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(54) **Title:** CHEWING GUM AND GUM BASE COMPOSITIONS HAVING REDUCED TRANS FATTY ACID CONTENT

(57) **Abstract:** A chewing gum base and chewing gum comprises 1 to 30 wt.% elastomer, 1 to 50 wt.% elastomer solvent, 0 to 40 wt.% filler, 0 to 40% polyvinyl acetate and 5 to 50% of a fat composition which contains less than 4% trans fatty acid residues. The fat composition functions as a softener for the gum base and closely matches the performance of prior art fat compositions.



CHEWING GUM AND GUM BASE COMPOSITIONS HAVING REDUCED TRANS FATTY ACID CONTENT

Background of the Invention

[0001] The present invention relates to chewing gum and gum bases. More specifically, this invention relates to improved formulations for chewing gum bases and chewing gums having reduced levels of trans fatty acid as constituents of triglycerides used as softeners in the gum base.

[0002] The fundamental components of a chewing gum typically are a water-insoluble gum base portion and a water-soluble bulking agent portion. The primary component of the gum base is an elastomeric polymer which provides the characteristic chewy texture of the product. The gum base will typically include other ingredients which modify the chewing properties or aid in processing the product. These include plasticizers, softeners, fillers, emulsifiers, plastic resins, as well as colorants and antioxidants. The water soluble portion of the chewing gum typically includes a bulking agent together with minor amounts of secondary components such as flavors, high-intensity sweeteners, colorants, water-soluble softeners, gum emulsifiers, acidulants and sensates. Typically, the water-soluble portion, sensates, and flavors dissipate during chewing and the gum base is retained in the mouth throughout the chew.

[0003] The water-insoluble softeners typically used in gum bases include fats (triglycerides) and waxes. For a variety of reasons, fats preferred as gum base softeners tend to have relatively high melting points (above 30°C) and to be derived from plant sources, i.e. vegetable oils. Because most vegetable oils have low melting points – typically below 20°C, these oils are normally partially or fully hydrogenated which increases the melting point by converting at least some of the unsaturated fatty acid residues (as fatty acid chains attached to triglyceride molecules are called) to saturated fatty acid residues. However, the process of hydrogenation, if not carried to completion, leaves some unsaturated fatty acid residues in a trans conformational isomers as opposed to the cis conformation more commonly found in nature. Trans fatty acids have been found to have

negative health impacts when consumed in the human diet. While the fats used in chewing gum bases are mostly expectorated with the gum cud, public health concerns and regulatory restrictions make their presence in chewing gum (and other food products) undesirable.

[0004] This invention is directed to novel fat compositions which provide gum bases and the chewing gums containing them with desirable textural and flavor properties while minimizing or eliminating trans fatty acid residues from the composition.

Summary of the Invention

[0005] A chewing gum base composition is composed of fat components having little or no trans fatty acid residues. Mixtures of hydrogenated and unhydrogenated vegetable oils are formulated to closely match key attributes of prior art fat blends while maintaining trans fatty acid residues below 4% or below 3% or below 2% or below 1% by weight of the fat composition.

Description of the Invention

[0006] The present invention relates to chewing gum bases and gums having reduced levels of trans fatty acid as constituents of triglycerides used as softeners in the gum base. For purposes of this invention, the fat composition may optionally include mono- and di-glycerides of fatty acids which act both as softeners and as emulsifiers.

[0007] In the present invention, a fat composition composed of a blend of unhydrogenated and fully-hydrogenated vegetable oils are combined in such combinations as to reproduce as closely as possible the physical and chemical characteristics of previously used fat blends which included partially-hydrogenated oils and therefore triglycerides having trans fatty acid residues (more succinctly called trans-fats). While the specific physical and chemical properties which the formulator will try to duplicate will vary from case to case, it is anticipated that at least the following properties will be considered.

[0008] Fatty acid distribution is basically the mixture of fatty acid residues which comprise the triglycerides of the composition. The residues may be characterized by the length of the fatty acid carbon chain (e.g. C14, C16, C18, C20); the degree of unsaturation (number of carbon-carbon double bonds in the chain) often designated as a number following the number of carbons such as C18:0, C18:1, C18:2; and the position of the double bond(s) on the molecule often expressed as an 'omega' number counting the number of carbons from the terminal end of the fatty acid chain (such as omega-3 for a double bond between the third and fourth carbon counting from the terminal (non-ester) end of the residue. A formulator may choose to try to replicate any or all of these aspects of the fatty acid distribution in the reformulated fat composition.

[0009] Melting point is the temperature at which the fat transitions from solid to liquid. In practice, fats tend to melt over a range of temperatures due to variations in the fatty acid distribution of the triglycerides. Typically a formulator will try to match the temperature at the onset of melting or in the middle of the transition which can be best determined by differential Scanning Calorimetry (DSC).

