

**CHEWING GUM AND BUBBLE GUM: THE WONDERS OF GUM BASE****Neha A. Bhatt, Hinal S. Mehta and Prof. Dr. Dhrubo Jyoti Sen***

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ABSTRACT

Gum base gives chewing gum its “chew.” It is made of a combination of food-grade polymers, waxes, and softeners that give it the texture desired by consumers and enable it to effectively deliver sweetness, flavour and various other benefits, including dental benefits. Gum Base is a non-nutritive masticatory substance (US FDA, “Code of Federal Regulation”). It is an inert and insoluble non-nutritive product used as a support for the edible and soluble portion of the chewing gum (sugar, glucose, polyols and flavours). The general description “Gum Base”, used on chewing gum products throughout the world, is recognized by The Food Chemicals Codex and most national legislation. Gum Base is produced through a blend of raw materials which can be categorized in five classes: 1. Elastomers act as the key ingredient and provide elasticity. 2. Resins act as binders and softeners. 3. Plasticizers render the elastomer soft to ensure thorough blending of the gum base. 4. Fillers contribute to the overall texture. 5. Antioxidants prevent oxidation of the gum base and flavors during shelf life. Chewing Gum Applications: The ingredients of a chewing

gum or a bubble gum can be divided into soluble and insoluble parts. The insoluble components are the gum base and a portion of the flavoring material; all other ingredients - like some of the flavors, sugar, glucose syrup, or polyols and intensive sweeteners in sugar-free products - are water soluble. Gum Base delivers a variety of gum bases that match the solution to customer requirements with regard to quality and price. A wide selection of gum bases is available. They can be combined with acid or non acid flavoring, sugar or sugar substitutes as well as vitamins or active ingredient in functional and pharmaceutical

products. Products can be made in various formats depending on the available process technology.

KEYWORDS: Elastomers, Resins, Plasticizers, Waxes, Fats, Emulsifiers, Fillers, Antioxidants, Gum base, Bezoar.

INTRODUCTION

Gum base is the non-nutritive, non-digestible, water-insoluble masticatory delivery system used to carry sweeteners, flavors and any other substances in chewing gum and bubble gum. It provides all the basic textural and masticatory properties of gum. Gum bases for chewing gum are different from those for bubble gum. A bubble gum base is formulated with the ability to blow bubbles; it contains higher levels of elastomers or higher molecular weight polymers for this purpose. Gum bases for non-acid flavored gum use calcium carbonate as a filler, while gum bases for acid flavored gum use talc as a filler, since acids can react with calcium carbonate to produce a gas, polyvinyl acetate (carpenter's glue), which is undesirable. Bubble gum usually contains 15-20% gum base, while chewing gum contains 20-25% gum base and sugar-free chewing gum contains 25-30% gum base. The possibility of making gum base with biodegradable zein (corn protein) is now under pipeline research. Zein is a class of prolamine protein found in maize (corn). It is usually manufactured as a powder from corn gluten meal. Zein is one of the best understood plant proteins. Pure zein is clear, odorless, tasteless, hard, water-insoluble, and edible, and it has a variety of industrial and food uses. Prolamins are a group of plant storage proteins having a high proline content and found in the seeds of cereal grains: wheat (gliadin), barley (hordein), rye (secalin), corn (zein), sorghum (kafirin) and as a minor protein, avenin in oats. They are characterised by a high glutamine and proline content and are generally soluble only in strong alcohol solutions. Some prolamins, notably gliadin, and similar proteins found in the tribe Triticeae (Triticeae glutens) may induce coeliac disease in genetically predisposed individuals. Large chewing gum manufacturers generally produce their own gum base in-house while small chewing gum producers usually buy gum base from third-party suppliers.^[1]

The composition of gum bases is usually of ingredients from the following categories

Elastomers: provide the elasticity or bounce and can be natural latexes (e.g. *Couma macrocarpa* (also called leche caspi or sorva), loquat (also called nispero), tunu, jelutong, or chicle which is still commercially produced), or synthetic rubbers (e.g. styrene-butadiene rubber, butyl rubber, polyisobutylene). An elastomer is a polymer with viscoelasticity (having

both viscosity and elasticity) and very weak inter-molecular forces, generally having low Young's modulus and high failure strain compared with other materials. The term, which is derived from *elastic polymer*, is often used interchangeably with the term rubber, although the latter is preferred when referring to vulcanisates. Each of the monomers which link to form the polymer is usually made of carbon, hydrogen, oxygen or silicon.



Figure-1: Chewing gum & Bubble gum

Elastomers are amorphous polymers existing above their glass transition temperature, so that considerable segmental motion is possible. At ambient temperatures, rubbers are thus relatively soft ($E \sim 3\text{MPa}$) and deformable. Their primary uses are for seals, adhesives and molded flexible parts. Application areas for different types of rubber are manifold and cover segments as diverse as tires, shoe soles as well as dampening and insulating elements.

Unsaturated rubbers that can be cured by sulfur vulcanization

Natural polyisoprene: *cis*-1,4-polyisoprene natural rubber and *trans*-1,4-polyisoprene (gutta-percha), Synthetic polyisoprene, Polybutadiene, Chloropene rubber, polychloroprene, Neoprene, Baypren etc, Butyl rubber (copolymer of isobutylene and isoprene) Halogenated butyl rubbers (chloro butyl rubber: CIIR; bromo butyl rubber: BIIR), Styrene-butadiene Rubber (copolymer of styrene and butadiene), Nitrile rubber (copolymer of butadiene and acrylonitrile), also called Buna N rubbers Hydrogenated Nitrile Rubbers, Therban and Zetpol.

Saturated rubbers that cannot be cured by sulfur vulcanization

EPM (ethylene propylene rubber, a copolymer of ethylene and propylene) and EPDM rubber (ethylene propylene diene rubber, a terpolymer of ethylene, propylene and a diene-component), Epichlorohydrin rubber, Polyacrylic rubber, Silicone rubber, Fluorosilicone Rubber, Fluoroelastomers, Viton, Tecnoflon, Fluorel, Aflas and Dai-El, Perfluoroelastomers, Tecnoflon PFR, Kalrez, Chemraz, Perlast, Polyether block amides, Chlorosulfonated polyethylene, Ethylene-vinyl acetate.

Resins: provide a cohesive body or strength and are most often glycerol esters of gum, terpene resins and/or polyvinyl acetate. Resin, in the most specific meaning of the term, is a hydrocarbon secretion of many plants, particularly coniferous trees. It is distinct from other liquid compounds found inside plants or exuded by plants, such as sap, latex, or mucilage. More broadly, the term "resin" is also used for many thick liquids, some of them artificial polymer bases (synthetic resins), that during normal use, harden into transparent or opaque solids.

