

The chemical secrets behind vanilla's allure

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From ice cream to lattes, vanilla is one of the most popular spices in the world. It's also one of the most labor-intensive to produce, and shortcuts lead to a less tasty product. Today, scientists report a profile of 20 key chemicals found in vanilla bean extracts, including several previously unknown ones, that together create vanilla's complex and enjoyable flavor. The work could help manufacturers and farmers develop better-tasting vanilla and improve quick-curing methods.

The researchers will present their results at the fall meeting of the American Chemical Society (ACS).

"Vanilla is the second-most expensive spice in the world," says Diana Paola Forero-Arcila, Ph.D., who is presenting this work at the meeting. "One of the reasons it's so expensive is because its [flavor](#) is developed during a curing process that takes up to nine months."

Two shortcuts are currently used to get around this long, drawn-out curing process. One is to speed it up with quick-curing methods that attempt to recreate the luscious natural [vanilla](#) flavor in a fraction of the time. Another is to make artificial vanilla, familiar to consumers as a less pricey alternative to the real thing.

But these types of products fall flat in terms of flavor because they both focus on vanillin, Forero-Arcila explains. Quick curing attempts to maximize the amount of vanillin in the cured bean, whereas artificial vanilla contains only one flavoring agent—lab-made vanillin. Though vanillin is an important part of a vanilla bean's flavor, the alternative products are missing many other [flavor compounds](#) that develop during the long, traditional curing process and that are essential to the distinctive vanilla taste. "It's very important that we understand the complexity of vanilla's flavor and try to identify the compounds that are behind that complexity," says Forero-Arcila.

To capture that complexity, Forero-Arcila, who is a postdoc at The Ohio State University, used an approach called untargeted flavoromics to pinpoint which chemicals in vanilla bean extracts are the most important for the overall aroma and taste. The researchers first made extracts from 15 beans they sourced from various countries and that were cured differently. They then constructed a chemical [profile](#) of each type of bean and identified which compounds were present. To find out how people reacted to the extracts, the team asked more than 100 individuals

to taste the samples and rate whether they liked or disliked the flavors.

By connecting the dots between the chemical profiles and the taste ratings, the researchers identified 20 compounds that are the main drivers behind whether a person likes the flavor of a vanilla extract. Of these compounds, some, like vanillin, were expected. "Some of the compounds we identified are well-known vanilla components; however, this is the first report of them impacting consumer acceptability," says Forero-Arcila. And several compounds important for the flavor were completely unknown, says Devin Peterson, Ph.D., the project's principal investigator. The researchers are still analyzing these novel vanilla compounds to determine the final structures, but they have observed that the compounds have phenolic and aglycone parts. They also identified some compounds present in the extracts that made people dislike the flavor. One example is anisaldehyde, which has a floral aroma. Forero-Arcila found that anisaldehyde is produced during the curing process from a previously unknown precursor.

With this new profile of compounds, the researchers plan to share what they've learned with others in the food and agricultural industries. They think that the profile could help producers and farmers identify high-quality, valuable extracts, and price those extracts to match their quality. "The more you understand about how to make the materials more valuable, the more that value should flow through the whole system," says Peterson. In the future, vanilla breeding programs and curing methods could focus on selectively producing the optimum compound profile for good flavor in vanilla plants.

More information: Chemical drivers of vanilla flavor liking, ACS Fall 2022. www.acs.org/content/acs/en/meetings/fall-2022.html

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