[0010] Enthalpy of melting is the total amount of energy needed to melt a specified quantity of the fat, usually expressed in Joules per gram. The formulator will typically determine the enthalpy of the target and replacement compositions through the use of DSC when attempting to match the fat composition being replaced.

[0011] In addition to these well-defined physical and chemical properties of the fat composition, it is known that fat compositions may affect the flavor release rate and profile of the final chewing gum product. Therefore, the formulator may also try to match that property in the fat composition being replaced. This may require some degree of trial and error, although methods using solubility parameters, polarity or other physical/chemical properties known to influence flavor release may also be employed.

[0012] In order to match the property of the previously used trans-fat (which we will define for our purposes as a fat composition having greater than 4% trans fatty acid residues by weight), the formulator may employ mathematical methods

to average the properties of the fat components, adjusting levels to bring the average close to the target fat composition.

[0013] Typically, the fatty softener composition will comprise at least 5% or at least 10% or at least 15% or at least 20% by weight of the gum base composition. Typical usage levels of the softener will be up to 50% or up to 40% or up to 35% by weight of the gum base composition.

[0014] The water-insoluble gum base of the present invention will comprise, in addition to the fatty softener composition, at least one elastomer which provides a lively, bouncy chew to the finished product. Elastomers may include, but are not limited to, polyisobutylene having a viscosity average molecular weight of about 100,000 to about 800,000, isobutylene-isoprene copolymer (butyl rubber), polyolefin thermoplastic elastomers such as ethylene-propylene copolymer and ethylene-octene copolymer, styrene-butadiene copolymers having styrene-butadiene ratios of about 1:3 to about 3:1 and/or polyisoprene, and combinations thereof. Natural elastomers which may be similarly incorporated into the gum bases of the present inventions include jelutong, lechi caspi, perillo, sorva, massaranduba balata, massaranduba chocolate, nispero, rosindinha, chicle, gutta hang kang, and combinations thereof. It is also contemplated that gum bases of the present invention may comprise unconventional elastomers such as biodegradable polymers such as polylactic acid and polycaprolactone, removable gum bases such as tri-block and multi-block copolymers disclosed in WO 2011032026, WO2014039755 and WO2014026122, crosslinked polymeric microspheres such as those disclosed in WO2011063338. Elastomers may be present in the inventive gum base at levels of 1 to 30% or 2 to 25% or 5 to 20% by weight of the gum base.

[0015] The water-insoluble gum base of the present invention will further comprise and at least one elastomer solvent (elastomer plasticizer) which serves to soften the elastomer and allow it to be blended with other gum base components. Elastomer solvents commonly used for petroleum-based elastomers include, but are not limited to, natural rosin esters, often called estergums, such as glycerol esters of partially hydrogenated rosin, glycerol esters of polymerized rosin, glycerol esters of partially or fully dimerized rosin, glycerol esters of rosin,

pentaerythritol esters of partially hydrogenated rosin, methyl and partially hydrogenated methyl esters of rosin, pentaerythritol esters of rosin, glycerol esters of wood rosin, glycerol esters of gum rosin; synthetics such as terpene resins derived from alpha-pinene, beta-pinene, and/or d-limonene; and any suitable combinations of the foregoing. The preferred elastomer plasticizers also will vary depending on the specific application, and on the type of elastomer which is used. In the case of unconventional elastomers, it may be necessary to use an unconventional elastomer solvent such as, in the case of a tri-block polymer, a low molecular weight di-block copolymer composed of the same monomer components as the tri-block elastomer. Elastomer solvents will be used at levels of 1 to 50% or 3 to 40% or 5 to 35% by weight of the gum base.

[0016] The gum base may optionally include inorganic fillers such as magnesium and calcium carbonate, ground limestone, silicate types such as magnesium and aluminum silicate, clay, alumina, talc, titanium oxide, mono-, di- and tri-calcium phosphate and calcium sulfate. Insoluble organic fillers including cellulose polymers such as wood as well as combinations of any of these also may be used. Fillers may be used at levels from 0 to 40% or 2 to 35% or 5 to 30% by weight of the gum base.

[0017] The gum base may also include a plastic resin such as polyvinyl acetate, polyvinyl laurate, and vinylacetate/vinyl laurate copolymers at levels from 0 to 40% or 5 to 35% or 10 to 30% by weight of the gum base.