Natural plant resins (the subject of this article) are valued for their chemical properties and associated uses, such as the production of varnishes, adhesives and food glazing agents. They are also prized as an important source of raw materials for organic synthesis, and provide constituents of incense and perfume. These were highly prized substances, and required as incense in some religious rites. Amber is a hard fossilized resin from ancient trees. The word *resin* comes from French *resine*, from Latin *resina* "resin", which either derives from or is a cognate of the Greek ῥητίνη *rhētīnē* "resin of the pine", of unknown earlier origin, though probably non-Indo-European. Other liquid compounds found inside plants or exuded by plants, such as sap, latex, or mucilage, are sometimes confused with resin, but are not chemically the same. Saps, in particular, serve a nutritive function that resins do not. There is no consensus on why plants secrete resins. However, resins consist primarily of secondary metabolites or compounds that apparently play no role in the primary physiology of a plant. While some scientists view resins only as waste products, their protective benefits to the plant are widely documented. The toxic resinous compounds may confound a wide range of herbivores, insects and pathogens; while the volatile phenolic compounds may attract benefactors such as parasitoids or predators of the herbivores that attack the plant.^[2]

The word "resin" has been applied in the modern world to nearly any component of a liquid that will set into a hard lacquer or enamel-like finish. An example is nail polish, a modern product which contains "resins" that are organic compounds, but not classical plant resins. Certain "casting resins" and synthetic resins (such as epoxy resin) have also been given the name "resin" because they solidify in the same way as some plant resins, but synthetic resins are liquid monomers of thermosetting plastics, and do not derive from plants.

The resin produced by most plants is a viscous liquid, composed mainly of volatile fluid terpenes, with lesser components of dissolved non-volatile solids which make resin thick and sticky. The most common terpenes in resin are the bicyclic terpenes α -pinene, β -pinene, δ -3

carene and sabinene, the monocyclic terpenes limonene and terpinolene, and smaller amounts of the tricyclic sesquiterpenes, longifolene, caryophyllene and δ -cadinene. Some resins also contain a high proportion of resin acids. The individual components of resin can be separated by fractional distillation.

A few plants produce resins with different compositions, most notably Jeffrey Pine and Gray Pine, the volatile components of which are largely pure *n*-heptane with little or no terpenes. The exceptional purity of the *n*-heptane distilled from Jeffrey Pine resin, unmixed with other isomers of heptane, led to its being used as the defining zero point on the octane rating scale of petrol quality. Because heptane is highly flammable, distillation of resins containing it is very dangerous. Some resin distilleries in California exploded because they mistook Jeffrey Pine for the similar but terpene-producing Ponderosa Pine. Some resins when soft are known as 'oleoresins', and when containing benzoic acid or cinnamic acid they are called balsams. Oleoresins are naturally occurring mixtures of oil and a resin; they can be extracted from various plants. Other resinous products in their natural condition are a mix with gum or mucilaginous substances and known as gum resins. Many compound resins have distinct and characteristic odors, from their admixture with essential oils.

Certain resins are obtained in a fossilized condition, amber being the most notable instance of this class; African solidified resin from which the volatile terpene components have been removed by distillation is known as rosin. Typical rosin is a transparent or translucent mass, with a vitreous fracture and a faintly yellow or brown colour, non-odorous or having only a slight turpentine odor and taste.

Rosin is insoluble in water, mostly soluble in alcohol, essential oils, ether and hot fatty oils, and softens and melts under the influence of heat, is not capable of sublimation, and burns with a bright but smoky flame. This comprises a complex mixture of different substances including organic acids named the resin acids. These are closely related to the terpenes, and derive from them through partial oxidation. Resin acids can be dissolved in alkalis to form resin soaps, from which the purified resin acids are regenerated by treatment with acids. Examples of resin acids are abietic acid (sylvic acid), $C_{20}H_{30}O_2$, plicatic acid contained in cedar and pimaric acid, $C_{20}H_{30}O_2$, a constituent of galipot resin. Abietic acid can also be extracted from rosin by means of hot alcohol; it crystallizes in leaflets, and on oxidation yields trimellitic acid, isophthalic acid and terebic acid. Pimaric acid closely resembles abietic acid into which it passes when distilled in a vacuum; it has been supposed to consist

of three isomers. Opal and the kauri gum of New Zealand are also procured in a semi-fossil condition.

Synthetic resins are materials with a property of interest that is similar to natural plant resins: they are viscous liquids that are capable of hardening permanently. Otherwise, chemically they are very different from the various resinous compounds secreted by plants (see resin for discussion of the natural products). The synthetics are of several classes. Some are manufactured by esterification or soaping of organic compounds. Some are thermosetting plastics in which the term "resin" is loosely applied to the reactant or product, or both. "Resin" may be applied to one of two monomers in a copolymer (the other being called a "hardener", as in epoxy resins). For those thermosetting plastics which require only one monomer, the monomer compound is the "resin." For example, liquid methyl methacrylate is often called the "resin" or "casting resin" while it is in the liquid state, before it polymerizes and "sets." After setting, the resulting PMMA is often renamed acrylic glass, or "acrylic." (This is the same material called Plexiglas and Lucite). The classic variety is epoxy resin, manufactured through polymerization-polyaddition or polycondensation reactions, used as a thermoset polymer for adhesives and composites. Epoxy resin is two times stronger than concrete, seamless and waterproof. Synthetic casting "resin" for embedding display objects in Plexiglas/Lucite (PMMA) is simply methyl methacrylate liquid, into which a polymerization catalyst is added and mixed, causing it to "set" (polymerize). The polymerization creates a block of PMMA plastic ("acrylic glass") which holds the display object in a transparent block. Another synthetic polymer sometimes called by the same general category, is acetal resin. By contrast with the other synthetics, however, it has a simple chain structure with the repeat unit of form $-\text{[CH}_2\text{O]}-$. Ion exchange resins are used in water purification and catalysis of organic reactions. See also AT-10 resin, melamine resin. Certain ion exchange resins are also used pharmaceutically as bile acid sequestrants, mainly as hypolipidemic agents, although they may be used for purposes other than lowering cholesterol. Solvent Impregnated Resins (SIRs) are porous resin particles, which contain an additional liquid extractant inside the porous matrix. The contained extractant is supposed to enhance the capacity of the resin particles. A large category of resins, which constitutes 75% of resins used, is the unsaturated polyester resins.^[3]

Waxes: act as softening agents and are most usually paraffin or microcrystalline wax. Waxes are a class of chemical compounds that are plastic (malleable) near ambient temperatures.

