



Chewing Gum

Grades: 3-5 and 6-8

Science Standards: Content Standard B: Physical Science; Content Standard G: History and Nature of Science

Background:

The Greeks chewed the resin from the mastic tree called *mastiche*. The Maya Indians of Mexico chewed *chicle* which is resin from the sapodilla tree. American Indians of New England chewed the sap from the spruce tree. A colonist, John Curtis, in 1848 manufactured "State of Maine Pure Spruce Gum". It was apparently not a very popular product because it tasted too much like spruce! Sweetened paraffin wax was his next product but it did not have the chewy nature of the spruce gum.

In December of 1869, William Finely Semple of Mount Vernon, Ohio applied for a patent for making chewing gum from rubber and "other articles". However, his product never entered the marketplace. In 1870, Thomas Adams, Sr. experimented with the sap from the Chiclezapote tree trying to make a rubber substitute. He never did find what he was looking for except he did accidentally discover that it was good to chew. By 1890, he had a factory in Staten Island, New York that employed 250 workers.

The chewing of gum became a huge craze. The New York Sun editorialized in 1890: "The habit has reached such a stage now that makes it impossible for a New Yorker to go to the theater or to church, or enter the street cars or the railway train, or walk on a fashionable promenade without meeting men and women whose jaws are working with the activity of the gum chewing victim. And the spectacle is maintained in the face of frequent reminders that gum-chewing, especially in public, is an essentially vulgar indulgence that not only shows bad breeding, but spoils a pretty continence and detracts from the dignity of those who practice the habit."

Bubble gum was first produced in 1906 by Frank Fler but it was not sold as a consumer product until 1928. Walter Diemer created the first bubble gum called "Blibber Blubber Bubble Gum". This was later changed to "Double Bubble Bubble Gum". The largest bubble ever blown with bubble gum was nearly two feet in diameter.

Chewing gum consists of a gum base, sugar, corn syrup, softeners, and flavorings. The gum base is the insoluble part left in the mouth while chewing. The gum base is made of resins from trees, latexes or the milky juices from plants, and manmade polymers. If the gum base is chicle from the sapodilla tree, this product is being harvested in Belize. Slashes are cut into the bark of the tree so that the sap runs down the tree into a collection bucket. Chicle is boiled over an open fire in the rainforest to evaporate some of the excess water. Once it is thick and taffy-looking, it is packed into wooded forms to make blocks. These blocks are

shipped to the American chewing gum manufacturers. The gum base could be made from styrene butadiene, poly(vinyl acetate) or polyethylene. The bubble gum base is firmer and more elastic than for regular chewing gum. The sugar is for sweetening the product. The corn syrup keeps the gum fresh and flexible. Softeners or fillers such as vegetable oils help to blend the ingredients and retain moisture. Sugarfree gum has sorbitol, mannitol, aspartame or saccharin instead of sugar. The most popular flavors in the United States are spearmint and peppermint.

A piece of chewing gum dating back 6,500 years (*C&EN*, March 24, 1997, page 64) from BÖkeburg, Sweden is believed to be from a natural tar. Elizabeth Aveling, University of Bradford, England, analyzed it and thinks the source was birch bark. Tar from birch was used for waterproofing and glue as early as 4500 B.C. There were small teeth marks in the gum indicating that teenagers and younger children chewed the gum. Making birch bark gum in the modern laboratory, requires heating the bark in sealed containers without air present since the gum chars when heated in air. The methods that people of so long ago must have used remains a mystery.

Materials:

One piece of bubble gum

Balance

Safety: Messy! Plan ahead!

Procedure:

Students can determine the percent gum base or polymer in a stick of gum by measuring its mass before chewing and after. This could be messy so set some strict parameters!

Take a chewed piece of gum (10 minutes of chewing) and place it in ice water for a minute. Notice how inflexible it is! Imagine a pair of boots in the winter made from this elastomer.

Take the same piece of gum, place it on a piece of paper. Hold the paper near a lighted electric bulb. Touch the gum when it is warm. Would you like to put on a raincoat as sticky as this?

Teacher Information:

Bubble gum is about 75% sugars and 25% gum base.

A detailed laboratory can be found on the Macrogalleria Web Page.

(www.psrc.usm.edu/macrog/demos/index.htm Select grades 5-8.)

Mad Dawg™ bubble gum could be used for this activity if you can find some. It foams in your mouth after a few chews. The foam is a mixture of sugar, saliva and carbon dioxide. See *Chem Matters*, October 1993 for more information. Also *Chem Matters*, October 1994, has a "Bubblegum" article by Gail Marsella. *Chem Matters*, December 2000 has an article, "Chewing Gum - Sticking to the Story" by Harold T. McKone that includes how forensic experts use chewing gum.

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