[0018] Furthermore, the base may include minor components such as emulsifiers, colors and antioxidants used at appropriate levels to achieve the desired benefit. As explained above, mono and di- glyceride compositions which act as softeners and emulsifiers are considered as part of the fat composition. Colorants and whiteners may include FD&C-type dyes and lakes, fruit and vegetable extracts, titanium dioxide, and combinations thereof. Antioxidants such as BHA, BHT, tocopherols, propyl gallate and other food acceptable antioxidants may be employed to prevent oxidation of fats, oils and elastomers in the gum base.

[0019] The water-insoluble gum base of the present invention may constitute from about 5 to about 95 % by weight of the chewing gum. More typically it may constitute from about 10 to about 50% by weight of the chewing gum and, in various preferred embodiments, may constitute from about 20 to about 35% by weight of the chewing gum.

[0020] Selection of various components in chewing gum bases or chewing gum formulations of this invention typically are dictated by factors, including for example the desired properties (e.g., physical (mouthfeel), taste, odor, and the like) and/or applicable regulatory requirements (e.g., in order to have a food grade product, food grade components, such as food grade approved oils like vegetable oil, may be used.)

[0021] The base may include wax or be wax-free. An example of a wax-free gum base is disclosed in U.S. Patent No. 5,286,500, the disclosure of which is incorporated herein by reference. Waxes, like fats, function as softeners in the gum base but are not considered part of the fat composition.

[0022] A water-insoluble gum base typically constitutes approximately 5 to about 95 percent, by weight, of a chewing gum of this invention; more commonly, the gum base comprises 10 to about 50 percent of a chewing gum of this invention; and in some preferred embodiments, 20 to about 35 percent, by weight, of such a chewing gum.

[0023] In addition to a water-insoluble gum base portion, a typical chewing gum composition includes a water-soluble bulk portion (or bulking agent) and one or more flavoring agents. The water-soluble portion can include high intensity sweeteners, binders, flavoring agents (which may be water insoluble), water-soluble softeners, gum emulsifiers, colorants, acidulants, fillers, antioxidants, and other components that provide desired attributes.

[0024] Water-soluble softeners, which may also known as water-soluble plasticizers and plasticizing agents, generally constitute between approximately 0.5 to about 15% by weight of the chewing gum. Water-soluble softeners may include glycerin, lecithin, and combinations thereof. Aqueous sweetener solutions such as those containing sorbitol, hydrogenated starch hydrolysates (HSH), corn

syrup and combinations thereof, may also be used as softeners and binding agents (binders) in chewing gum.

[0025] Preferably, a bulking agent or bulk sweetener will be useful in chewing gums of this invention to provide sweetness, bulk and texture to the product. Typical bulking agents include sugars, sugar alcohols, and combinations thereof. Bulking agents typically constitute from about 5 to about 95% by weight of the chewing gum, more typically from about 20 to about 80% by weight and, still more typically, from about 30 to about 70% by weight of the gum. Sugar bulking agents generally include saccharide containing components commonly known in the chewing gum art, including, but not limited to, sucrose, dextrose, maltose, dextrin, dried invert sugar, fructose, levulose, galactose, corn syrup solids, and the like, alone or in combination. In sugarless gums, sugar alcohols such as sorbitol, maltitol, erythritol, isomalt, mannitol, xylitol and combinations thereof are substituted for sugar bulking agents. Sugar alcohols are sometimes referred to as polyols or alditols. Combinations of sugar and sugarless bulking agents may also be used.

[0026] In addition to the above bulk sweeteners, chewing gums typically comprise a binder/softener in the form of a syrup or high-solids solution of sugars and/or sugar alcohols. In the case of sugar gums, corn syrups and other dextrose syrups (which contain dextrose and significant amounts higher saccharides) are most commonly employed. These include syrups of various DE levels including high-maltose syrups and high fructose syrups. In the case of sugarless products, solutions of sugar alcohols including sorbitol solutions and hydrogenated starch hydrolysate syrups are commonly used. Also useful are syrups such as those disclosed in US 5,651,936 and US 2004-234648 which are incorporated herein by reference. Such syrups serve to soften the initial chew of the product, reduce crumbliness and brittleness and increase flexibility in stick and tab products. They may also control moisture gain or loss and provide a degree of sweetness depending on the particular syrup employed. In the case of syrups and other aqueous solutions, it is generally desirable to use the minimum practical level of water in the solution to the minimum necessary to keep the solution free-flowing at acceptable handling temperatures. The usage level of such syrups and solutions

should be adjusted to limit total moisture in the gum to less than 3 wt.%, preferably less than 2 wt.% and most preferably less than 1 wt.%.