They are also a type of lipid. Characteristically, they melt above 45°C (113°F) to give a low viscosity liquid. Waxes are insoluble in water but soluble in organic, nonpolar solvents. All waxes are organic compounds, both synthetic and naturally occurring. Waxes are organic compounds that characteristically consist of long alkyl chains. Natural waxes may contain esters of carboxylic acids and long chain alcohols or mixtures of substituted hydrocarbons, such as long chain fatty acids and primary alcohols. Synthetic waxes are long-chain hydrocarbons lacking functional groups.

Plant and animal waxes: Waxes are synthesized by many plants and animals. Those of animal origin typically consist of wax esters derived from a variety of carboxylic acids and fatty alcohols. In waxes of plant origin characteristic mixtures of un-esterified hydrocarbons may predominate over esters. The composition depends not only on species, but also on geographic location of the organism. Because they are mixtures, naturally produced waxes are softer and melt at lower temperatures than the pure components.

Animal waxes: The most commonly known animal wax is beeswax, but other insects secrete waxes. A major component of the beeswax used in constructing honeycombs is the ester myricyl palmitate which is an ester of triacontanol and palmitic acid. Its melting point is 62-65°C. Spermaceti occurs in large amounts in the head oil of the sperm whale. One of its main constituents is cetyl palmitate, another ester of a fatty acid and a fatty alcohol. Lanolin is a wax obtained from wool, consisting of esters of sterols.

Plant waxes: Plants secrete waxes into and on the surface of their cuticles as a way to control evaporation, wettability and hydration. The epicuticular waxes of plants are mixtures of substituted long-chain aliphatic hydrocarbons, containing alkanes, alkyl esters, fatty acids, primary and secondary alcohols, diols, ketones, aldehydes. From the commercial perspective, the most important plant wax is Carnauba wax, a hard wax obtained from the Brazilian palm *Copernicia prunifera*. Containing the ester myricyl cerotate, it has many applications, such as confectionery and other food coatings, car and furniture polish, floss coating, surfboard wax, and other uses. Other more specialized vegetable waxes include candelilla wax and ouricury wax.

Petroleum derived waxes: Although many natural waxes contain esters, paraffin waxes are hydrocarbons, mixtures of alkanes usually in a homologous series of chain lengths. These materials represent a significant fraction of petroleum. They are refined by vacuum

distillation. Paraffin waxes are mixtures of saturated n- and iso- alkanes, naphthenes and alkyl- and naphthene-substituted aromatic compounds. The degree of branching has an important influence on the properties. Millions of tons of paraffin waxes are produced annually. They are used in foods (such as chewing gum and cheese wrapping), in candles and cosmetics, as non-stick and waterproofing coatings and in polishes.

Montan wax: Montan wax is a fossilized wax extracted from coal and lignite. It is very hard, reflecting the high concentration of saturated fatty acids and alcohols. Although dark brown and smelly, they can be purified and bleached to give commercially useful products.

Polyethylene and related derivatives: Some waxes are obtained by cracking polyethylene at 400°C. The products have the formula $(CH_2)_nH_2$, where n ranges between about 50 and 100. Waxes are mainly consumed industrially as components of complex formulations, often for coatings. The main use of polyethylene and polypropylene waxes is in the formulation of colourants for plastics. Waxes confer matting effects and wear resistance to paints. Polyethylene waxes are incorporated into inks in the form of dispersions to decrease friction. They are employed as release agents. They are also used as slip agents, e.g. in furniture, and corrosion resistance.^[4]

Candles: Waxes and hard fats such as tallow are used to make candles, used for lighting and decoration.

Wood products: Waxes are used as finishes and coatings for wood products. Beeswax is frequently used as a lubricant on drawer slides where wood to wood contact occurs.

Animal waxes: Beeswax - produced by honey bees, Chinese wax - produced by the scale insect *Ceroplastes ceriferus*, Lanolin (wool wax) - from the sebaceous glands of sheep, Shellac wax - from the lac insect *Kerria lacca*, Spermaceti - from the head cavities and blubber of the sperm whale.

Vegetable waxes: Bayberry wax - from the surface wax of the fruits of the bayberry shrub, *Myrica faya*, Candelilla wax - from the Mexican shrubs *Euphorbia cerifera* and *Euphorbia antisyphilitica*, Carnauba wax - from the leaves of the Carnauba palm, *Copernica cerifera*, Castor wax - catalytically hydrogenated castor oil, Esparto wax - a byproduct of making paper from esparto grass, (*Macrochloa tenacissima*), Japan wax - a vegetable triglyceride (not a true wax), from the berries of *Rhus* and *Toxicodendron* species, Jojoba oil - a

replacement for spermaceti, jojoba is pressed from the seeds of the jojoba bush, *Simmondsia chinensis*, Ouricury wax - from the Brazilian feather palm, *Syagrus coronata*, Rice bran wax - obtained from rice bran (*Oryza sativa*), Soy wax - from soybean oil, Tallow Tree wax - from the seeds of the tallow tree *Triadica sebifera*.

Mineral waxes: Ceresin waxes, Montan wax - extracted from lignite and brown coal, Ozocerite - found in lignite beds, Peat waxes.

Petroleum waxes: Paraffin wax - made of long-chain alkane hydrocarbons, Microcrystalline wax - with very fine crystalline structure, Petroleum jelly.

Synthetic waxes: Polyethylene waxes - based on polyethylene, Fischer-Tropsch waxes, Chemically modified waxes - usually esterified or saponified, substituted amide waxes, polymerized α -olefins.

