

Ada-approved fluoride toothpaste



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Toothpaste is a paste or gel dentifrice used with a toothbrush as an accessory to clean and maintain the aesthetics and health of teeth.

Toothpaste is used to promote oral hygiene: it serves as an abrasive that aids in removing the dental plaque and food from the teeth, assists in suppressing halitosis, and delivers active ingredients (mainly fluoride) to help prevent tooth and gum disease (gingivitis). [1] Most of the cleaning is achieved by the mechanical action of the toothbrush, and not by the toothpaste.

Salt and sodium bicarbonate (baking soda) are among materials that can be substituted for commercial toothpaste. Toothpaste is not intended to be swallowed, but is generally not very harmful if accidentally swallowed in small amounts. Ingredients In addition to 20-42% water, toothpastes are derived from a variety of components, including three main ones: abrasives, fluoride, and detergents. Abrasives Abrasives constitute at least 50% of a typical toothpaste. These insoluble particles help remove plaque from the teeth.

The removal of plaque and calculus helps minimize cavities and periodontal disease. [citation needed] Representative abrasives include particles of aluminum hydroxide ($\text{Al}(\text{OH})_3$), calcium carbonate (CaCO_3), various calcium hydrogen phosphates, various silicas and zeolites, and hydroxyapatite ($\text{Ca}_5(\text{PO}_4)_3\text{OH}$). Abrasives, like the dental polishing agents used in dentists' offices, also cause a small amount of enamel erosion which is termed "polishing" action. Some brands contain powdered white mica, which acts as a mild abrasive, and also adds a cosmetically pleasing glittery shimmer to the paste.

The polishing of teeth removes stains from tooth surfaces, but has not been shown to improve dental health over and above the effects of the removal of plaque and calculus. [2] Fluorides Fluoride in various forms is the most popular active ingredient in toothpaste to prevent cavities. Fluoride occurs in small amounts in plants, animals, and some natural water sources. The additional fluoride in toothpaste has beneficial effects on the formation of dental enamel and bones. Sodium fluoride (NaF) is the most common source of fluoride, but stannous fluoride (SnF_2), stannous fluoride (an organic salt of fluoride), and sodium monofluorophosphate ($\text{Na}_2\text{PO}_3\text{F}$) are also used. Stannous fluoride has been shown to be more effective than sodium fluoride in reducing the incidence of dental caries [3] and controlling gingivitis. [4] Much of the toothpaste sold in the United States has 1000 to 1100 parts per million fluoride. In European countries, such as the UK or Greece, the fluoride content is often higher; a NaF of 0.312% w/w (1,450 ppm fluoride) is not uncommon.

Surfactants Many, although not all, toothpastes contain sodium lauryl sulfate (SLS) or related surfactants (detergents). SLS is found in many other personal care products, as well, such as shampoo, and is mainly a foaming agent, which enables uniform distribution of toothpaste, improving its cleansing power. [2] Other components Antibacterial agents Triclosan, an antibacterial agent, is a common toothpaste ingredient in the United Kingdom. Triclosan or zinc chloride prevent gingivitis and, according to the American Dental Association, helps reduce tartar and bad breath. [1][5] A 2006 review of clinical research concluded there was evidence for the effectiveness of 0.30% triclosan in reducing plaque and gingivitis. [6]

Flavorants Toothpaste comes in a variety of colors, and flavors intended to encourage use of the product. Three most common flavorants are peppermint, spearmint, and wintergreen. Toothpaste flavored with peppermint-anise oil is popular in the Mediterranean region. These flavors are provided by the respective oils, e. g. peppermint oil. [2] More exotic flavors include anise, apricot, bubblegum, cinnamon, fennel, lavender, neem, ginger, vanilla, lemon, orange, and pine.

More unusual flavors have been used, e. g. peanut butter, iced tea, and even whisky. Unflavored toothpastes exist. Remineralizers Hydroxyapatite nanocrystals and calcium phosphate are included in some formulations for remineralization,[7] i. e. the reformation of enamel. Miscellaneous components Agents are added to suppress the tendency of toothpaste to dry into a powder. Included are various sugar alcohols, such as glycerol, sorbitol, or xylitol, or related derivatives, such as 1, 2-propylene glycol and polyethyleneglycol. [8] Strontium chloride or potassium nitrate is included in some toothpastes to reduce sensitivity.