[0027] High intensity artificial sweeteners can also be used in combination with the above-described sweeteners. Preferred sweeteners include, but are not limited to sucralose, aspartame, salts of acesulfame, alitame, neotame, saccharin and its salts, cyclamic acid and its salts, glycyrrhizin, stevia and stevia compounds such as rebaudioside A, dihydrochalcones, thaumatin, monellin, lo han guo and the like, alone or in combination. In order to provide longer lasting sweetness and flavor perception, it may be desirable to encapsulate or otherwise control the release of at least a portion of the artificial sweetener. Such techniques as wet granulation, wax granulation, spray drying, spray chilling, fluid bed coating, coacervation, and fiber extrusion may be used to achieve the desired release characteristics.

[0028] Usage level of the artificial sweetener will vary greatly and will depend on such factors as potency of the sweetener, rate of release, desired sweetness of the product, level and type of flavor used and cost considerations. Thus, the active level of artificial sweetener may vary from 0.02 to about 8% by weight. When carriers used for encapsulation are included, the usage level of the encapsulated sweetener will be proportionately higher.

[0029] Combinations of sugar and/or sugarless sweeteners may be used in chewing gum. Additionally, the softener may also provide additional sweetness such as with aqueous sugar or alditol solutions.

[0030] If a low calorie gum is desired, a low caloric bulking agent can be used. Examples of low caloric bulking agents include: polydextrose; Raftilose, Raftilin; fructooligosaccharides (NutraFlora); Palatinose oligosaccharide; Guar Gum Hydrolysate (Sun Fiber); or indigestible dextrin (Fibersol). However, other low calorie bulking agents can be used. In addition, the caloric content of a chewing gum can be reduced by increasing the relative level of gum base while reducing the level of caloric sweeteners in the product. This can be done with or without an accompanying decrease in piece weight.

[0031] A variety of flavoring agents can be used. The flavor can be used in amounts of approximately 0.1 to about 15 weight percent of the gum, and preferably, about 0.2 to about 5%. Flavoring agents may include essential oils, synthetic flavors or mixtures thereof including, but not limited to, oils derived from plants and fruits such as citrus oils, fruit essences, peppermint oil, spearmint oil, other mint oils, clove oil, oil of wintergreen, anise and the like. Artificial flavoring agents and components may also be used. Natural and artificial flavoring agents may be combined in any sensorially acceptable fashion. Sensate components which impart a perceived tingling or thermal response while chewing, such as a cooling or heating effect, also may be included. Such components include cyclic and acyclic carboxamides, menthol derivatives, and capsaicin among others. Acidulants may be included to impart tartness.

[0032] In addition to typical chewing gum components, chewing gums of the present invention may include active agents such as dental health actives such as minerals, nutritional supplements such as vitamins, health promoting actives such as antioxidants for example resveratrol, stimulants such as caffeine, medicinal compounds and other such additives. These active agents may be added neat to the gum mass or encapsulated using known means to prolong release and/or prevent degradation. The actives may be added to coatings, rolling compounds and liquid or powder fillings where such are present.

[0033] It may be desirable to add components to the gum or gum base composition which enhance environmental degradation of the chewed cud after it is chewed and discarded. For example, in the case of a polyester elastomer, an esterase enzyme may be added to accelerate decomposition of the polymer. Alternatively, proteinases such as proteinase K, pronase, and bromelain can be used to degrade poly(lactic acid) and cutinases may be used to degrade poly(6-methyl- ϵ -caprolactone). Such enzymes may be available from Valley Research, Novozymes, and other suppliers. Optionally, the enzyme or other degradation agent may be encapsulated by spray drying, fluid bed encapsulation or other means to delay the release and prevent premature degradation of the cud.

[0034] The present invention may be used with a variety of processes for manufacturing chewing gum including batch mixing, continuous mixing and tableted gum processes.

EXAMPLES

[0035] Fatty softeners useful in the present invention will comprise primarily un-hydrogenated and fully-hydrogenated vegetable oils such as those derived from corn, soy, cottonseed, palm, palm kernel, cocoa, rape, peanut, sunflower, safflower, olive, coconut, avocado, grape seed, flax and other food acceptable oils from plant sources. Such oils may be either used in their natural state or fully hydrogenated to remove all or virtually all of the double bonds (unsaturation) in the fatty acid residues. It is strongly preferred that the component fats/oils should have less than 4% or less than 3% or less than 2% or less than 1% of residues having a trans configuration in any unsaturation point of the molecule. This will insure that the resulting fat composition contains no more than 4% of such residues and preferably much less. Some Examples of component fats/oil useful in the compositions are shown in Table 1.

