

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>A23G 3/30</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 95/23519</b> <b>(43) International Publication Date:</b> 8 September 1995 (08.09.95)
<b>(21) International Application Number:</b> PCT/US95/02356 <b>(22) International Filing Date:</b> 24 February 1995 (24.02.95) <b>(30) Priority Data:</b> 08/204,035 1 March 1994 (01.03.94) US <b>(71) Applicant:</b> NABISCO, INC. [US/US]; Seven Campus Drive, Parsippany, NJ 07054-0311 (US). <b>(72) Inventors:</b> D'AMELIA, Ronald, P.; 1 Fox Place, Hicksville, NY 11801 (US). CEA, Theresa, R.; 1425 East 27th Street, Brooklyn, NY 11210 (US). BEAM, John, E.; 5140 River Chase Ridge, Winston-Salem, NC 27104 (US). WHITE, Roy, Albert; 78 Root Road, Somers, CT 06071 (US). AGRO, Susan, Cross; 363 Old Springfield Road, Somers, CT 06071 (US). <b>(74) Agents:</b> SHEAR, Stephen, B.; Nabisco, Inc., Patent Dept., 7 Campus Drive, Parsippany, NJ 07054-0311 (US) et al.		<b>(81) Designated States:</b> CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> CHEWING GUM CONTAINING FLAVORANT ADSORBED IN CROSS-LINKED ELASTOMERIC POLYMER  <b>(57) Abstract</b>  Disclosed is chewing gum containing a flavoring component in which the flavorant is releasably adsorbed in a cross-linked elastomeric polymer.		

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgystan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

1                    CHEWING GUM CONTAINING FLAVORANT ADSORBED  
                      IN CROSS-LINKED ELASTOMERIC POLYMER

5                    BACKGROUND OF THE INVENTION

                     The present invention relates to chewing gums,  
and in particular to gums containing flavorants of  
natural or artificial origin. The invention relates  
more particularly to gums having a particular flavoring  
10                   component which comprises a specially prepared  
combination of flavorant and polymeric matrix.

                     The pertinent literature describes gum  
formulations in which the flavorant is entrapped,  
encapsulated, impregnated within porous microbeads or is  
15                   otherwise physically surrounded.

                     One example is U.S. Patent No. 4,711,784,  
which discloses chewing gum compositions including a  
high molecular weight polyvinyl acetate blended with a  
hydrophobic plasticizer which forms a film with the high  
20                   molecular weight polyvinyl acetate. This film-coated  
polymer serves as an encapsulating composition for  
sweetener components such as aspartame. The film  
coating is considered necessary to control release of  
the sweetener during mastication of the gum, and to  
25                   prevent undesired interaction between the sweetener and  
other components of the gum.

                     U.S. Patent No. 4,386,106 discloses a delayed  
release encapsulated flavorant composition useful in  
chewing gums. This encapsulated composition is prepared  
30                   by forming an emulsion of a flavoring agent in a  
partially hydrophilic matrix material comprising

-2-

1 gelatin, a natural gum and plasticizer, drying the  
emulsion, grinding it, and then coating the resultant  
powder with a water-insoluble material. Here again, a  
coating is required so as to form a physical barrier to  
release of the flavoring component.

5 U.S. Patent No. 5,153,011 discloses a flavor  
ingredient useful in chewing gum compositions,  
comprising flavoring agent, styrene butadiene rubber,  
starch or modified starch, optional water and thickeners  
such as silicon dioxide. The flavoring agent is mixed  
10 with the elastomer, whereupon an aqueous starch solution  
and thickener are added. There is no disclosure or  
recognition herein that using a cross-linked polymer can  
provide the additional benefits which the present  
applicants have discovered.

15 U.S. Patent No. 4,992,280 discloses a  
flavorant release composition comprising polyvinyl  
acetate having a number average molecular weight of  
about 150,000 to 200,000 daltons, which composition can  
be incorporated into chewing gum. It is necessary to  
20 dissolve the polyvinyl acetate in a volatile non-  
reactive solvent as part of the procedure by which the  
flavorant is incorporated into the product. This patent  
also fails to disclose or recognize any advantages to  
the use of cross-linked polymer in preparing a flavorant  
25 useful in chewing gums.