Fats: behave as plasticizers and mainly come from hydrogenated vegetable oils. Fat is one of the three main macronutrients: **fat, carbohydrate and protein**. Fats are a wide group of compounds whose basis is in long-chain organic acids, called fatty acids. More particularly fats are esters of such organic acids formed with the alcohol glycerol. Glycerol is a triol, meaning that it has three chemically active -OH (hydroxyl) groups. Fats are made when each of these three -OH groups reacts with a fatty acid. The resulting fats are called triglycerides. Because of their preponderant aliphatic structure, fats are hydrophobic, generally soluble in organic solvents but generally insoluble in water. Fats made up of shorter chain fatty acids are usually liquid at room temperature, whereas the longer chain fats will be solid. Some ambiguity in terminology arises because the words "oil", "fat", and "lipid" are often used interchangeably. Of these lipid is the general term, because a lipid is not necessarily a triglyceride. Oil is the term usually used to refer to fats that are liquids at normal room temperature, while fat is usually used to refer to fats that are solids at normal room temperature. Fat is important foodstuff for many forms of life and fats serve both structural and metabolic functions. They are necessary part of the diet of most heterotrophs (including humans). Some fatty acids that are set free by the digestion of fats are called essential because they cannot be synthesized in the body from simpler constituents. There are two essential fatty acids (EFAs) in human nutrition: α -linolenic acid (an ω -3 fatty acid) and linoleic acid (an ω -6 fatty acid). Other lipids needed by the body can be synthesized from these and other fats. Fats and other lipids are broken down in the body by enzymes called

lipases produced in the pancreas. Fats and oils are categorized according to the number and bonding of the carbon atoms in the aliphatic chain. Fats that are saturated fats have no double bonds between the carbons in the chain. Unsaturated fats have one or more double bonded carbons in the chain. The nomenclature is based on the non-acid (non-carbonyl) end of the chain. This end is called the omega end or the n-end. Thus α -linolenic acid is called an ω -3 fatty acid because the 3rd carbon from that end is the first double bonded carbon in the chain counting from that end. Some oils and fats have multiple double bonds and are therefore called polyunsaturated fats. Unsaturated fats can be further divided into *cis* fats, which are the most common in nature and *trans* fats, which are rare in nature. Unsaturated fats can be altered by reaction with hydrogen effected by a catalyst. This action, called hydrogenation, tends to break all the double bonds and makes a fully saturated fat. To make vegetable shortening, then, liquid *cis*-unsaturated fats such as vegetable oils are hydrogenated to produce saturated fats, which have more desirable physical properties e.g., they melt at a desirable temperature (30–40°C), and store well, whereas polyunsaturated oils go rancid when they react with oxygen in the air. However, *trans* fats are generated during hydrogenation as contaminants created by an unwanted side reaction on the catalyst during partial hydrogenation. Consumption of such *trans* fats has shown to increase the risk of coronary heart disease. Saturated fats can stack themselves in a closely packed arrangement, so they can solidify easily and are typically solid at room temperature. For example, animal fats tallow and lard are high in saturated fatty acid content and are solids. Olive and linseed oils on the other hand are unsaturated and liquid. Fats serve both as energy sources for the body and as stores for energy in excess of what the body needs immediately. Each gram of fat when burned or metabolized releases about 9 food calories (37 kJ = 8.8 kcal). Fats are broken down in the healthy body to release their constituents, glycerol and fatty acids. Glycerol itself can be converted to glucose by the liver and so become a source of energy.^[5]

Table-1: Comparison between unsaturated & saturated fatty acids

Trans (Elaidic acid)	Cis (Oleic acid)	Saturated (Stearic acid)
Elaidic acid is the principal <i>trans</i> unsaturated fatty acid often found in partially hydrogenated vegetable oils.	Oleic acid is a <i>cis</i> unsaturated fatty acid making up 55–80% of olive oil.	Stearic acid is a saturated fatty acid found in animal fats and is the intended product in full hydrogenation. Stearic acid is neither <i>cis</i> nor <i>trans</i> because it has no carbon-carbon double bonds.

There are many different kinds of fats, but each is a variation on the same chemical structure. All fats are derivatives of fatty acids and glycerol. The fat molecules are called triglycerides (triesters of glycerol). Three chains of fatty acid are bonded to each of the three -OH groups of the glycerol by the reaction of the carboxyl end of the fatty acid (-COOH) with the alcohol. HOH (water) is eliminated and the carbons are linked by an -O- bond through dehydration synthesis. This process is called esterification and fats are therefore esters. As a simple visual illustration, if the kinks and angles of these chains were straightened out, the molecule would have the shape of a capital letter E. The fatty acids would each be a horizontal line; the glycerol "backbone" would be the vertical line that joins the horizontal lines. Fats therefore have "ester" bonds. The properties of any specific fat molecule depend on the particular fatty acids that constitute it. Fatty acids form a family of compounds are composed of increasing numbers of carbon atoms linked into a zig-zag chain (hydrogen atoms to the side). The more carbon atoms there are in any fatty acid, the longer its chain will be. Long chains are more susceptible to intermolecular forces of attraction (in this case, van der Waals forces), and so the longer ones melt at a higher temperature (melting point).

Fatty acid chains differ by length, often categorized as short to very long.

- Short-chain fatty acids (SCFA) are fatty acids with aliphatic tails of fewer than six carbons (i.e. butyric acid).
- Medium-chain fatty acids (MCFA) are fatty acids with aliphatic tails of 6–12 carbons, which can form medium-chain triglycerides.
- Long-chain fatty acids (LCFA) are fatty acids with aliphatic tails 13-21 carbons.
- Very long chain fatty acids (VLCFA) are fatty acids with aliphatic tails longer than 22 carbons

Any of these aliphatic fatty acid chains may be glycerated and the resultant fats may have tails of different lengths from very short triolein to very long, e.g., cerotic acid, or *hexacosanoic acid*, a 26-carbon long-chain saturated fatty acid. Long chain fats are exemplified by tallow (lard) whose chains are 17 carbons long. Most fats found in food, whether vegetable or animal, are made up of medium to long-chain fatty acids, usually of equal or nearly equal length. Many cell types can use either glucose or fatty acids for this energy. In particular, heart and skeletal muscle prefer fatty acids. Despite long-standing assertions to the contrary, fatty acids can also be used as a source of fuel for brain cells.

Importance for living organisms

Fats are also sources of essential fatty acids, an important dietary requirement. They provide energy as noted above. Vitamins A, D, E and K are fat-soluble, meaning they can only be digested, absorbed, and transported in conjunction with fats. Fats play a vital role in maintaining healthy skin and hair, insulating body organs against shock, maintaining body temperature, and promoting healthy cell function. Fat also serves as a useful buffer towards a host of diseases. When a particular substance, whether chemical or biotic, reaches unsafe levels in the bloodstream, the body can effectively dilute—or at least maintain equilibrium of—the offending substances by storing it in new fat tissue. This helps to protect vital organs, until such time as the offending substances can be metabolized and/or removed from the body by such means as excretion, urination, accidental or intentional bloodletting, sebum excretion, and hair growth.^[6]

Adipose tissue

The obese mouse on the left has large stores of adipose tissue. For comparison, a mouse with a normal amount of adipose tissue is shown on the right. In animals, adipose, or fatty tissue is the body's means of storing metabolic energy over extended periods of time. Adipocytes (fat cells) store fat derived from the diet and from liver metabolism. Under energy stress these cells may degrade their stored fat to supply fatty acids and also glycerol to the circulation. These metabolic activities are regulated by several hormones (e.g., insulin, glucagon and epinephrine). The location of the tissue determines its metabolic profile: visceral fat is located within the abdominal wall (i.e., beneath the wall of abdominal muscle) whereas "subcutaneous fat" is located beneath the skin (and includes fat that is located in the abdominal area beneath the skin but *above* the abdominal muscle wall). Visceral fat was recently discovered to be a significant producer of signaling chemicals (i.e., hormones), among which several are involved in inflammatory tissue responses. One of these is resistin which has been linked to obesity, insulin resistance, and Type 2 diabetes. This latter result is currently controversial, and there have been reputable studies supporting all sides on the issue.