Table 1			
Example #	Oil source	Degree of Hydrogenation	Trans fat content (%)
1	Palm Kernel	None	< 1
2	Soy	None	< 2
3	Soy	Full	1.0
4	Cottonseed	Full	< 2
5	Peanut	None	< 1
6	Peanut	Full	< 2
7	Palm	None	2.0
8	Avacado	None	< 2
9	Palm/Soy	Full	0.5
10	Palm Kernel	Full	< 1
11	Cottonseed	None	< 1
12	Coconut	None	<0.5
13	Coconut	Full	< 2
14	Palm (mono-, di- and tri-glycerides)	Full	< 1
15	Soy (mono-, di- and tri-glycerides)	Full	< 1

[0036] The fat components of Examples 1-15 can be combined as disclosed above to create fat compositions useful in gum bases. Examples are shown in Tables 2-10.

Table 2						
Fat of Example #	Ex. 16	Ex. 17	Ex. 18	Ex. 19	Ex. 20	Ex. 21
1			15.21			
2	7.14			13.56		
3	41.51	61.75	42.66			66.01
4					58.44	
5						
6						
7		31.99	13.28		14.92	19.60
8	21.34					
9	21.34			44.05		
10				31.22		
11						
12						
13					18.77	
14	8.67		28.85	11.17		
15		6.26			7.87	14.39
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 3						
Fat of Example #	Ex. 22	Ex. 23	Ex. 24	Ex. 25	Ex. 26	Ex. 27
1						
2				9.11		
3		51.49	13.00	11.49	60.65	59.84
4						
5						
6			52.56			
7	15.60	24.74			11.41	26.14
8						
9				64.89		
10	60.10					
11						
12	17.88		24.61			
13						
14	3.21	23.77	9.83	6.44	27.94	
15	3.21			8.07		14.02
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 4						
Fat of Example #	Ex. 28	Ex. 29	Ex. 30	Ex. 31	Ex. 32	Ex. 33
1				9.95		
2						
3	41.87	11.79	21.78		49.28	68.64
4						
5						
6						
7	34.36	30.05	16.13	9.95	27.69	25.10
8						
9		48.80	40.31	23.52		
10						
11						
12						
13				46.14		
14				10.44		
15	23.77	9.36	21.78		23.03	6.26
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 5						
Fat of Example #	Ex. 34	Ex. 35	Ex. 36	Ex. 37	Ex. 38	Ex. 39
1	17.10					
2						
3	34.61	34.32	62.82		57.09	
4				55.28		
5						
6						
7		25.10	21.18	31.69	14.97	
8						
9		34.32				64.25
10	35.07					
11						21.44
12						
13						
14	13.22			13.03	27.94	
15		6.26	16.00			14.31
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 4						
Fat of Example #	Ex. 40	Ex. 41	Ex. 42	Ex. 43	Ex. 44	Ex. 45
1					8.15	2.03
2				13.46		
3	56.78		31.22	24.78		27.28
4						
5						
6						
7	21.44	11.41	18.71	7.23		7.62
8						
9		60.65	22.47		70.13	41.13
10			12.79			
11						
12					9.87	
13				38.60		
14		27.94			11.85	
15	21.78		14.81	15.93		21.94
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 5						
Fat of Example #	Ex. 46	Ex. 47	Ex. 48	Ex. 49	Ex. 50	Ex. 51
1	14.23	8.69				
2				11.36		
3			59.35	48.28	30.71	59.35
4	18.59	31.55				
5						
6						
7		8.69	17.90	11.48	14.34	17.90
8						
9	41.63	30.65	9.57	10.42		6.25
10						
11						
12	24.21	5.42				
13						
14		15.00				
15	1.34		13.18	18.46	38.95	16.50
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 6						
Fat of Example #	Ex. 52	Ex. 53	Ex. 54	Ex. 55	Ex. 56	Ex. 57
1						
2						
3	51.49	42.66		33.84		46.71
4			30.16			
5					21.64	
6					60.98	
7	34.12	19.77		11.48	5.49	19.97
8			19.59			
9		17.45		38.18		
10			35.86			
11						
12						
13						
14		10.12				
15	14.39	10.00	14.39	16.50	11.890	33.32
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 7						
Fat of Example #	Ex. 58	Ex. 59	Ex. 60	Ex. 61	Ex. 62	Ex. 63
1	11.72					
2			14.44			
3	9.84		51.75	30.16	62.80	
4	19.62					
5		18.72				10.21
6		60.96				
7			4.19	19.59	23.03	
8						
9	49.92		9.16	35.86		
10						7.35
11						
12					2.48	8.82
13						
14	8.09		20.46			63.94
15		20.32		14.39	11.69	9.68
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 10						
Fat of Example #	Ex. 64	Ex. 65	Ex. 66	Ex. 67	Ex. 68	Ex. 69
1						
2					21.56	
3	37.03	52.50	50.00			11.56
4				37.26		
5						7.96
6						
7	25.94	24.47	16.68			
8				27.19		
9	8.56				67.32	42.95
10				9.33		
11						
12						14.38
13						
14				26.22		13.82
15	28.47	23.03	33.32		11.12	9.33
Total	100.00	100.00	100.00	100.00	100.00	100.00

[0037] Gum bases can be made with the above fat compositions.