Sodium polyphosphate is added to minimize the formation of tartar. Safety Fluoride Although water fluoridation has been praised as one of the top medical achievements of the 20th century,[9] fluoride-containing toothpaste can be acutely toxic if swallowed in large amounts. [10][11] The risk of using fluoride is low enough that the use of 'full-strength' toothpaste (1350-1500ppm fluoride) is advised for all ages (although smaller volumes are used for young children; a 'smear' of toothpaste until three years old). [11] A major concern of dental fluorosis is for children under 12 months ingesting excessive fluoride through toothpaste.

Several non-fluoride toothpastes are available. Diethylene glycol The inclusion of sweet-tasting but toxic diethylene glycol in Chinese-made toothpaste led to a several nation, multiple brand toothpaste recall in 2007. [12] The world outcry made Chinese officials ban the practice of using diethylene glycol in toothpaste. [13] Miscellaneous issues and debates With the exception of toothpaste intended to be used on pets such as dogs and cats, and toothpaste used by astronauts, most toothpaste is not intended to be swallowed, and doing so may cause nausea or diarrhea. Tartar fighting' toothpastes have been debated. [14] Case reports of plasma cell gingivitis have been reported with the use of herbal toothpaste containing cinnamon. [15] SLS has been proposed to increase the frequency of mouth ulcers in some people, as it can dry out the protective layer of oral tissues, causing the underlying tissues to become damaged. [16] Alteration of taste perception After using toothpaste, orange juice and other juices have an unpleasant taste. This effect is attributed to products of the chemical reaction between stannous fluoride in toothpaste and the acetic acid in the juices. 17] Sodium lauryl sulfate alters taste perception. It can break down phospholipids that inhibit taste receptors for sweetness, giving food a bitter taste. In contrast, apples are known to taste more pleasant after using toothpaste. [18] Distinguishing between the hypotheses that the bitter taste of orange juice results from stannous fluoride or from sodium lauryl sulfate is still an unresolved issue and it is thought that the menthol added for flavor may also take part in the alteration of taste perception when binding to lingual cold receptors.

Other types of toothpaste
Whitening toothpastes
Many toothpastes make whitening claims. Some of these toothpastes contain peroxide, the same ingredient found in tooth bleaching gels. The abrasive in these toothpaste remove the stains, not the peroxide. [19] Whitening toothpaste cannot alter the natural color of teeth or reverse discoloration by penetrating surface stains or decay. To remove surface stains, whitening toothpaste may include abrasives to gently polish the teeth, and/or additives such as sodium tripolyphosphate to break down or dissolve stains.

When used twice a day, whitening toothpaste typically takes two to four weeks to make teeth appear more white. Whitening toothpaste is generally safe for daily use, but excessive use might damage tooth enamel. Teeth whitening gels represent an alternative. [20] Herbal and "natural" toothpastes
Many consumers have started to switch over to natural toothpastes to avoid synthetic and artificial flavors that are commonly found in regular toothpastes. [21] Due to the increased demand of natural products, most of the toothpaste manufacturers now produce herbal toothpastes.

This type of toothpaste does not contain dyes or artificial flavors. Many herbal toothpastes do not contain fluoride or sodium lauryl sulfate. The ingredients found in natural toothpastes vary widely but often include baking soda, aloe, eucalyptus oil, myrrh, plant extract (strawberry extract), and essential oils. In addition to the commercially available products, it is possible to make one's own toothpaste using similar ingredients.
History
Early toothpastes
The Greeks, and then the Romans, improved the recipes for toothpaste by adding abrasives such as crushed bones and oyster shells.

22] In the 9th century, the Persian musician and fashion designer Ziryab invented a type of toothpaste, which he popularized throughout Islamic Spain. [23] The exact ingredients of this toothpaste are unknown,[24] but it was reported to have been both " functional and pleasant to taste". [23] It is not known whether these early toothpastes were used alone, were to be rubbed onto the teeth with rags, or were to be used with early toothbrushes, such as neem-tree twigs and miswak. Toothpastes or powders came into general use in the 19th century. Tooth powder

Tooth powders for use with toothbrushes came into general use in the 19th century in Britain. Most were homemade, with chalk, pulverized brick, or salt as ingredients. A 1866 Home Encyclopedia recommended pulverized charcoal, and cautioned that many patented tooth powders that were commercially marketed did more harm than good. Arm & Hammer marketed a baking soda-based toothpowder in the United States until approximately 2000, and Colgate currently markets toothpowder in India and other countries. Modern toothpaste An 18th century American and British toothpaste recipe called for burnt bread.