Emulsifiers: help to hydrate, the most common being lecithin or glycerol monostearate. An emulsion is a mixture of two or more liquids that are normally immiscible (unmixable or unblendable). Emulsions are part of a more general class of two-phase systems of matter called colloids. Although the terms *colloid* and *emulsion* are sometimes used interchangeably,

emulsion should be used when both the dispersed and the continuous phase are liquids. In an emulsion, one liquid (the dispersed phase) is dispersed in the other (the continuous phase). Examples of emulsions include vinaigrettes, milk, mayonnaise, and some cutting fluids for metal working. The word "emulsion" comes from the Latin word for "to milk", as milk is an emulsion of fat and water, among other components. Two liquids can form different types of emulsions. As an example, oil and water can form, first, an oil-in-water emulsion, wherein the oil is the dispersed phase, and water is the dispersion medium. Second, they can form a water-in-oil emulsion, wherein water is the dispersed phase and oil is the external phase. Multiple emulsions are also possible, including a "water-in-oil-in-water" emulsion and an "oil-in-water-in-oil" emulsion. Emulsions, being liquids, do not exhibit a static internal structure. The droplets dispersed in the liquid matrix (called the "dispersion medium") are usually assumed to be statistically distributed. The term "emulsion" is also used to refer to the photo-sensitive side of photographic film. Such a photographic emulsion consist of silver halide colloidal particles dispersed in a gelatin matrix. Nuclear emulsions are similar to photographic emulsions, but used in particle physics to detect high-energy elementary particles. An emulsifier (also known as an "emulgent") is a substance that stabilizes an emulsion by increasing its kinetic stability. One class of emulsifiers is known as "surface active agents", or surfactants.

Examples of food emulsifiers are: Egg yolk – in which the main emulsifying agent is lecithin. In fact, *lecithos* is the Greek word for egg yolk, Mustard – where a variety of chemicals in the mucilage surrounding the seed hull act as emulsifiers, Soy lecithin is another emulsifier and thickener, Pickering stabilization – uses particles under certain circumstances, Sodium phosphates, Sodium stearyl lactylate, DATEM (Diacetyl Tartaric (Acid) Ester of Monoglyceride) – an emulsifier used primarily in baking. Detergents are another class of surfactants and will physically interact with both oil and water, thus stabilizing the interface between the oil and water droplets in suspension. This principle is exploited in soap, to remove grease for the purpose of cleaning. Many different emulsifiers are used in pharmacy to prepare emulsions such as creams and lotions. Common examples include emulsifying wax, cetaryl alcohol, polysorbate 20, and cetareth 20. Sometimes the inner phase itself can act as an emulsifier, and the result is a **nanoemulsion**, where the inner state disperses into "nano-size" droplets within the outer phase. A well-known example of this phenomenon, the "Ouzo effect", happens when water is poured into a strong alcoholic anise-based beverage, such as ouzo, pastis, arak, or raki. The anisolic compounds, which are soluble in ethanol, then

form nano-size droplets and emulsify within the water. The resulting color of the drink is opaque and milky white.^[7]

A number of different chemical and physical processes and mechanisms can be involved in the process of emulsification

- Surface tension theory – according to this theory, emulsification takes place by reduction of interfacial tension between two phases
- Repulsion theory – the emulsifying agent creates a film over one phase that forms globules, which repel each other. This repulsive force causes them to remain suspended in the dispersion medium
- Viscosity modification – emulgents like acacia and tragacanth, which are hydrocolloids, as well as PEG (or polyethylene glycol), glycerine, and other polymers like CMC (carboxymethyl cellulose), all increase the viscosity of the medium, which helps create and maintain the suspension of globules of dispersed phase.

Fillers: impart texture and the most commonly used are calcium carbonate or talc. Fillers are particles added to material (plastics, composite material, concrete) to lower the consumption of more expensive binder material or to better some properties of the mixtured material. Worldwide more than 53 million tons of fillers with a total sum of approximately EUR16 billion are used every year in different application areas, such as paper, plastics, rubber, paints, coatings, adhesives and sealants. As such, fillers, produced by more than 700 companies, rank among the world's major raw materials and are contained in a variety of goods for daily consumer needs. Formerly, fillers were used predominantly to cheapen end products, in which case they are called extenders. Among the 21 most important fillers, calcium carbonate holds the largest market volume and is mainly used in the plastics sector. While the plastic industry mostly consumes ground calcium carbonate the paper industry primarily uses precipitated calcium carbonate that is derived from natural minerals. Wood flour and saw dust are used as filler in thermosetting plastic. In some cases, fillers also enhance properties of the products, e.g. in composites. In such cases, a beneficial chemical interaction develops between the host material and the filler. As a result, a number of optimized types of fillers, nano-fillers or surface treated goods have been developed.

Antioxidants: protect from oxidation and extend shelf-life; the most common type is BHT. An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction involving the loss of electrons or an increase in oxidation state. Oxidation

reactions can produce free radicals. In turn, these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cell. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. They do this by being oxidized themselves, so antioxidants are often reducing agents such as thiols, ascorbic acid (vitamin C), or polyphenols.

- Substituted phenols and derivatives of phenylene diamine are common antioxidants used to inhibit gum formation in gasoline (petrol).
- Although oxidation reactions are crucial for life, they can also be damaging; plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, vitamin A, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidases. Insufficient levels of antioxidants, or inhibition of the antioxidant enzymes, cause oxidative stress and may damage or kill cells. Oxidative stress is damage to cell structure and cell function by overly reactive oxygen-containing molecules and chronic excessive inflammation. Oxidative stress seems to play a significant role in many human diseases, including cancers. The use of antioxidants in pharmacology is intensively studied, particularly as treatments for stroke and neurodegenerative diseases. For these reasons, oxidative stress can be considered to be both the cause and the consequence of some diseases.
- Antioxidants are widely used in dietary supplements and have been investigated for the prevention of diseases such as cancer, coronary heart disease and even altitude sickness. Although initial studies suggested that antioxidant supplements might promote health, later large clinical trials of antioxidant supplements including β -carotene, vitamin A, and vitamin E singly or in different combinations suggest that supplementation has no effect on mortality or possibly increases it. Randomized clinical trials of antioxidants including beta carotene, vitamin E, vitamin C and selenium have shown no effect on cancer risk or have increased cancer risk associated with supplementation. Supplementation with selenium or vitamin E does not reduce the risk of cardiovascular disease.
- Antioxidants also have many industrial uses, such as preservatives in food and cosmetics and to prevent the degradation of rubber and gasoline.