Table 11					
	Ex. 70	Ex. 71	Ex. 72	Ex. 73	Ex. 74
Butyl Rubber	7.93	9.48	8.11		
Styrene Butadiene Rubber				12.36	10.78
Polyisobutylene	5.44	4.17	6.23	11.19	9.96
Calcium Carbonate	28.87	25.69			30.27
Terpene Resin	14.66	12.64	15.29		
Estergum				16.98	15.64
Polyvinyl Acetate (Low MW)	19.66	17.26	20.65	15.00	16.48
Polyvinyl Acetate (High MW)	2.56	6.23	3.66	4.36	3.57
Fat Composition of any of Examples 16-69	17.86	21.51	13.04	19.71	10.27
Talc			31.00	17.37	
BHT	0.02	0.02	0.02	0.03	0.03
Lecithin	3.00	3.00	2.00	3.00	3.00
Total	100.00	100.00	100.00	100.00	100.00

[0038] Chewing gums can be made with the above gum bases.

Table 12					
	Ex. 75	Ex. 76	Ex. 77	Ex. 78	Ex. 79
Gum base of any of Examples 70-74r	25.00	28.00	30.00	33.00	36.00
Sorbitol	55.49	51.19			
Sugar			53.89	50.79	47.49
Mannitol	2.00	3.00			
Corn Syrup			12.00	11.00	10.00
Hydrogenated Starch Hydrolysate	13.00	12.00			
Peppermint flavor	1.51		1.11	1.21	
Fruit Flavor		1.81			1.51
Glycerin	3.00	4.00	3.00	4.00	5.00
Lecithin					
Total	100.00	100.00	100.00	100.00	100.00

[0039] Additional gum bases can be made according to the formulas in Examples 80-110.

Table 13					
	Ex. 80	Ex. 81	Ex. 82	Ex. 83	Ex. 84
Butyl Rubber	10.00	11.00	7.00	13.00	2.00
Styrene Butadiene Rubber			4.00		3.00
Polyisobutylene	10.00	10.00	11.00	13.00	11.00
Terpene Resin	13.00	14.00	8.00	16.00	
Estergum			7.00		16.00
Polyvinyl Acetate (Low MW)	21.00	23.96	18.00	17.00	7.00
Polyvinyl Acetate (High MW)	3.00		2.00	4.00	20.00
Fat Composition of Ex. 3	4.00	6.50	2.00	8.00	
Fat Composition of Ex. 5	2.00		1.00		
Fat Composition of Ex. 7		1.50			2.00
Fat Composition of Ex. 9	11.00	10.00	7.00		10.50
Fat Composition of Ex. 11			2.00		
Fat Composition of Ex.12				2.00	
Fat Composition of Ex.13			6.00	9.00	
Triacetin					3.00
Glycerol Monostearate	4.00	5.50	2.00		5.00
Calcium Carbonate	15.00	11.00		14.00	
Talc			16.00		17.00
BHT	0.05	0.04	0.04	0.03	0.05
Lecithin	1.00		1.00	2.97	2.00
Microcrystalline Wax	6.95	3.00	5.00	1.00	
Paraffin Wax		3.50	1.00		
Acetylated Monoglyceride					1.45
Total	100.00	100.00	100.00	100.00	100.00

Table 14					
	Ex. 85	Ex. 86	Ex. 87	Ex. 88	Ex. 89
Butyl Rubber	12.50	11.00	2.00	8.00	13.00
Styrene Butadiene Rubber			12.00		
Polyisobutylene	12.50	13.00	8.00	5.50	7.00
Terpene Resin	6.47	6.00	4.00	15.00	20.97
Estergum			20.96		
Polyvinyl Acetate (Low MW)	22.00	26.00	21.00	20.50	18.00
Polyvinyl Acetate (High MW)		1.00		2.48	
Fat Composition of Ex. 3	8.00	6.00	3.00	4.00	5.00
Fat Composition of Ex. 6		2.00			
Fat Composition of Ex. 7	3.00	4.00		3.50	3.00
Fat Composition of Ex. 9	9.50	6.00	7.00	8.00	8.00
Fat Composition of Ex. 11			3.00		
Fat Composition of Ex. 13					2.00
Fat Composition of Ex. 15	4.00	2.00	1.00	4.00	2.00
Triacetin					
Calcium Carbonate	22.00	20.00		26.00	18.00
Talc			13.00		
BHT	0.03	0.05	0.04	0.02	0.03
Lecithin				3.00	2.00
Microcrystalline Wax		3.00	2.00		1.00
Paraffin Wax			3.00		
Total	100.00	100.00	100.00	100.00	100.00