U.S. Patent No. 4,963,369 discloses chewing  
gums containing porous polymeric beads impregnated with  
flavor ingredients. The porous polymeric beads can be  
formed of polymerized styrene cross-linked with divinyl  
30 benzene. Such products have a number of  
characteristics, many of them relatively

-3-

disadvantageous, by which they can be distinguished from  
the gums of the present invention. The disclosed  
polymeric beads must, of necessity, be confined to a  
particle size below the threshold particle size which  
may be detected by the consumer upon chewing the gum  
containing the particles. Otherwise, since the  
particles are not themselves chewable, their presence  
would be detected as a gritty or sandy texture which is  
decidedly undesirable in a chewing gum. Keeping the  
particles at such a very small size, however, leads to  
the fact that the particles have a very high surface  
area-to-mass ratio. This very high ratio, and the very  
microscopic size of the particles themselves, mean that  
the flavorant is relatively freely lost from the  
particulate beads. Accordingly, this patent teaches  
that it is commonly preferred to apply a coating or  
other barrier to the beads, after the flavoring agent  
has been applied into the beads, in order to retard and  
control loss of flavoring agent from the beads upon  
mastication of the chewing gum. By contrast, the gums  
of the present invention comprising discrete macroscopic  
pieces of cross-linked elastomeric polymer containing  
flavoring agent contribute to the positive flavor and  
chewability sensations of the gum even as they are  
considerably larger than microparticulate size.  
Moreover, the elastomeric pieces do not require any sort  
of film or other barrier to the removal of flavor from  
the polymeric matrix during chewing.

Those familiar with the manufacture of chewing  
gums and confections are aware that flavoring agents can  
be vulnerable to gradual degradation in finished  
products. This degradation can even be accelerated

- 4 -

through mediation by one or more other ingredients  
1 present in the product. By "mediation" is meant that  
the presence of such other ingredient(s) in the form in  
which it or they are present appears to accelerate the  
decomposition of the flavorant, regardless of whether  
5 the mechanism of decomposition is chemical reaction,  
catalysis of reaction with other components, oxidation,  
or otherwise. The products which have the potential for  
mediating the degradation of the flavorants include  
sweeteners or other agents whose presence is obviously  
10 desirable in the final product. Past attempts to  
prevent or retard degradation of the flavorants have  
generally involved physically separating or isolating  
the flavorants within the formulation, by means such as  
encapsulation or other physical entrapment mechanisms,  
15 in order to enable the flavorants present to contribute  
as fully as desired to the flavor of the final product.

It is also recognized in this art that the  
consumer's perception of the flavorant(s) upon chewing  
is important to the acceptance of the gum or confection  
20 by the consumer. Attributes including the initial  
impact of flavor upon the onset of chewing, and the  
extension of duration of the flavor during chewing, are  
particularly important, the latter even more so than the  
former. Achieving a desirable balance of both  
25 properties is a challenge, particularly since it is  
frequently found that techniques which enhance one such  
property do so to the detriment of the other.

Thus, there is a need for chewing gum and  
confection compositions which satisfy the objectives of  
30 exhibiting a sufficient degree of flavor extension and

-5-

initial flavor impact while protecting, and even enhancing, the stability of the flavorants present.

#### BRIEF SUMMARY OF THE INVENTION

The present invention meets the aforementioned objectives as well as other desired characteristics that will be apparent.

In one aspect, the present invention comprises a chewing gum comprising a gum base, a flavoring component, and optionally a sweetening component, wherein the flavoring component consists of one or more flavorants absorbed releasably in a solid matrix formed of a cross-linked elastomeric polymer. The polymer is preferably selected from the group consisting of polyvinyl acetate, copolymers of vinyl acetate and a second vinyl comonomer, styrene-butadiene rubber, natural rubber, butyl rubber and polyisobutylene. The sweetening component optionally comprises one or more sweeteners absorbed releasably in such a solid matrix.

