



Synthetic biology vanilla: “natural” and “sustainable?”

Consumers trust that when products are marketed as natural and sustainable, they will not contain ingredients produced via genetic engineering or synthetic biology. However, a new flavor and fragrance, synthetic biology vanilla, produced using extreme genetic engineering techniques, may enter the market this year – and it will likely be labeled as “natural.” Synthetic biology and its products are not subject to mandatory health and environmental assessment or adequate oversight and will likely not be labeled when used in consumer products or food.

This may set a precedent for other synthetic biology flavors and fragrances currently in development. Labeling synbio ingredients as “natural” could confuse consumers and potentially displace truly natural commodities currently produced by small farmers around the globe, such as vanilla beans. Currently commercialized synthetic biology applications also pose significant threats to the earth’s biodiversity and could speed rain forest and other habitat destruction by increasing demand for sugar as a feedstock.

What is synthetic biology?

Synthetic biology (synbio) is an extreme version of genetic engineering. Instead of swapping genes from one species to another (as in conventional genetic engineering), synthetic biologists employ a number of new genetic engineering techniques, such as using synthetic (human-made) DNA to create entirely new forms of life or to “reprogram” existing organisms to produce chemicals that they would not produce naturally.

What is synbio vanillin?

Natural vanillin comes from the vanilla orchid. Synthetic biology vanillin is distinct from the artificial vanillin already on the market, although both are engineered in labs. Artificial vanillin is a mix of chemical components. The new synthetic biology vanillin is synthesized by a genetically engineered organism – a GMO yeast engineered using synthetic biology techniques.

To create this synbio yeast, synthetic DNA is designed on a computer and inserted into the DNA of naturally occurring yeast. This is very different from traditional methods of selectively breeding naturally occurring yeast for various purposes, such as brewing beer or baking bread. In selective breeding, no foreign genetic matter that does not occur naturally in yeast is inserted into the yeast genome. The synbio yeast are fed sugar and biosynthesize vanillin through a fermentation process.¹ Even though this vanillin is engineered and created by a pathway that does not exist in nature, the synbio company Evolva and its partner, International Flavors and Fragrances, are marketing synbio vanillin as “natural.”²

Clearing land to for sugar cane cultivation

Currently commercialized synthetic biology flavors and fragrances: “natural” and “sustainable?”

In the absence of regulations to protect human health and the environment, and labeling to ensure consumer right-to-know, synthetic biology is starting to enter food and consumer products. Synbio vanillin is produced by genetically engineered yeast, which are designed in labs and feed on sugar – something most people would not describe as “natural.”

The claims of “sustainability” for this technology are also questionable at best. While the industry claims that currently commercialized synbio ingredients like synbio vanilla could



1 Griffith F. The significance of pneumococcal types. *J. Hygiene.* (1928);27:113–159. Hansen, EH, B. L. Møller, G. R. Kock, C. M. Büchner, C. Kristensen, O. R. Jensen, F. T. Okkels, C. E. Olsen, M. S. Motawia, and J. Hansen. 2009. De novo biosynthesis of Vanillin in Fission yeast (*Schizosaccharomyces pombe*) and Baker’s yeast (*Saccharomyces cerevisiae*). *Applied and Environmental Microbiology* 75: 2765-2774.

2 Evolva. “Vanilla.” <http://www.evolva.com/products/vanilla>



reduce impacts on land, synbio yeast, in fact, require large amounts of sugar as a feedstock in order to live and produce these ingredients. Expanding sugarcane plantations to meet feedstock demand from a growing synbio industry could exacerbate the current destruction of critical savannah and rain forest ecosystems in Latin America (including some of Brazil's most eco-sensitive areas of land), Africa and Southeast Asia.³

Vanilla farming is sustainable, labor-intensive and culturally important to families in the rain forests of Madagascar, Mexico and Southeast Asia. Natural vanilla farmers protect rain forests by growing high-value vanilla orchids which depend on these intact ecosystems. The natural vanilla market adds economic value to these intact rainforests and provides a livelihood for hundreds of thousands of small farmers.⁴ If synthetic biology vanillin, marketed and labeled

as “natural,” displaces truly natural vanilla flavoring, thousands of vanilla farming communities could be harmed, and the land they preserve may in turn be converted into industrial-scale plantations for commodities like soy, beef or sugar.

The escape of engineered synthetic biology organisms into the environment – either intentionally or otherwise – could have serious and unforeseeable consequences, including genetic contamination of wild species, disruption of natural ecosystems and release of chemical and biological pollutants.⁵⁶ No containment strategies are foolproof, and while some types of pollution can be cleaned up, once in the environment these synthetic organisms, which are designed to reproduce, may be impossible to recall.⁷

Virtually unregulated, unassessed for safety and not labeled

Like conventional GMOs, the products of synthetic biology are virtually unregulated, not required to be assessed to ensure they are safe for our health and environment, and are not currently required to be labeled. Labeling synbio ingredients as “natural” misleads consumers who are seeking truly natural products and do not want to feed their families foods derived from risky new genetic engineering methods.⁸

Synbio vanilla and other synthetic biology ingredients should not be marketed as “natural.” Synbio ingredients should not be incorporated into food or consumer products in absence of regulations specific to synthetic biology, mandatory and transparent assessments to ensure they are safe for our health and environment, mandatory labeling to ensure consumer right to know, and transparency about which synthetic biology methods are being used to produce them.⁹

More information on synthetic biology: www.foe.org/synbio, www.synbiowatch.org

Contact:

Dana Perls, food and technology campaigner, Friends of the Earth, foodtech@foe.org

³ Mendonca, Maria Luisa. “Brazil: sugar cane plantations devastate vital Cerrado region.” *Pacific Ecologist* 17 (2009): 25+. Academic OneFile. Web. 18 Aug. 2014.
⁴ Communication with Michel Grisoni, CIRAD (Centre de coopération internationale en recherche agronomique pour le développement), based in Réunion. Vanilla production estimates provided by Michel Grisoni.
⁵ Creating a Research Agenda for the Ecological Implications of Synthetic Biology. Woodrow Wilson Center. (2014) http://web.mit.edu/cis/Publications/SYNBIO_res_agenda.pdf
⁶ New Directions: The Ethics of Synthetic Biology and Emerging Technologies. Presidential Commission for the Study of Bioethical Issues. December 2010, Washington, D.C.
⁷ Snow, A. “Risk of Environmental Releases of Synthetic GEOs.” Presentation for the Presidential Commission for the Study of Bioethical Issues. July 8, 2010. <http://www.howplantswork.com/wp-content/uploads/2011/02/risks-of-environmental-releases-of-synthetic-geos.pdf>
⁸ New Poll Finds Synthetic Biology Remains a Mystery. Woodrow Wilson Center and Hart Research. March 2013: http://www.synbioproject.org/news/project/synthetic_biology_remains_mystery/
⁹ Taleb, Nassim N., Yaneer Bar-Yam, Raphael Douady, Joseph Norman, and Rupert Read. The Precautionary Principle: Fragility and Black Swans from Policy Actions. N.p., 24 July 2014. <https://docs.google.com/file/d/0B8nhA1fk3QlbGFzOXF5UUN3N2c/edit?pli=1>.