

MAGILL'S CHOICE

Inventions and Inventors

Volume 1

Abortion pill — Laminated glass

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SALEM PRESS, INC.
Pasadena, California Hackensack, New Jersey

ASPARTAME

THE INVENTION: An artificial sweetener with a comparatively natural taste widely used in carbonated beverages.

THE PEOPLE BEHIND THE INVENTION:

Arthur H. Hayes, Jr. (1933-), a physician and commissioner of the U.S. Food and Drug Administration (FDA)

James M. Schlatter (1942-), an American chemist

Michael Sveda (1912-), an American chemist and inventor

Ludwig Frederick Audrieth (1901-), an American chemist and educator

Ira Remsen (1846-1927), an American chemist and educator

Constantin Fahlberg (1850-1910), a German chemist

SWEETNESS WITHOUT CALORIES

People have sweetened food and beverages since before recorded history. The most widely used sweetener is sugar, or sucrose. The only real drawback to the use of sucrose is that it is a nutritive sweetener: In addition to adding a sweet taste, it adds calories. Because sucrose is readily absorbed by the body, an excessive amount can be life-threatening to diabetics. This fact alone would make the development of nonsucrose sweeteners attractive.

There are three common nonsucrose sweeteners in use around the world: saccharin, cyclamates, and aspartame. Saccharin was the first of this group to be discovered, in 1879. Constantin Fahlberg synthesized saccharin based on the previous experimental work of Ira Remsen using toluene (derived from petroleum). This product was found to be three hundred to five hundred times as sweet as sugar, although some people could detect a bitter aftertaste.

In 1944, the chemical family of cyclamates was discovered by Ludwig Frederick Audrieth and Michael Sveda. Although these compounds are only thirty to eighty times as sweet as sugar, there was no detectable aftertaste. By the mid-1960's, cyclamates had replaced saccharin as the leading nonnutritive sweetener in the United States. Although cyclamates are still in use throughout the

world, in October, 1969, FDA removed them from the list of approved food additives because of tests that indicated possible health hazards.

A POLITICAL ADDITIVE

Aspartame is the latest in artificial sweeteners that are derived from natural ingredients—in this case, two amino acids, one from milk and one from bananas. Discovered by accident in 1965 by American chemist James M. Schlatter when he licked his fingers during an experiment, aspartame is 180 times as sweet as sugar. In 1974, the FDA approved its use in dry foods such as gum and cereal and as a sugar replacement.

Shortly after its approval for this limited application, the FDA held public hearings on the safety concerns raised by John W. Olney, a professor of neuropathology at Washington University in St. Louis. There was some indication that aspartame, when combined with the common food additive monosodium glutamate, caused brain damage in children. These fears were confirmed, but the risk of brain damage was limited to a small percentage of individuals with a rare genetic disorder. At this point, the public debate took a political turn: Senator William Proxmire charged FDA Commissioner Alexander M. Schmidt with public misconduct. This controversy resulted in aspartame being taken off the market in 1975.

In 1981, the new FDA commissioner, Arthur H. Hayes, Jr., re-approved aspartame for use in the same applications: as a tabletop sweetener, as a cold-cereal additive, in chewing gum, and for other miscellaneous uses. In 1983, the FDA approved aspartame for use in carbonated beverages, its largest application to date. Later safety studies revealed that children with a rare metabolic disease, phenylketonuria, could not ingest this sweetener without severe health risks because of the presence of phenylalanine in aspartame. This condition results in a rapid buildup in phenylalanine in the blood. Laboratories simulated this condition in rats and found that high doses of aspartame inhibited the synthesis of dopamine, a neurotransmitter. Once this happens, an increase in the frequency of seizures can occur. There was no direct evidence, however, that aspartame actually caused seizures in these experiments.

Many other compounds are being tested for use as sugar replacements, the sweetest being a relative of aspartame. This compound is seventeen thousand to fifty-two thousand times sweeter than sugar.

IMPACT

The business fallout from the approval of a new low-calorie sweetener occurred over a short span of time. In 1981, sales of this artificial sweetener by G. D. Searle and Company were \$74 million. In 1983, sales rose to \$336 million and exceeded half a billion dollars the following year. These figures represent sales of more than 2,500 tons of this product. In 1985, 3,500 tons of aspartame were consumed. Clearly, this product's introduction was a commercial success for Searle. During this same period, the percentage of reduced-calorie carbonated beverages containing saccharin declined from 100 percent to 20 percent in an industry that had \$4 billion in sales. Universally, consumers preferred products containing aspartame; the bitter aftertaste of saccharin was rejected in favor of the new, less powerful sweetener.

There is a trade-off in using these products. The FDA found evidence linking both saccharin and cyclamates to an elevated incidence of cancer. Cyclamates were banned in the United States for this reason. Public resistance to this measure caused the agency to back away from its position. The rationale was that, compared to other health risks associated with the consumption of sugar (especially for diabetics and overweight persons), the chance of getting cancer was slight and therefore a risk that many people would choose to ignore. The total domination of aspartame in the sweetener market seems to support this assumption.

See also Cyclamate; Genetically engineered insulin.

FURTHER READING

Blaylock, Russell L. *Excitotoxins: The Taste That Kills*. Santa Fe, N.Mex.: Health Press, 1998.

Roberts, Hyman Jacob. *Aspartame (NutraSweet®): Is It Safe?* Philadelphia: Charles Press, 1990.

Stegink, Lewis D., and Lloyd J. Filer, *Aspartame: Physiology and Biochemistry*. New York: M. Dekker, 1984.