Another aspect of the invention is an improved method of making chewing gum by combining in any sequence gum base, a flavoring component and, optionally, a sweetening component, wherein the improvement comprises using as the flavoring component one or more flavorants releasably absorbed in a solid matrix formed of a cross-linked elastomeric polymer. Optionally, one or more sweeteners releasably adsorbed in such a matrix is used as the sweetening component. The method extends the flavor, reduces plasticization of the gum by the flavorant, and retards or prevents oxidative degradation of the flavorant.

- 6 -

1 In another aspect of the present invention,  
the aforementioned chewing gum further comprises a  
sweetening component which consists of one or more  
sweeteners absorbed releasably in a solid matrix formed  
of a cross-linked elastomeric polymer.

#### 5 DETAILED DESCRIPTION OF THE INVENTION

The invention will be described with respect  
to its preferred embodiment, in chewing gums. The  
10 chewing gum of the present invention comprises the gum  
base itself, optional solvents, and/or plasticizers.  
The amount of gum base employed will vary greatly  
depending on various factors such as the type of base  
used, consistency desired and other components used to  
15 make the final product. In general, amounts of about 5%  
to about 50% by weight of the final chewing gum  
composition are acceptable for use in the chewing gum  
compositions, preferred amounts thereof being about 15%  
to about 25% by weight. The gum base may be any water-  
20 insoluble gum base well known in the art. Illustrative  
examples of suitable polymers in gum bases include both  
natural and synthetic elastomers and rubbers. For  
example, those polymers which are suitable in gum bases  
include, without limitation, substances of vegetable  
25 origin such as natural rubber, chicle, jelutong, gutta  
percha and crown gum. Synthetic elastomers such as  
butadiene-styrene copolymers, isobutylene-isoprene  
copolymers, polyethylene, polyisobutylene, polyvinyl  
acetate, and copolymers of vinyl acetate, and mixtures  
30 thereof, are particularly useful.



- 7 -

1           The gum base composition may contain elastomer  
solvents to aid in softening the elastomer component.  
Such elastomer solvents may comprise methyl, glycerol or  
pentaerythritol esters of rosins or modified rosins,  
such as hydrogenated, dimerized or polymerized rosins,  
5       or mixtures thereof. Examples of elastomer solvents  
suitable for use herein include the pentaerythritol  
ester of partially hydrogenated wood rosin,  
pentaerythritol ester of wood rosin, glycerol ester of  
partially dimerized rosin, glycerol ester of polymerized  
10       rosin, glycerol ester of tall oil rosin, glycerol ester  
of wood rosin and partially hydrogenated wood rosin and  
partially hydrogenated methyl ester of rosin, such as  
polymers of alpha-pinene or beta-pinene; terpene resins  
including polyterpene; and mixtures thereof. The  
15       solvent may be employed in an amount ranging from about  
10% to about 75% and preferably about 45% to about 70%  
by weight to the gum base.

          The gum base can also contain any of a variety  
of traditional ingredients such as plasticizers or  
20       softeners such as lanolin, stearic acid, sodium  
stearate, potassium stearate, glyceryl triacetate,  
glycerine and the like and/or waxes, for example,  
natural waxes, petroleum waxes, such as paraffin waxes  
and microcrystalline waxes, to obtain a variety of  
25       desirable textures and consistency properties. These  
individual additional materials are generally employed  
in amounts of up to about 30% by weight and preferably  
in amounts of from about 3% to about 20% by weight of  
the final gum base composition.

30           The chewing gum composition may additionally  
include conventional additives such as emulsifiers such

-8-

as lecithin and glyceryl monostearate; and additional  
1 fillers such as dicalcium phosphate, tricalcium  
phosphate, aluminum hydroxide, magnesium hydroxide,  
alumina, aluminum silicates, calcium carbonate, and talc  
and combinations thereof. These fillers may be used in  
5 the gum base in various amounts. Preferably the amount  
of fillers when used will vary from about 4 to about 30%  
by weight of the final chewing gum.