Old gum bases were based on either natural elastomers such as latexes, vegetable gums like chicle, spruce gum, and mastic gum, or alternatively on waxes, e.g. paraffin wax and beeswax, but today synthetic rubbers are preferred.^[8]

Chewing gum is a soft, cohesive substance intended for chewing but not swallowing. Humans have used chewing gum for at least 3,000 years. Modern chewing gum was originally made of chicle, a natural latex. By the 1960s, chicle was replaced by butadiene-based synthetic rubber which is cheaper to manufacture. Most chewing gums are considered polymers. The tar from which the gums were made is believed to have antiseptic properties and other medicinal advantages. The ancient Aztecs used chicle as a base for making a gum-like substance and to stick objects together in everyday use.

Forms of chewing gums were also chewed in Ancient Greece. The Ancient Greeks chewed mastic gum, made from the resin of the mastic tree. Many other cultures have chewed gum-like substances made from plants, grasses and resins. The American Indians chewed resin made from the sap of spruce trees. Modern chewing gum was first developed in the 1860s when chicle was brought from Mexico by the former President, General Antonio Lopez de Santa Anna, to New York, where he gave it to Thomas Adams for use as a rubber substitute. Chicle did not succeed as a replacement for rubber, but as a gum, which was cut into strips and marketed as Adams New York Chewing Gum in 1871. Black Jack (1884) and Chiclets (1899), it soon dominated the market. Synthetic gums were first introduced to the U.S. after chicle no longer satisfied the needs of making good chewing gum. The hydrocarbon polymers approved to be in chewing gum are styrene-butadiene rubber, isobutylene, isoprene copolymer, paraffin wax and petroleum wax.

Brain function

A review about the cognitive advantages of chewing gum by Onyper et al. (2011) found strong evidence of improvement for the following cognitive domains: Working memory, episodic memory and perceptual speed of processing. However the improvements were only evident when chewing took place prior to cognitive testing. The precise mechanism by which gum chewing improves cognitive functioning is however not well understood. The researchers did also note that chewing-induced arousal could be masked by the distracting nature of chewing itself, which they named "dual-process theory", which in turn could explain some of the contradictory findings by previous studies. They also noticed the similarity between mild physical exercise such as pedaling a stationary bike and chewing gum. It has been demonstrated that mild physical exercise leads to little cognitive impairment during the physical task accompanied by enhanced cognitive functioning afterwards. Furthermore the researchers noted that no improvement could be found for verbal fluency,

which is in accordance with previous studies. This finding suggests that the effect of chewing gum is domain specific. The cognitive improvements after a period of chewing gum have been demonstrated to last for 15-20 minutes and decline afterwards.

Sugar-free gum sweetened with xylitol has been shown to reduce cavities and plaque. The sweetener sorbitol has the same benefit, but is only about one-third as effective as xylitol. Other sugar substitutes, such as maltitol, aspartame and acesulfam, have also been found to not cause tooth decay. Xylitol is specific in its inhibition of *Streptococcus mutans*, bacteria that are significant contributors to tooth decay. Xylitol inhibits *Streptococcus mutans* in the presence of other sugars, with the exception of fructose. Xylitol is a safe sweetener that benefits teeth and saliva production because it is not fermented to acid like most sugars. Daily doses of xylitol below 3.44 grams are ineffective and doses above 10.32 grams show no additional benefit. Other active ingredients in chewing gum include fluoride, which strengthens tooth enamel and p-chlorbenzyl-4-methylbenzylpiperazine, which prevents travel sickness. Chewing gum also increases saliva production. Food and sucrose have a demineralizing effect upon enamel that has been reduced by adding calcium lactate to food. Calcium lactate added to toothpaste has reduced calculus formation. One study has shown that calcium lactate enhances enamel remineralization when added to xylitol-containing gum, but another study showed no additional remineralization benefit from calcium lactate or other calcium compounds in chewing-gum. Other studies indicated that the caries preventive effect of chewing sugar-free gum is related to the chewing process itself rather than being an effect of gum sweeteners or additives, such as polyols and carbamide.

A helpful way to cure halitosis (bad breath) is to chew gum. Chewing gum not only helps to add freshness to breath but can aid in removing food particles and bacteria associated with bad breath from teeth. It does this by stimulating saliva, which essentially washes out the mouth. Chewing sugar-free gum for 20 minutes after a meal helps prevent tooth decay, according to the American Dental Association, because the act of chewing the sugar-free gum produces saliva to wash away bacteria, which protects teeth. Chewing gum after a meal replaces brushing and flossing, if that's not possible, to prevent tooth decay and increase saliva production. Chewing gum can also help with the lack of saliva or xerostomia since it naturally stimulates saliva production.^[9] Saliva is made of chemicals, such as organic molecules, inorganic ions and macromolecules. 0.5% of saliva deals with dental health, since tooth enamel is made of calcium phosphate; that inorganic ion in saliva help repair the teeth

and keeps them in good condition. The pH of saliva is neutral, which having a pH of 7 allows it to remineralize tooth enamel. Falling below a pH of 5.5 (which is acidic) causes the saliva to demineralize the teeth.

The effects of chewing gum after meals following an orthodontic procedure, to see if chewing exercises caused subjects pain or discomfort, or helped maintain a large occlusal contact area. 35 adult volunteers chewed gum for 10-15 minutes before or after three meals each day for 4 weeks. 90% of those questioned said that the gum felt "quite hard" and half reported no discomfort. Several randomized controlled studies have investigated the use of chewing gum in reducing the duration of post-operative ileus following abdominal and specifically gastrointestinal surgery. A systematic review of these suggests gum chewing, as a form of "sham feeding", is a useful treatment therapy in open abdominal or pelvic surgery, although the benefit is less clear when laparoscopic surgical techniques are used.

