

Artificial Sweeteners

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Saccharin

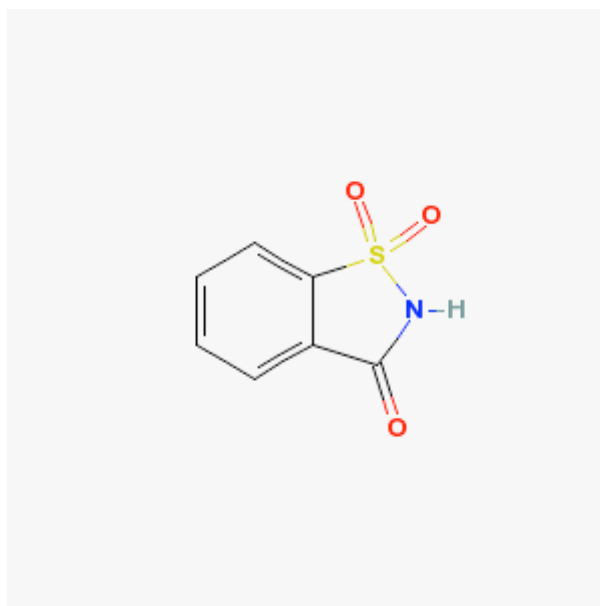


Fig 1. Saccharin Structural Formula

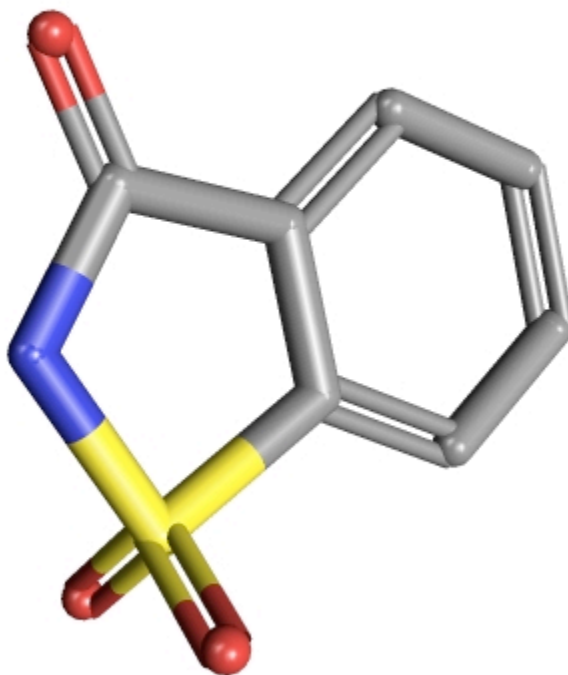


Fig 2. Saccharin 3D Structural Formula

Saccharin was first synthesized at Johns Hopkins in May of 1878 by Constantine Fahlberg who received a US patent for the compound in 1885 (US patent #319,082). John F. Queeny became aware of saccharin sometime in the late 1890s and began to manufacture it in 1901 under a new company he formed giving it the maiden name of his wife, Monsanto Chemical Company.

Saccharin is a white odorless crystalline strongly acid powder with only slight solubility in water. Commercial preparations come in three forms (a) acid, (b) sodium, and (c) calcium. The sodium form is the most common due to its solubility in water, stability, and cost of production.

Saccharin is approximately 300 times as sweet as sugar depending upon the method of measurement and has been reported to be from 200 to 800 times as sweet (DuBois et al. sweeteners: discovery, molecular design, and chemoreception. (1991).

Acesulfame K

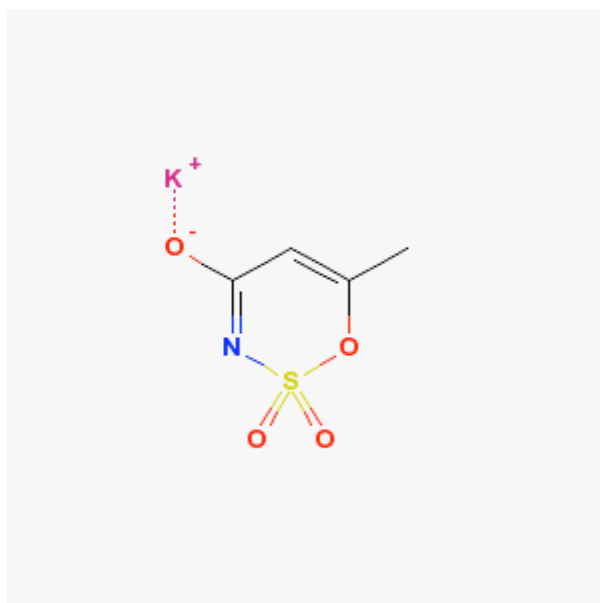
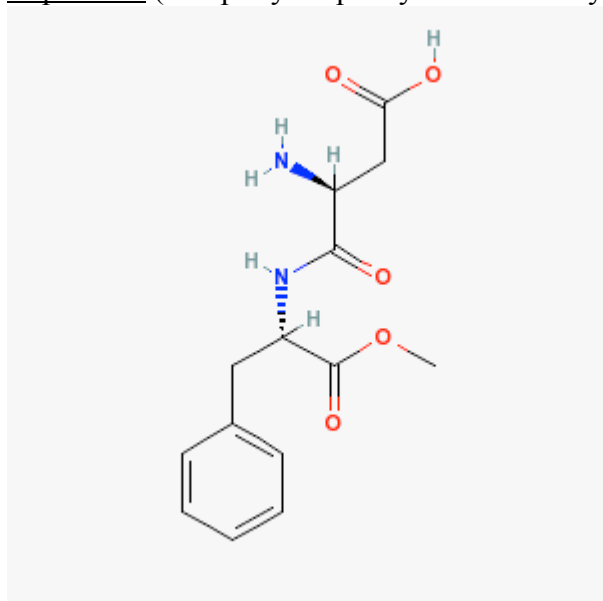


Fig 3. Acesulfame K Structural Formula

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous
- ❖

Alitame

Aspartame (L-aspartyl-L-phenylalanine methyl ester)



Aspartame was discovered accidentally by James Schlatter of Searle & Co. in 1965¹. Current estimates place it as present in more than 6000 products worldwide.

