinc salt (percentages of total microgranule);

b) a second region, without gum base, consisting of a fully water-soluble coating, characterized in that it contains more than 75% maltitol, glucopyranosyl-sorbitol and glucopyranosyl-mannitol mixture, or xylitol and mannitol mixture, and contains magnolia bark extract ranging from 0.02% to 2% of the chewing gum;

2) chewing of said one piece of chewing gum for 10 minutes,

said gum being able to release into the oral cavity, in 10 minutes' chewing, between 40% and 80% of its magnolia bark extract content (as a percentage of the total extract) and between 50% and 80% (as a percentage of the total zinc), so that said ingredients perform a synergic action against the symptoms of halitosis.

An example of a microgranule containing zinc, a microgranule according to the invention, a comparative example and an efficacy evaluation test are set out below.

Example 1: composition of microgranules used in the gum according to the invention

Ingredients of microgranule	**Example 1**
	%
Sorbitol	85.00
Xylitol	8.00
Acesulfame K	1.00
Flavours	0.80
Green colouring	0.20
Gum arabic	0.50
Zinc lactate	3.10
Water	1.40
Total microgranule	**100**

Tables 3 below illustrates the chewing gum compositions according to the invention (example 3) and a reference compositions (example 2). Said gums take the form of filled pellets, consisting of three separate regions: filling (region without gum base), core (region with gum base), and coating (region without gum base).

The percentages are expressed in relation to the total of the single portion. The values in mg refer to a portion weighing 2.2 g which, in the example, corresponds to a single piece.

Table 3

Ingredients	**Reference example 2**		**Example 3**	
Filling (region without gum base, fully water-soluble)	%	mg per piece	%	mg per piece
Maltitol syrup	6.700	147.400	6.700	147.400
Acesulfame K	0.001	0.022	0.001	0.022
Sucralose	0.001	0.022	0.001	0.022
Flavours	0.057	1.254	0.057	1.254
Blue colouring	0.001	0.022	0.001	0.022
Emulsifier	0.008	0.176	0.008	0.176
Glycerol	0.100	2.200	0.100	2.200
Thickener	0.002	0.044	0.002	0.044
Water	0.130	2.860	0.130	2.860
Total filling	**7.000**	**154.000**	**7.000**	**154.000**
Core (region with gum base)	%	mg per piece	%	mg per piece
Gum base	22.700	499.400	22.700	499.400
Microgranules, example 1	0.000	0.000	**0.600**	**13.200**
(of which Zn)			**(0.005)**	**(0.11)**
Aspartame	0.050	1.100	0.050	1.100
Acesulfame	0.050	1.100	0.050	1.100
Sucralose	0.030	0.660	0.030	0.660

(cont.)

Table 3 (cont.)

Encapsulated aspartame	1.300	28.600	1.300	28.600
Maltitol syrup	1.870	41.140	1.870	41.140
Mannitol	5.800	127.600	5.800	127.600
Powdered maltitol	18.000	396.000	18.000	396.000
Xylitol	3.500	77.000	3.500	77.000
Flavours	2.000	44.000	2.000	44.000
Sorbitol	7.700	169.400	7.100	156.200
Total core	**63.000**	**1386.000**	**63.000**	**1386.000**
Coating (region without gum base, fully water-soluble)	%	mg per piece	%	mg per piece
Maltitol	27.5	605.000	27.35	601.700
Gelatin	0.07	1.540	0.07	1.540
Gum arabic	1.77	38.940	1.77	38.940
White colouring	0.47	10.340	0.47	10.340
Flavours	0.06	1.320	0.06	1.320
Aspartame	0.05	1.100	0.05	1.100
Acesulfame	0.05	1.100	0.05	1.100
Magnolia bark extract	0.00	0.000	**0.15**	**3.300**
Carnauba wax	0.03	0.660	0.03	0.660
Total coating	**30**	**660.000**	**30**	**660**
Total filling/core/coating	**100.000**	**2200.000**	**100.000**	**2200.000**

Activity test for treatment of symptoms of halitosis

A test was conducted with OralChroma on the gum according to the invention (example 3) compared with the reference gum (example 2), to measure the oral VSC of volunteers having a minimum oral VSC value of 75 ppb. A product available on the market was tested, consisting of sugar-free corrugated tablets with herbal extracts (0.36% green coffee beans and 0.36% burdock). The methodology used to measure the VSC is as previously described.

The results are summarized in table 4 below.

Table 4

% reduction in oral VSC concentration compared with concentration before chewing			
time	**gum according to the invention (Example 3)**	**control gum not containing Zn or MBE (Example 2)**	**tablet on the market**
after 10 min chewing	50.9	31.2	23.9
after 1 h	27.6	6.9	5.1
after 2 h	13.6	2.3	4.9

The gum according to the invention is clearly able to reduce the oral concentration of VSC to a greater extent than (i) gum not containing any functional ingredients and (ii) the product on the market, both immediately after chewing and after one or two hours.