The present invention contemplates the  
optional inclusion of a sweetener component which  
10 comprises any one or more sweeteners known in the art,  
including both natural and artificial sweeteners. Thus,  
sweeteners may be chosen from the following non-limiting  
list, which includes sugars such as sucrose, glucose,  
corn syrup, dextrose, invert sugar, fructose and  
15 mixtures thereof; saccharine and its various salts such  
as the sodium or calcium salt; cyclamic acid and its  
various salts such as the sodium salt; free aspartame;  
dihydrochalcone sweetening compounds; glycyrrhizin;  
Stevia rebaudiana (Stevioside); monellin, thaumatin,  
20 Sucralose, isomaltitol, neosugar, lactitol,  
polydextrose, and maltitol; and sugar alcohols such as  
sorbitol, sorbitol syrup, mannitol, xylitol, and the  
like. Also contemplated as a sweetener is the  
nonfermentable sugar substitute hydrogenated starch  
25 hydrolysate (also known as Lycasin) which is described  
in U.S. Pat. No. Re. 26,959. Also contemplated is the  
synthetic sweetener 3,6-dihydro-6-methyl-1-1,2,3-  
oxathiazin-4-one-2,2-dioxide, particularly the potassium  
(Acesulfame-K), sodium and calcium salts thereof as  
30 described in German Patent No. 2,001,017.7.

-9-

Products within the scope of the present invention may include no sweetener at all. If sweetener is included, the amount of sweetener is effective to provide the desired degree of sweetness, generally 0.001 to 70 wt.% of the final product.

Suitable flavorants include both natural and artificial flavors and mints, such as oil of peppermint, menthol, oil of spearmint, vanilla, oil of cinnamon, oil of wintergreen (methyl salicylate), and various fruit flavors, including but not limited to lemon oil, orange oil, grape flavor, lime oil, grapefruit oil, apple, apricot essence, and combinations thereof. The flavorings are generally utilized in amounts that will vary depending upon the individual flavor, and may, for example, range in amounts of about 0.5% to about 3% by weight of the final composition weight.

Colorants can be present in the chewing gums and confections of the present invention. Examples include the pigments such as titanium dioxide and other dyes suitable for food, drug and cosmetic applications known as F.D. & C. dyes, and the like. The materials may be incorporated in amounts of up to about 1% by weight, preferably up to about 6% by weight.

The flavoring component of the gums and confections of the present invention preferably consists of one or more of said flavorants adsorbed releasably in a solid matrix formed of a cross-linked elastomeric polymer. This flavoring component, following preparation as described herein, is then incorporated with the other ingredients of the chewing gum or confection. Preferably, this flavoring component comprises about 0.005% to about 25% by weight of the

-10-

1 final chewing gum product. No other suspending agent,  
filler, extender, nor entrapment agent, need be present  
in the sweetener component. This aspect of the present  
invention thus contributes ease and economy of  
5 formulation, with an unprecedented realization of  
benefits. In chewing gums those benefits include  
unimpeded onset of flavor during the initial chew  
coupled with a prolonged extension of the flavor effect  
during chewing, all of which are realized together with  
10 the full, undegraded effect of the sweetener component.  
Other benefits include lessening of the plasticization  
of the gum base by the flavorant, and retarded or  
eliminated oxidation of the flavorant.

15 Some, or all, of the sweetener used in the  
gums and confections of the present invention can also  
be in the form of a sweetening component in which one or  
more sweeteners is releasably adsorbed in a solid matrix  
of cross-linked elastomeric polymer. Preferably, the  
sweetener is one which is liquid at the conditions under  
which it is used to make such products. Sweeteners that  
20 are normally solids can be dissolved or suspended in a  
liquid which is then adsorbed into the matrix. The  
resulting component can then be readily added to the  
other ingredients used in making the gum or confection.  
This aspect of the invention thus contributes ease and  
25 economy of formulation, as well as the unimpeded onset  
of the desired sweetness coupled with prolonged  
extension of sweetness.

30 Notably, the use of the flavoring component  
and sweetening component described herein permits  
attainment of a given level of flavor and sweetness  
perception with less flavorant or sweetener, as the case

-11-

may be; that is, the availability of the flavorant  
and/or sweetener appears enhanced. Without being bound  
by any particular theory, it is believed that the  
flavorant or sweetener is less likely to be masked  
within gum base, by absorption into the gum base or  
otherwise; under this theory, a greater proportion out  
of any total loading of flavor and sweetness is  
"available" for perception by the consumer.