Another formula around this time called for dragon's blood (a resin), cinnamon, and burnt alum. [25] By 1900, a paste made of hydrogen peroxide and baking soda was recommended for use with toothbrushes. Pre-mixed toothpastes were first marketed in the 19th century, but did not surpass the popularity of tooth-powder until World War I. In 1892, Doctor Washington Sheffield of London manufactured toothpaste into a collapsible tube, Dr. Sheffield's Creme Dentifrice. He had the idea after his son traveled to Paris and saw painters using paint from tubes.

In York in 1896, Colgate & Company Dental Cream was packaged in collapsible tubes imitating Sheffield. The original collapsible toothpaste tubes were made of lead. [26][27] Fluoride was first added to toothpastes in the 1890s. "Tanagra", containing calcium fluoride as the active ingredient, was sold by Karl F. Toellner Company, of Bremen, Germany, based upon the early work of chemist Albert Deninger. [28] An analogous invention by Roy Cross, of Kansas City, Mo. , was initially criticized by the American Dental Association (ADA) in 1937. Fluoride toothpastes developed in the 1950s received the ADA's approval.

To develop the first ADA-approved fluoride toothpaste, Procter & Gamble started a research program in the early 1940s. In 1950, Procter & Gamble developed a joint research project team headed by Dr. Joseph Muhler at Indiana University to study new toothpaste with fluoride. In 1955, Procter & Gamble's Crest launched its first clinically proven fluoride-containing toothpaste. On August 1, 1960, the ADA reported that "Crest has been shown to be an effective anticavity (decay preventative) dentifrice that can be of significant value when used in a conscientiously applied program of oral hygiene and regular professional care. The amount of fluoride in toothpastes varies from country to country. In 2006 BioRepair appeared in Europe with the first toothpaste containing synthetic hydroxylapatite as an alternative to fluoride for the remineralization and reparation of tooth enamel. The "biomimetic hydroxylapatite" is intended to protect the teeth by creating a new layer of synthetic enamel around the tooth instead of hardening the existing layer with fluoride that chemically changes it into

fluorapatite. [29] In June 2007, the US Food and Drug Administration and similar agencies in

Panama, Puerto Rico and Australia advised consumers to avoid certain brands of toothpaste manufactured in China after some were found to contain the poisonous diethylene glycol, also called diglycol or labeled as "DEG" on the tube. [30] Striped toothpaste Striped toothpaste was invented by a New Yorker named Leonard Lawrence Marraffino in 1955. The patent (US patent 2, 789, 731, issued 1957) was subsequently sold to Unilever, who marketed the novelty under the 'Stripe' brand-name in the early 1960s. This was followed by the introduction of the 'Signal' brand in Europe in 1965 (UK patent 813, 514).

Although 'Stripe' was initially very successful, it never again achieved the 8% market share that it cornered during its second year. Marraffino's design, which remains in use for single-color stripes, is simple. The main material, usually white, sits at the crimp end of the toothpaste tube and makes up most of its bulk. A thin pipe, through which that carrier material will flow, descends from the nozzle to it. The stripe-material (this was red in 'Stripe') fills the gap between the carrier material and the top of the tube. The two materials are not in separate compartments.

The two materials are sufficiently viscous that they will not mix. When pressure is applied to the toothpaste tube, the main material squeezes down the thin pipe to the nozzle. Simultaneously, the pressure applied to the main material causes pressure to be forwarded to the stripe material, which then issues out through small holes (in the side of the pipe) onto the main carrier material as it is passing those holes. In 1990 Colgate-Palmolive was granted

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a patent (USPTO 4, 969, 767) for two differently colored stripes. In this scheme, the inner pipe has a cone-shaped plastic guard around it, and about half way up its length.

Between the guard and the nozzle-end of the tube is then a space for the material for one color, which then issues out of holes in the pipe. On the other side of the guard is space for second stripe-material, which has its own set of holes. Striped toothpaste should not be confused with layered toothpaste. Layered toothpaste requires a multi-chamber design (e. g. USPTO 5, 020, 694), in which two or three layers then extrude out of the nozzle. This scheme, like that of pump dispensers (USPTO 4, 461, 403), is more complicated (and thus, more expensive to manufacture) than either the Marraffino design or the Colgate design.