Stomach

Chewing gum is used as a novel approach for the treatment of Gastro Oesophageal Reflux Disease (GORD). One hypothesis is that chewing gum stimulates the production of more bicarbonate-containing saliva and increases the rate of swallowing. After the saliva is swallowed, it neutralizes acid in the oesophagus. In effect, chewing gum exaggerates one of the normal processes that neutralize acid in the oesophagus. However, chewing gum is sometimes considered to contribute to the development of stomach ulcers. It stimulates the stomach to secrete acid and the pancreas to produce digestive enzymes that aren't required. In some cases, when consuming large quantities of gum containing sorbitol, gas and/or diarrhoea may occur.

Possible carcinogens

Concern has arisen about the possible carcinogenicity of the vinyl acetate (acetic acid ethenyl ester) used by some manufacturers in their gum bases. Currently, the ingredient can be hidden in the catch-all term "gum base". The Canadian government at one point classified the ingredient as a "potentially high hazard substance." However, on January 31, 2009, the Government of Canada's final assessment concluded that exposure to vinyl acetate is not considered to be harmful to human health. This decision under the Canadian Environmental Protection Act (CEPA) was based on new information received during the public comment period, as well as more recent information from the risk assessment conducted by the European Union.

Swallowed gum

Various myths hold that swallowed gum will remain in a human's stomach for up to 7 years, as it is not digestible. According to several medical opinions, there seems to be little truth behind the tale. In most cases, swallowed gum will pass through the system as quickly as any other food. There have been cases where swallowing gum has resulted in complications requiring medical attention. A 1998 paper describes a four-year-old boy being referred with a two-year history of constipation. The boy was found to have "always swallowed his gum after chewing five to seven pieces each day", being given the gum as a reward for good behaviour and the build-up resulted in a solid mass which could not leave the body. A 1½-year-old girl required medical attention when she swallowed her gum and four coins, which got stuck together in her oesophagus. Bezoars are formed in the stomach when food or other foreign objects stick to gum and build up, causing intestinal blockage. As long as the mass of gum is small enough to pass out of the stomach, it will likely pass out of the body easily, but it is recommended that gum not be swallowed or given to young children who do not understand not to. A bezoar is a mass found trapped in the gastrointestinal system (Gastrolith, usually in the stomach), though it can occur in other locations. A pseudobezoar is an indigestible object introduced intentionally into the digestive system. There are several varieties of bezoar, some of which have inorganic constituents and others organic. The term has both a modern (medical, scientific) and a traditional usage. Food bezoar (or boli; singular bolus) carry the archaic and positive meaning of bezoar, and are composed of loose aggregates of food items such as seeds, fruit pith, or pits, as well as other types of items such as shellac, bubble gum, soil, and concretions of some medications. Lactobezoars are a specific type of food bezoar comprising inspissated milk. It is most commonly seen in premature infants receiving formula foods. Pharmacobezoars (or medication bezoars) are mostly tablets or semiliquid masses of drugs, normally found following overdose of sustained-release medications. Phytobezoars are composed of indigestible plant material (e.g., cellulose) and are frequently reported in patients with impaired digestion and decreased gastric motility. Diospyrobezoar is type of phytobezoars formed from unripe persimmons. Coca-Cola has been used in the treatment. Trichobezoars are a bezoar formed from hair – an extreme form of hairball. Humans who frequently consume hair sometimes require these to be removed. The Rapunzel syndrome, a very rare and extreme case, may require surgery. Many schools do not allow chewing gum because students often dispose of it inappropriately, the chewing may be distracting in class and the gum might carry diseases or bacteria from other students. The Singapore government outlawed chewing gum in 1992 because it was becoming a danger

when it was wedged in the sliding doors of underground trains. However, in 2002 the government allowed sugarless gum to be sold in pharmacies if a doctor or dentist prescribed it.^[10] Chewing gum is not water soluble and unlike other confectionery is not fully consumed. There has been much effort at public education and investment aimed at encouraging responsible disposal. Despite this it is commonly found stuck underneath benches, tables, handrails and escalators. It is extremely difficult and expensive to remove once "walked in" and dried. Gum bonds strongly to asphalt and rubber shoe soles because they are all made from polymeric hydrocarbons. It also bonds strongly with concrete paving. Removal is generally achieved by steam jet and scraper but the process is slow and labour-intensive.



Figure-2: Bubble gum

Bubble gum is a type of chewing gum, designed to be inflated out of the mouth as a bubble. In 1928, Walter E. Diemer, an accountant for the Fleeer Chewing Gum Company in Philadelphia, was experimenting with new gum recipes. One recipe was found to be less sticky than regular chewing gum and stretched more easily. This gum became highly successful and was eventually named by the president of Fleeer as Dubble Bubble because of its stretchy texture. The original bubble gum was pink in color because that was the only dye. Diemer had on hand at the time and it was his favorite color. In modern chewing gum, if natural rubber such as chicle is used, it must pass several purity and cleanliness tests. However, most modern types of chewing gum use synthetic gum based materials. These materials allow for longer-lasting flavor, a better texture, and a reduction in tackiness. While chewing gum was widely popular from the mid 20th century until the 2000s, in the early

2010s it has seen a decline in sales, falling 11% in the United States between 2009 and 2013 after peaking in 2009. Reasons cited include more alternatives for fresh breath, a backlash against the mess gum makes and poor marketing choices by gum companies. Bubble gum is available in many colors and flavors. Although the exact ingredients were kept a mystery to customers, chemicals such as ethyl methylphenylglycidate, isoamyl acetate, fruit extracts and more give it its sweet flavor. When blended, the chemicals and extracts fuse to make a sweet, palatable flavor. Gums made with vanilla, coconut, peppermint and almond extracts are available.^[11]

Flavors include blue raspberry, lemon, strawberry, apple, cherry, watermelon, cinnamon, banana, peppermint, cotton candy and grape of which strawberry and banana can be achieved with ethyl methylphenylglycidate and isoamyl acetate, limonene, respectively. Malic acid can be used for apple flavor, allyl hexanoate for pineapple, ethyl propionate for fruit punch, cinnamic aldehyde for cinnamon and acetophenone for cherry. More unusual flavors such as berry, cola, lemon lime, peach, tropical fruit, pineapple, orange, or fruit punch can also be found, as well as novelty tastes such as bacon or popcorn. In taste tests, children tend to prefer strawberry and blue raspberry flavors, rejecting more complex flavors as they say these make them want to swallow the gum rather than continue chewing. The 26-inch bubble blown by Susan Montgomery Williams of Fresno, California in 1996 holds the Guinness World Record for largest bubblegum bubble. Chad Fell holds the record for "Largest Hands-free Bubblegum Bubble" at 50.8 centimetres (20.0 in), achieved on 24 April 2004.^[12]