In addition, particularly when the present  
invention is carried out using liquid flavorant syrups  
or solutions, the present invention permits the operator  
to avoid having to dry (spray-dry) the flavorant. This,  
in turn, reduces the cost of the operation and permits  
retention of the more volatile components of the  
flavorant, as drying generally requires the application  
of heat which would drive off the more volatile  
components and could even alter the structure of flavor  
components. As a result, the perceived flavor is  
stronger and fuller.

The cross-linked elastomeric polymer is  
preferably based on a polymer used in chewing gums, and  
more preferably based on a polymer that is present (in  
cross-linked or uncross-linked form) in the chewing gum.  
One such elastomeric polymer is styrene-butadiene rubber  
(SBR), that is, a copolymer of styrene and butadiene.  
There are numerous ratios of styrene to butadiene that  
can be employed, with 50:50 and 23:77  
(styrene:butadiene) being commonly used chewing gum  
grades. The present invention preferably encompasses  
SBR with 0-70% styrene and 30-100% butadiene (mol %).

Another elastomeric polymer is butyl rubber,  
by which is meant an elastomeric copolymer of

-12-

1 isobutylene and isoprene (preferably not more than 2  
mol. % isoprene). Yet another elastomeric polymer is  
natural rubber, that is, a polymer of (trans-1,4-  
isoprene) or (cis-1,4-isoprene). Other elastomeric  
5 polymers include polyisobutylene. Cross-linked  
polyvinyl acetate can also be used to advantage in the  
present invention, as can copolymers of vinyl acetate  
and a second vinyl comonomer. In such copolymers, the  
vinyl acetate preferably comprises at least 50% of the  
10 copolymer; by "vinyl comonomer" is meant a comonomer of  
the general formula  $\text{CH}_2=\text{CHR}$  where R is hydrogen or a  
substituent which preferably is a longer chain (up to  
 $\text{C}_{24}$ ) acyloxy group such as vinyl laurate.

There are several methods by which the  
elastomeric polymer can be cross-linked. Cross-linking  
15 can be effected chemically, for instance by reaction of  
the polymer with a peroxide compound effective to cross-  
link the polymer. Peroxide compounds useful for this  
purpose are well known in the polymer arts; examples  
include di-tert-butyl peroxide, dicumyl peroxide,  
20 benzoyl peroxide, t-butyl hydroperoxide, t-butyl  
peroxybenzoate, t-butyl peroxyacetate, 1,1,4,4-  
tetramethyl tetramethylene bis (t-butyl peroxide), and  
hydrogen peroxide. Cross-linking can also be effected  
chemically by reacting the polymer with sulfur,  
25 preferably in the presence of any of the many known  
accelerators such as benzothiazole, thiurams like  
tetramethyl-thiuram disulfide, and thiocarbamates like  
zinc dimethyl dithiocarbamate.

30 Cross-linking of polymers such as polyvinyl  
acetate can be effected by lightly deacetylating the  
polymer, reacting the polymer with a difunctionally

-13-

1 reactive cross-linking agent such as a lower alkyl  
dialdehyde, and then reacetylating the polymer.

5 Cross-linking can also be effected by  
subjecting the polymer to an effective dose of high-  
energy irradiation. The effect of the irradiation  
varies with the identity of the polymer, so attention  
must be paid to whether the irradiation may cause chain  
scission (as may occur with polyisobutylene) rather than  
cross-linking. In many instances the effectiveness  
and/or rate of cross-linking by radiation is enhanced by  
10 the presence of an enhancer; one example of an enhancer  
is trimethylol propane trimethacrylate. The radiation  
is typically high-intensity ultraviolet radiation, or  
electron beam radiation.

15 It is also possible to induce cross-linking by  
mechanical action, as by shearing the polymer for a  
length of time sufficient to form peroxide on the  
polymer chain. The appropriate conditions can be  
established experimentally for any given polymer.

20 The cross-linking can be carried out before  
the flavoring component is present in the polymer, or it  
can be carried out with the flavoring component already  
present in the polymer. In either case, the flavoring  
component is preferably introduced into the polymer by  
contacting the polymer with a solution of the flavoring  
25 component at a dilution which permits the flavoring  
component to permeate and penetrate into the polymer.  
Loadings of flavoring component (expressed as active  
ingredient) in the polymer are preferably at least 10  
wt.%, more preferably at least 40 wt.%, up to 70 wt.% or  
30 even as high as 90 wt.%.