CLAIMS

1. A chewing gum consisting of at least a first region with gum base and at least a second fully water-soluble region without gum base, said gum comprises a synergic combination of:

a) vegetable extracts selected from magnolia bark extract, green tea extract and combinations thereof; and

b) zinc ions, at least partly contained in fully water-soluble microgranules.

2. The chewing gum according to claim 1 wherein the vegetable extract is magnolia bark extract comprising magnolol and honokiol.

3. The chewing gum according to claim 1, wherein the magnolia bark extract is in a concentration higher than 80% by weight of the extract.

4. The chewing gum according to claim 1 wherein the vegetable extract is green tea extract comprising catechin.

5. The chewing gum according to claim 1, wherein the green tea extract is in a concentration higher than 40% by weight of the extract.

6. The chewing gum according to any one of claims 1 to 5 wherein said vegetable extracts are contained in said second region.

7. The chewing gum according to any one of claims 1 to 6 wherein said vegetable extracts are contained in said first region.

8. The chewing gum according to any one of claims 1 to 7 wherein zinc is contained in said first region.

9. The chewing gum according to any one of claims 1 to 8 wherein said water-soluble microgranules comprise one or more polyalcohols, hydrocolloids, flavours, dyes, sweetening agents and other excipients, alone or in a mixture thereof, said microgranules having an average particle-size distribution lower than 1000 μm.

10. The chewing gum according to any one of claims 1 to 9 wherein the zinc ion content ranges from 0.0005% to 0.05% by weight and the vegetable extract content ranges from 0.02% to 2%.

11. The chewing gum according to any one of claims 1 to 10 containing per single portion zinc ions from 0.012 mg to 1.2 mg, and magnolia bark extract from 0.5 mg to 50 mg.

12. The chewing gum according to any one of claims 1 to 11, wherein a single portion chewed for 10 minutes by a consumer with a minimum volatile sulfur compound (VSC) value in the oral air of 75 ppb is capable of reducing, immediately after chewing, an average concentration of volatile sulfur compounds in oral air of the consumer by at least 40% compared with a value before chewing.

13. The chewing gum according to any one of claims 1 to 12, wherein a single portion chewed for 10 minutes by a consumer with a minimum volatile sulfur compound (VSC) value in the oral air of 75 ppb is capable of reducing, one hour after starting chewing, an average concentration of volatile sulfur compounds in oral air of the consumer by at least 15% compared with a value before chewing.

14. The chewing gum according to any one of claims 1 to 13, wherein the zinc ion is present as a salt selected from the group consisting of zinc chloride, acetate, lactate, gluconate, butyrate, glycerate, glycolate, formate, picolinate, propionate, salicylate, tartrate, sulfate, ascorbate, bisglycinate, lysinate, malate, mono-L-methionine sulfate, pidolate and mixtures thereof.

15. The chewing gum according to claim 10 or 11 wherein an additional zinc salt is present, selected from the group consisting of zinc oleate, stearate, citrate, phosphate, carbonate, borate, oxalate, aspartate, oxide and mixtures thereof.

16. The chewing gum according to claim 15 wherein a single portion of chewing gum contains said additional zinc salt in such amounts as to supply 0.1 to 10 mg of zinc.

17. The chewing gum according to any one of claims 1 to 16, wherein said first region with gum base forms a core and said second fully water-soluble region, without gum base, forms a coating layer that at least partially coats the first region.

18. The chewing gum according to claim 17 wherein more than 70% by dry weight of the coating layer consists of maltitol or a mixture of glucopyranosyl-mannitol and glucopyranosyl-sorbitol.

19. The chewing gum according to claim 17 or 18 wherein a filling is also present inside said first region.

20. The chewing gum according to claim 19 wherein said filling contains one or more of polyalcohols, excipients, emulsifiers, vitamins, mineral salts, including zinc salts, green tea extracts and magnolia bark extracts, dyes, acidifiers and flavours.

21. The chewing gum according to any one of claims 1 to 16 wherein said first region and said second region are configured as regions in a form of overlapping, alternating layers.

22. The chewing gum according to any one of claims 1 to 21 comprising at least one flavour selected from those deriving from species of the genera Mentha, Citrus, Spilanthes and menthol, artificial and natural flavours which act as cooling and salivating agents and combinations thereof.

23. The chewing gum according to any one of claims 1 to 22 for use in the treatment of halitosis symptoms.

24. Use, to treat halitosis symptoms, of the chewing gum according to any one of claims 1 to 22.