Table 15					
	Ex. 90	Ex. 91	Ex. 92	Ex. 93	Ex. 94
Butyl Rubber	10.00	9.00	11.00	5.00	6.00
Styrene Butadiene Rubber				3.00	2.50
Polyisobutylene	12.00	1.50	8.00	12.00	9.00
Terpene Resin	9.50	22.00	18.00		
Ester gum				18.95	18.46
Polyvinyl Acetate (Low MW)	24.00	24.00	22.00	15.00	14.00
Polyvinyl Acetate (High MW)				3.00	
Fat Composition of Ex. 3	9.00	8.50	7.00	5.00	8.00
Fat Composition of Ex. 5			3.00		
Fat Composition of Ex. 7	4.50	5.00		3.00	5.00
Fat Composition of Ex. 9	11.00				9.00
Fat Composition of Ex. 10				3.00	
Fat Composition of Ex. 11					
Fat Composition of Ex. 13			5.00	5.00	
Fat Composition of Ex. 14	4.50	3.96	3.00	3.00	4.00
Triacetin					
Calcium Carbonate	12.00	23.00	21.00	20.00	24.00
Talc					
BHT	0.04	0.04	0.04	0.05	0.04
Lecithin	1.00	3.00	1.96		
Microcrystalline Wax	2.46				
Paraffin Wax				3.00	
Acetylated Monoglyceride				1.00	
Total	100.00	100.00	100.00	100.00	100.00

Table 16					
	Ex. 95	Ex. 96	Ex. 97	Ex. 98	Ex. 99
Butyl Rubber		7.00	9.00	8.00	10.00
Styrene Butadiene Rubber	9.00				2.00
Polyisobutylene	8.00	10.00	2.00	10.47	6.00
Terpene Resin		14.00			15.00
Estergum	18.00		17.00	15.00	4.00
Polyvinyl Acetate (Low MW)	26.00	18.00	20.00	17.00	15.00
Polyvinyl Acetate (High MW)	4.00	1.00	5.00		
Fat Composition of Ex. 3	7.00		6.78	18.00	4.00
Fat Composition of Ex. 4	4.00	6.00			8.00
Fat Composition of Ex. 7		5.00	5.00	6.50	
Fat Composition of Ex. 9			1.50		
Fat Composition of Ex. 10		3.00			1.00
Fat Composition of Ex. 11	4.00				1.00
Fat Composition of Ex. 13		6.00			
Fat Composition of Ex. 14		2.00	6.00	3.00	3.00
Triacetin	0.95		0.70		
Calcium Carbonate	19.00	18.00	21.00	22.00	24.00
Talc					
BHT	0.05	0.04	0.02	0.03	0.03
Lecithin		1.00	4.00		1.00
Microcrystalline Wax		3.96			3.00
Paraffin Wax		4.00	2.00		3.00
Acetylated Monoglyceride		1.00			
Total	100.00	100.00	100.00	100.00	100.00

Table 17					
	Ex. 100	Ex. 102	Ex. 103	Ex. 104	Ex. 105
Butyl Rubber	8.00	10.00	15.00	10.50	3.00
Styrene Butadiene Rubber					16.00
Polyisobutylene	15.00	2.00	6.00	16.00	7.00
Terpene Resin	13.00	25.00	22.00		6.00
Ester gum					25.00
Polyvinyl Acetate (Low MW)	18.00	27.36	15.00	21.96	10.00
Polyvinyl Acetate (High MW)	8.00		2.00		2.00
Fat Composition of Ex. 3	4.00	8.50		13.00	
Fat Composition of Ex. 5	6.00				
Fat Composition of Ex. 7		7.00		9.00	5.00
Fat Composition of Ex. 9			9.00	13.00	
Fat Composition of Ex. 12			4.00		3.00
Fat Composition of Ex. 13	7.00				
Fat Composition of Ex. 14			1.00		
Fat Composition of Ex. 15		5.00		4.00	2.00
Triacetin			1.00		1.00
Calcium Carbonate	17.00		16.96		14.96
Talc		11.50		12.50	
BHT	0.04	0.04	0.04	0.04	0.04
Lecithin		3.60	2.00		
Microcrystalline Wax	3.96				2.00
Paraffin Wax			5.00		3.00
Acetylated Monoglyceride			1.00		
Total	100.00	100.00	100.00	100.00	100.00