-14-

Satisfactory molecular weight ranges for the polymers before cross-linking are set forth in the following table:

SBR	greater than 100,000 Daltons
PVAc	greater than 2,000 Daltons
Butyl rubber	greater than 400,000 Daltons
PIB	greater than 50,000 Daltons
Nat'l rubber	greater than 5,000 Daltons

The cross-linked polymer impregnated with the flavoring component may then be preferably subdivided into discrete macroscopic pieces, to aid in the incorporation of the polymeric flavorant into the other ingredients of the chewing gum. The cross-linked impregnated polymer can simply be mixed in with those other ingredients to be broken up by shear forces during mixing. After dispersion in the gum base, the cross-linked polymer is preferably in the form of pieces about 7 to 40 microns or larger in their longest dimension, preferably averaging about 14 microns. In the preferred form, the cross-linked polymer forms discrete pieces or "islands" in the final gum product. If desired, the islands can be given a color that is different from the color of the remainder of the gum, for a striking visual effect in the final gum piece.

The cross-linked elastomer/flavor matrix has an unusual consistency or texture such that when added to a gum batch, the cross-linked elastomer/flavor matrix is torn apart into tiny pieces which never completely mix into the gum to form a homogeneous mass. This is shown by the fact that when color is added to the cross-



-15-

1 linked elastomer/flavor matrix which is subsequently  
added to a gum batch, the resulting mixture contains  
tiny color islands. This does not happen when non-  
cross-linked elastomer/flavor matrix is used. In this  
case, a homogenous distribution throughout the gum batch  
5 is shown by a homogeneous coloring of the gum. The  
texture of the cross-linked elastomer/flavor matrix is  
slightly different from normal gum which causes the  
particles to remain discrete and not be incorporated  
into the gum mixture, yet they are similar enough to be  
10 undetectable organoleptically. Although this is  
certainly the easiest way to mix the cross-linked  
elastomer/flavor matrix into the gum, alternative  
methods could be cryogrinding to a fine powder  
immediately prior to addition to the gum batch or  
15 premixing with sucrose in a high shear mixer which  
pulverizes the cross-linked elastomer/flavor matrix into  
fine particles ready for addition to a gum batch.

It should thus be recognized that the cross-  
linked elastomeric polymer is quite distinct from  
20 flavor-impregnated microparticulate polymeric beads used  
in gums described, e.g., in U.S. Patent No. 4,963,369.  
The pieces of cross-linked polymer used in the present  
invention can be larger than such microparticulate  
beads. The cross-linked elastomer is chewable without  
25 loss of product attractiveness whereas the beads, which  
are hard and unyielding to the chew, would not be  
chewable and would therefore give the gum a very  
unpleasant gritty texture in the mouth.

Indeed, while the pieces of the cross-linked  
30 elastomeric polymer are not necessarily detectable upon  
chewing apart from the gum as a whole, they contribute

not only to the flavor perception but also to the overall chewable texture perception of the final gum product.

In addition, prior teachings as to incorporating such microparticulate flavor-bearing beads teach that the beads are preferably coated, to retard the loss of flavor from the beads. By contrast, the cross-linked elastomeric polymer used in the present invention needs no such coating. This is the case because the cross-linking and larger particle size provides better retention of the flavor, releasing the flavor more gradually. Also, the ratio of surface area to volume of the pieces used in the present invention is several orders of magnitude lower than that of microparticulate beads, which means that the release of flavoring component is to a much greater extent controlled by diffusion from the interior to the surface in the present invention. Where for some reason it is desired to coat the cross-linked polymer "islands", satisfactory materials are any which form a coating and which are inert to the consumer. Examples include shellac, gelatin, polyvinyl acetate, elastomers, resins, zein, paraffin, fats and waxes. Encapsulating material may be hydrophobic or hydrophilic, and can comprise one or several layers of the same or different material. Encapsulation can be carried out using conventional powder-encapsulating equipment and procedures. It will thus be recognized that an emulsifier can be included in the encapsulating material to facilitate formation of the desired coating(s). Suitable emulsifiers have an HLB value of 2 to 13; examples include lecithin, polyglycerol esters, mono- and diglycerides, sorbitan

monostearate, and polysorbate 60. Care must be exercised, though, to ensure that the resulting coated particles do not feel gritty to the teeth during mastication.