This is a **list of chewing gum brands**. Chewing gum is a type of gum made for chewing, and dates back at least 5,000 years. Modern chewing gum was originally made of chicle, a natural latex. By the 1960s, chicle was replaced by butadiene-based synthetic rubber which is cheaper to manufacture. Most chewing gums are considered polymers. **Chicle** is a natural gum traditionally used in making chewing gum and other products. It is collected from several species of Mesoamerican trees in the *Manilkara* genus, including *M. zapota*, *M. chicle*, *M. staminodella*, and *M. bidentata*. The tapping of the gum is similar to the tapping of latex from the rubber tree: zig-zag gashes are made in the tree trunk and the dripping gum is collected in small bags. It is then boiled until it reaches the correct thickness. Locals who collect chicle are called *chicleros*. Historically, the Wrigley Company was a prominent user of this ingredient in the production of chewing gum. In response to a land reform law passed in Guatemala in 1952, which ended feudal work relations and expropriated unused lands and

sold them to the indigenous and peasants, the Wrigley Gum Company discontinued buying Guatemalan chicle. Since it was the sole buyer of Guatemalan chicle, the government was forced to create a massive aid program for growers. By the 1960s, most chewing gum companies had switched from using chicle to butadiene-based synthetic rubber which was cheaper to manufacture. The only U.S. gum companies still using chicle are Glee Gum, Simply Gum, and Tree Hugger Gum.^[13]

Table-2: List of chewing gum & brands

Name	Parent Company	Year Founded	Country of Origin
5	Wrigley	2007	USA
Airwaves	Wrigley		USA
BigBabol	Perfetti Van Melle		Italy
Bazooka	Brooklyn		USA
Beechies	Beech-Nut		USA
Big League Chew	Ford Gum	1980	USA
Big Red	Wrigley	1976	United Kingdom
Bubbaloo	Canderaria	1980s	
Talin Taparia	Gurgaon	2015	
Bubble Joe		2007	
Bubble Yum	Hershey	1975	USA
Bubblicious	Cadbury	1977	United Kingdom
Carmen	Seham Food Stuff Co.	1950	Syria
Chiclets	Cadbury	1906	United Kingdom
Chicza	Consortio Chiclero	2008	México
Cinnaburst	Cadbury		United Kingdom
Clorets	Cadbury	1951	United Kingdom
Dentyne	Cadbury	1899	United Kingdom
Dirol	Dandy	1968	Denmark
Donald Bubble Gum	Maple Leaf		Netherlands
Doublemint	Wrigley	1914	USA
Dubble Bubble	Concord Confections	1928	Canada
Eat it	Eat it, LLC		USA
Eclipse	Wrigley	1999	USA
Ello Gum	Ello Gum International	2011	USA
Europe Chewing Gum	Ayul Trading Incorporated		Canada
Excel	Wrigley	1991	USA
Exit	Unigum	2011	Turkey
Extra	Wrigley	1984	USA
Freedent	Wrigley	1975	USA
Freshen Up			USA
Fruit Stripe gum	Hershey	<i>early 1960s</i>	USA
Fusen gum	Marukawa		Japan
Glee Gum	Verve, Inc.	1995	USA
Gorila (bubble gum)	Lusiteca		Portugal
Hilal			Pakistan

Hoodia Gum			USA
Hubba Bubba	Wrigley	1979	USA
Ice Breakers	Hershey	1996	USA
Jenkki	Leaf	1951	Finland
Juicy Fruit	Wrigley	1893	Canada/USA
Kallas	Khayri Kallas	1955	Syria
Lotte			Japan
Love is...			Turkey
Maple Leaf Chewing gum	Maple Leaf	1948	Netherlands
Master			Lebanon
Mentos	Perfetti Van Melle	1948	Netherlands
Mintad			Syria
Neurogum	Neurogum LLC	2013	California, USA
Nicorette	McNeil AB	<i>late 1960s</i>	Sweden
Orbit	Wrigley	2001	USA
Peppersmith	Peppersmith	2009	United Kingdom
PÜR Gum	Action Candy Company	2010	Canada
Rasha			Syria
Razzles	Wrigley	1966	USA
Scottie Chew Crazy Long			USA
Seham	Seham Food Stuff Co.	1950	Syria
Simply Gum		2013	USA
Splot	Colombina	2000	Colombia
Sportlife	Cloetta	1981	Netherlands & Belgium
Spry	Xlear Inc.		USA
Stimorol	Dandy	1956	Denmark
Stride	Cadbury	2006	United Kingdom
Think Gum	Think Gum, LLC	2007	USA
Tidal Wave	Amurof Confections		USA
Trident	Kraft Foods	1964	United States
Turbo			
Vibe Energy Gum	Super Mouth Ltd		United Kingdom
Winterfresh	Wrigley	1994	USA
Wrigley's Spearmint	Wrigley	1893	USA
X-Time	Colombina	2000	Colombia
XyloBurst	Focus Nutrition		USA
Zapp Gum	Zapp Xylitol Gum Brands		USA
ZOFT Gum	ZOFT Gum Company	2006	USA

Overview

Gum base is the ingredient that distinguishes chewing and bubble gum from all other confectionery products. It is an insoluble and non-nutritive substance that enables a chewing gum to be chewed for hours without experiencing substantial changes. Gum base is made of food-grade polymers, plasticizers, softeners, texturizers and emulsifiers among other ingredients, which impart their unique properties to chewing gum. In order to be food-grade, the gum base has to comply with international requirements such as the FDA 21 CFR

172.615 and the Food Chemicals Codex Specifications. Every time developing a new gum base focussing on the physical properties that the chewing gum should have: elasticity, plasticity, hardness and the desired texture. Optimal performance in the production lines is important because of its impact on productivity. Originally, chewing gum was made from the latex sap of the sapodilla tree. This sap is called chicle. Other natural gum bases may be used, such as sorva and jelutong. Sometimes beeswax or paraffin wax is used as a gum base. After World War II, chemists learned to make synthetic rubber, which came to replace most natural rubber in chewing gum (e.g., polyethylene and polyvinyl acetate). In addition to the gum base, chewing gum contains sweeteners, flavorings, and softeners. Softeners are ingredients such as glycerin or vegetable oil that are used to blend the other ingredients and help prevent the gum from becoming hard or stiff. Neither natural nor synthetic latex are readily degraded by the digestive system. However, if you swallow your gum it will almost certainly be excreted, usually in pretty much the same condition as when you swallowed it. However, frequent gum swallowing may contribute to the formation of a bezoar or enterolith, which is a sort of intestinal stone.

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