Table 18					
	Ex. 106	Ex. 107	Ex. 108	Ex. 109	Ex. 110
Butyl Rubber	3.00	13.00	10.50	6.00	
Styrene Butadiene Rubber	9.00			2.00	15.95
Polyisobutylene	12.00	4.00	16.00	14.00	8.00
Terpene Resin	5.00	21.00		12.00	
Ester gum	13.00			6.00	29.00
Polyvinyl Acetate (Low MW)	16.00	7.00	21.95	17.00	8.00
Polyvinyl Acetate (High MW)	4.00	3.00			2.00
Fat Composition of Ex. 3		5.00	13.00		4.00
Fat Composition of Ex. 4	9.00			5.00	
Fat Composition of Ex. 7		4.00	9.00		
Fat Composition of Ex. 9			13.00		
Fat Composition of Ex. 10	2.00	2.50			
Fat Composition of Ex. 11	4.00				8.00
Fat Composition of Ex. 13		4.00			4.00
Fat Composition of Ex. 14	5.00		4.00	3.00	3.00
Triacetin				0.80	
Calcium Carbonate	14.00	18.00	12.50	24.20	17.00
Talc					
BHT	0.05	0.05	0.05	0.05	0.05
Lecithin				2.00	1.00
Microcrystalline Wax	3.95	4.00		4.00	
Paraffin Wax		4.00		4.00	
Acetylated Monoglyceride		0.45			
Total	100.00	100.00	100.00	100.00	100.00

[0040] Chewing gums can be made according to the formulas in Examples 111 – 115. The chewing gum mass can be used to prepare products in stick, tab or coated pellet forms. Coated pellets are typically coated with a sugar or polyol panned coating. It is also possible to make products having liquid or powder center fills.

Table 19					
	Ex. 111	Ex. 112	Ex. 113	Ex. 114	Ex. 115
Gum base of any of Examples 80-110	25.00	28.00	30.00	33.00	36.00
Sorbitol	54.49	50.19			
Xylitol			53.89	51.79	47.49
Mannitol	2.00	3.00	1.00		
Hydrogenated Starch Hydrolysate Syrup	13.00	12.00		8.00	9.00
Peppermint flavor	1.51			1.21	
Fruit Flavor		1.81	2.11		1.51
Glycerin 99%	3.00	4.00	8.00	4.00	5.00
Lecithin	1.00	1.00	1.00	2.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

[0041] Unless otherwise specified, all percentages expressed herein are weight percentages and all temperatures are expressed in °C. The terms ‘fat’ and ‘oil’ are considered chemically synonymous. The terms ‘fat composition’ and ‘gum base’ are intended to include all appropriate components whether they are pre-blended or added separately during the gum base or chewing gum mixing processes. All patents, patent applications, provisional applications, and publications referred to or cited herein are incorporated by reference in their entirety to the extent they are not inconsistent with the explicit teachings of this specification. Further, while only certain features of the invention have been illustrated and described herein, many modifications and changes will occur to

those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

What is claimed is:

1. A chewing gum base comprising an 1 to 30 wt.% elastomer, 1 to 50 wt.% elastomer solvent, 0 to 40 wt.% filler, 0 to 40% polyvinyl acetate and 5 to 50% of a fat composition wherein the fat composition has a trans fatty acid residue content of less than 4 wt.%.
2. The gum base of claim 1 wherein the fat composition has a trans fatty acid residue content of less than 3 wt.%.
3. The gum base of claim 1 wherein the fat composition has a trans fatty acid residue content of less than 2 wt.%.
4. The gum base of claim 1 wherein the fat composition has a trans fatty acid residue content of less than 1 wt.%.
5. The gum base of claim 1 wherein the fat composition has a trans fatty acid residue content of less than 0.5 wt.%.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/021511

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A23G 4/06; A23G 4/08 (2016.01)

CPC - A23G 4/06; A23G 4/066; A23G 4/08 (2016.02)

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)

IPC(8) - A23D 9/00; A23G 4/06; A23G 4/08 (2016.01)

CPC - A23D 9/00; A23G 4/06; A23G 4/066; A23G 4/08 (2016.02)

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

USPC - 424/48, 401; 426/5, 606; IPC(8) - A23D 9/00; A23G 4/06, 4/08; CPC - A23D 9/00; A23G 4/06, 4/066, 4/08 (keyword delimited)

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

Orbit, Google Patents, Google Scholar.

Search terms used: gum, elastomer, solvent, fat, trans.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012/0100194 A1 (YAMAI et al) 26 April 2012 (26.04.2012) entire document	1-5
Y	US 2013/0280408 A1 (INTERCONTINENTAL GREAT BRANDS LLC) 24 October 2013 (24.10.2013) entire document	1-5

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

* Special categories of cited documents:

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"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search

21 April 2016

Date of mailing of the international search report

23 MAY 2016

Name and mailing address of the ISA/

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