A sweetener, including one or more of any of the above-mentioned sweeteners, can also be absorbed into the cross-linked elastomer and thus incorporated into gums of the present invention. The techniques for cross-linking the elastomer and for absorbing the sweetener or sweeteners into the cross-linked elastomer, are those set forth hereinabove as to flavorants.

Chewing gums in accordance with the present invention are formulated in accordance with essentially conventional processing technology. Thus, preferably, the gum base including any resins, plasticizers, fillers and/or other gum base components are softened together by heating and then mixed together with the flavoring component and optional sweetening component, and the mixture is stirred together for a time sufficient to insure a homogeneous mass. Flavoring and sweeteners can be solely in the particles of cross-linked elastomer or can also be in the rest of the gum matrix. The mass can be formed into pellets or into slabs from which individual stick-type pieces are cut using technology familiar to those skilled in this art.

The invention will be described further in the following examples which are provided for purposes of illustration without limitation.

-18-

Example 1

1 A 50/50 (mol. %) styrene-butadiene rubber was  
milled on a rubber mill briefly to slightly peroxidize  
it and break down any gel content. Then 40 parts of  
5 flavorant per 100 parts of SBR was milled in and the  
mixture was compression molded for 3 minutes at 160°C.  
The rubber was now substantially insoluble in hot  
toluene, thereby indicating that it had been  
successfully cross-linked. The flavor-impregnated  
10 cross-linked elastomer which resulted was incorporated  
into a chewing gum. The gum was found to exhibit  
prolonged flavor retention and satisfactory performance  
as a chewing gum.

15

20

25

30

35

- 19 -

Example 2

The procedure of Example 1 was repeated using a 23/77 (mol. %, styrene-butadiene) SBR rubber. Similar results were observed.

Example 3

1 Benzoyl peroxide was milled at a rate of 2  
parts per 100 parts of polymer at 23°C into a 50/50  
(mol. %) styrene-butadiene rubber into which 40 wt.%  
5 flavor and 0.5 wt.% FDC Blue #1 Aluminum Lake pigment  
had previously been absorbed. The resulting mixture was  
compression molded for 3 minutes at 160°C. The product  
thus formed, a cross-linked elastomer (now insoluble in  
hot toluene) containing flavor, was incorporated into a  
10 chewing gum. The gum was found to exhibit prolonged  
flavor retention and satisfactory performance as chewing  
gum.

-21-

Example 4

Polyvinyl acetate (MW = 160,000) (100 parts) was milled with 2 parts of benzoyl peroxide and 15 parts of 0.8-micron calcium carbonate. The resulting product was formed into a sheet of 13 mil. thickness which was cured for 4 minutes at 160°C. The sheet was immersed in cinnamon oil, allowed to drip dry, then wrapped in a silicone release liner and foil and left overnight. The resulting cross-linked polyvinyl acetate sheet was found to have absorbed flavoring giving the sheet a net flavoring content of 43 wt.%.

-22-

Example 5

1 Polyvinyl alcohol (80% hydrolyzed) having an  
average molecular weight of 9,000 was dissolved in hot  
water. The solution was concentrated by evaporation to  
5 50 wt.% polymer. Then an aqueous solution of 25 wt.%  
glutaric dialdehyde was added, following which the  
resultant solution was again concentrated. Acetic  
anhydride was then added until polymer precipitated from  
solution. That polymer, cross-linked polyvinyl acetate,  
10 was recovered and dried. 100 parts of this polymer was  
subjected to high shear blending with 67 parts of  
cinnamon flavoring. The product was a powder which had  
absorbed all the flavoring oil.



-23-

WHAT IS CLAIMED IS:

1. A chewing gum comprising:  
a gum base; and  
a flavoring component;

wherein said flavoring component consists essentially of one or more flavorants absorbed in a cross-linked elastomeric polymer, wherein said one or more absorbed flavorants are releasable from said gum upon chewing of the gum.

