

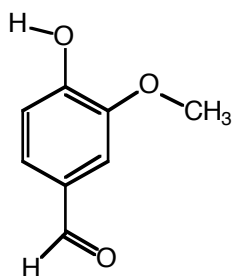
Vanilla

Vanilla comes from the seeds of an orchid plant. This climbing, tropical orchid is native to Mexico and was used by the Aztecs to flavor their chocolate drinks. The orchid flowers are pollinated by bees and hummingbirds specific for the job as they co-evolved, which means pollination (and thus seed production) didn't happen when people tried to grow vanilla outside of its natural habitat. Hoping local bees would adapt to the job and importing the Mexican bees to other habitats were unsuccessful. However, Edmund Albius¹ developed a method of hand pollination in 1841 on Reunion Island, and natural vanilla grown outside of Mexico (Madagascar is the highest producer) continues to be hand-pollinated by this method. The long seedpods are harvested after they have matured for about eight months, fermented, chopped up and treated with alcohol to dissolve the vanillin, the compound that is the predominant constituent of what we recognize as vanilla. Over 170 compounds have been identified in vanilla.

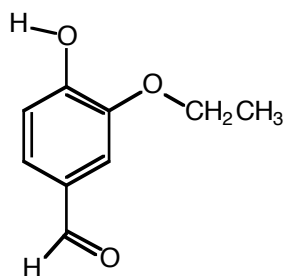
Vanilla can be detected in *very* small quantities - at concentrations of 0.1 parts per million when it is dissolved in water. To show how small changes in chemical structure can influence taste, ethyl vanillin, which has one more carbon and two more hydrogen atoms than vanillin, is 3-4 times stronger in its vanilla aroma. (See the structures at the bottom of the page.)

Because vanillin production is labor-intensive and very costly, and the desire for vanilla outpaces the available natural material, most of what is sold in the U.S. is artificial or synthetic vanilla, which is essentially the same compound but is made from byproducts of wood and paper processing. In addition, some commercial vanilla advertised as "natural" has been found to be adulterated with synthetic vanillin as well as other compounds such as coumarin, a toxic compound well known as a pharmaceutical blood thinner and less well known as a source of the smell of new-mown hay. Coumarin has a flavor like vanilla but it has a sharp aftertaste; it is not found in vanilla sold in the United States.

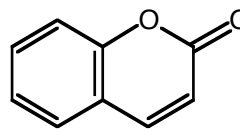
Three Chemical Structures of Importance in Vanilla Chemistry



Vanillin



Ethyl vanillin,
shows 3-4 times the
flavor of vanilla.



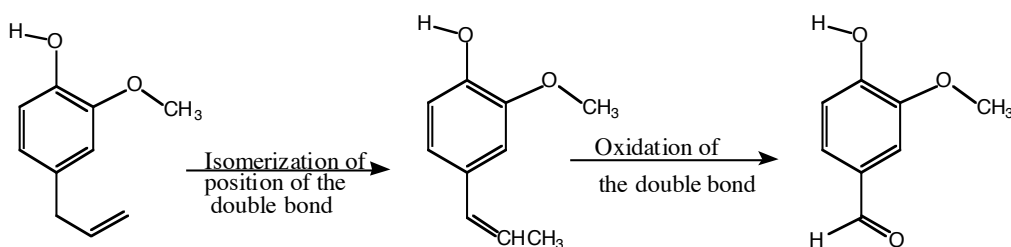
Coumarin,
illicitly used to
adulterate vanilla

¹ Edward Albius is variously described on the web as a 12-year-old slave, a former slave, a slave who won his freedom because of his development of this process. His implement of pollination is described as a lemon thorn, a bamboo splint, and hand (squeezing). Sometimes the plantation owner is given the credit for Albius' discovery.

Synthetic Vanillin

The first synthesis of vanillin used eugenol, a compound found in cloves and other plants, as the starting material. The double bond was isomerized, and then oxidized and cleaved to form vanillin. (See the reaction below.) These days it is cheaper to synthesize vanillin by other methods. The difference between natural vanillin and synthetic vanillin is that the synthetic form lacks the 169 (and more) other chemicals that round out the deeper flavor of natural vanilla.

The First Synthesis of Vanillin (1896)



Vanilla shows up in all sorts of products - in foods and flavoring, obviously, but also in fragrances, cosmetics, and aromatherapy. On July 24, 2000, the BBC reported that it has even been used in a patch to curb cravings for chocolates and sweets; it halved people's consumption of chocolate and resulted in greater weight loss as compared to results from the groups that wore either a lemon scented or a dummy patch. It is now marketed as an "aromacology" product.

A few years ago I accidentally dropped and broke a pound bottle of vanillin (a white powder in its pure form) on the lab floor and although vanilla is my all-time favorite flavor and aroma, I had to leave the lab until the dust settled and I could return to sweep it up. Too much of a good thing is - well - too much of a good thing!

Interesting references

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The vanilla patch: <http://news.bbc.co.uk/1/hi/health/848621.stm>