The proteolytic enzymes of the small intestine hydrolyze aspartame into its component parts, aspartate, phenylalanine, and methanol in a ratio of 4:5:1 respectively. Aspartate and phenylalanine are found in the circulation and tissues from the hydrolysis of proteins in, protein catabolism. Caveat: aspartame should not be consumed by persons suffering from phenylketonuria for obvious reasons.

Even after high doses of aspartame the plasma levels of phenylalanine and aspartate do not rise above those seen postprandially in normal humans²⁻⁴ making any fears of abnormally high plasma levels of the two amino acids unjustified.

It is the methanol around which most controversy swirls. Methanol can and does form both formaldehyde and formic acid in plasma and tissues.

The safety of aspartame is the most thoroughly studied of all the artificial sweeteners with more than 200 scientific studies in animals and humans⁵ (pp 45). These studies include investigation of toxicity of acute, subchronic, and chronic bioassays, neurotoxicity studies, immunotoxicity studies, and reproductive, teratogenic, and multigenerational bioassays in animals as well as carcinogenic bioassays in three transgenic mice models. In addition to the foregoing clinical studies and epidemiological studies attest to the safety of the product. Its safety has been affirmed by a plethora of regulatory agencies and scientific bodies worldwide, these include but not limited to: the joint FAO/WHO Expert Committee on Food Additives (JECFA) of the Codex Alimentarius (Food and Agricultural Organization/World Health Organization), the Scientific Committee for Food of the Commission of European Communities, and the US Food and Drug Administration (FDA), and more than 100 other regulatory agencies.

The acceptable daily intake of aspartame has been pegged at 40 mg/kg/day set by JECFA and by the United States Food and Drug Administration at 50 mg/kg /day. Since aspartame is 200 times sweeter than sugar an acceptable daily intake of 50 mg per kilogram body weight is equivalent in sweetness to approximately 600 g or 1.32 lbs of sucrose consumed daily by a 60 kg person over a lifetime. That is one hell of a lot of sugar.

Toxicology

Over the years there has been, and still is, relentless heated controversy as to the toxicity of aspartame and its metabolic products. Those metabolic products are: aspartate, phenylalanine, and methanol. The safety issue revolving around these metabolic products have been extensively studied and found to be nonissues.

An Internet search of the word "aspartame" produced 680,000 hits, most of which are warning the consumer that aspartame is responsible for the induction of over 92 known disease states including death. Some of these websites are clearly designed to unreasonably exacerbate public fears, while at the same time providing very little scientific information to support their position, a typical example is: "snopes.com: [Aspartame -- Sweet Poison?](http://snopes.com)", which accuses aspartame of being responsible for an epidemic of multiple sclerosis and lupus. Many of the websites come replete with anecdotal videos of horrifying tales chronicling the consequences of being subject to aspartame.

1. Cancer

- i. The incidence of brain tumors increased after the introduction of aspartame to the market⁶.
- ii. No association between consumption of aspartame and risk of brain tumor development⁷.
- iii. No significant association between brain tumors of low-calorie soft drink consumption⁸.
- iv. No association between consumption of aspartame during pregnancy and brain tumor risk⁹.
- v. No significant associations were found between hematopoietic or brain cancers and aspartame consumption¹⁰.
- vi. No significant associations were found between aspartame consumption and the following neoplasms: cancers of the oral cavity and pharynx, oesophageal, colon, rectal, laryngeal, breast, ovarian, prostate, and kidney cancer¹¹.

Aspartame is not fermented by dental plaque and therefore, unlike sugar, does not contribute to the formation of dental caries¹².

Cyclamate

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology

- ❖ Miscellaneous
- ❖

Dulcin

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Neohesperidin Dihydrochalcone

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Tagatose

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous
- ❖

Neotame

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Saccharin

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous
- ❖

Stevioside

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Sucralose

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Reduced-calorie sweeteners

The reduced calorie sweeteners are added to the white paper pursuant to your request of September 16 that I include the xylitol. Xylitol is not technically an artificial sweetener but a natural sugar alcohol that sweetens with reduced calories and a lower glycemic index than sugars. Since I'm going to add xylitol I thought I might just as well talk about other reduced calorie-sweeteners in common use.

Erythritol

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Hydrogenated Starch Hydrolysates

- ❖ Date of Discovery
- ❖ Comparative Sweetness

- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Isomalt

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Maltitol

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Lactitol

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Sorbitol and Mannitol

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State
- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

Xylitol

- ❖ Date of Discovery
- ❖ Comparative Sweetness
- ❖ Structural Formula
- ❖ Physical State

- ❖ Solubility
- ❖ Toxicology
- ❖ Miscellaneous

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