2. A chewing gum according to Claim 1 comprising about 0.005 to about 25 wt.% of said flavoring component.

3. A chewing gum according to Claim 1 wherein said cross-linked elastomeric polymer is selected from the group consisting of cross-linked styrene-butadiene rubber, cross-linked butyl rubber, cross-linked natural rubber, cross-linked polyvinyl acetate, cross-linked copolymers of vinyl acetate, and cross-linked polyisobutylene.

4. A chewing gum according to Claim 1 wherein the weight ratio of flavorant to polymer in said flavoring component is at least about 1:10.

5. A chewing gum according to Claim 1 wherein said flavorant is selected from the group consisting of peppermint oil, menthol, cinnamon oil, spearmint oil, vanilla, wintergreen oil, lemon oil, orange oil, grape, lime oil, grapefruit oil, apple, apricot essence, and mixtures thereof.

6. A chewing gum according to Claim 1, further comprising a sweetening component which consists essentially of one or more sweeteners absorbed in a

-24-

1 cross-linked elastomeric polymer, wherein said one or  
more absorbed sweeteners are releasable from said gum  
upon chewing of the gum.

5 7. A chewing gum according to Claim 6  
wherein said sweetener is selected from the group  
consisting of sucrose, glucose, corn syrup, dextrose,  
invert sugar, fructose, saccharine, salts of saccharine,  
cyclamic acid, salts of cyclamic acid, aspartame,  
10 dihydrochalcones, glycyrrhizin, Stevia rebaudiana,  
monellin, thaumatin, Sucralose, isomaltitol, neosugar,  
lactitol, polydextrose, maltitol, sorbitol, sorbitol  
syrup, mannitol, xylitol, hydrogenated starch  
hydrolysate, Acesulfame, salts of Acesulfame, and  
mixtures thereof.

15 8. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is cross-  
linked styrene-butadiene rubber.

20 9. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is cross-  
linked butyl rubber.

10. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is cross-  
linked natural rubber.

25 11. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is cross-  
linked polyvinyl acetate.

12. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is a  
cross-linked copolymer of vinyl acetate.

30 13. A chewing gum according to Claim 1  
wherein said cross-linked elastomeric polymer is cross-  
linked polyisobutylene.

-25-

14. A method of making chewing gum,  
comprising combining effective amounts of a gum base, a  
sweetener component and a flavoring component wherein  
said flavoring component consists essentially of one or  
more flavorants absorbed in a cross-linked elastomeric  
polymer.

15. The method of Claim 14 wherein said  
flavoring component is made by providing said polymer in  
uncross-linked form and cross-linking it in the presence  
of said flavorant.

16. The method of Claim 14 wherein said  
flavoring component is made by impregnating said cross-  
linked polymer with said flavorant.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US95/02356

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A23G 3/30

US CL :426/5

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. : 426/3, 4, 5, 6, 96

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)

APS

search terms: chewing gum, cross-linked polymer, pva, butyl rubber, styrene-butadiene, rubber, adsorbed, flavor

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,128,155 (SONG ET AL) 07 July 1992, see entire document.	1-16
Y	US, A, 4,963,369 (SONG ET AL) 16 October 1990, see entire document.	1-16
Y	US, A, 4,992,280 (YUNG CHU ET AL) 12 February 1991, see entire document.	1-16
Y	US, A, 3,761,286 (SHEPHERD ET AL) 25 September 1973, see entire document.	1-16
Y	US, A, 5,139,787 (BRODERICK ET AL) 18 August 1992, see	1-16



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 part 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)	"&" 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

09 MAY 1995

Date of mailing of the international search report

01 JUN 1995

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

JEANETTE M. HUNTER

Telephone No. (703) 308-3849

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US95/02356

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,154,927 (SONG ET AL) 13 October 1992, see entire document.	1-16
Y	US, A, 5,154,938 (BRODERICK ET AL) 13 October 1992, see entire document.	1-16
A	US, A, 5,153,011 (PATEL ET AL) 06 October 1992.	1-16