

FOOD INGREDIENTS

Phytolon

Making natural food colors that break synthetics' hold on the market



Halim Jubran (left) and Tal Zeltzer, two of Phytolon's founders

In 2016, the food giant Mars vowed to remove artificial colors from all its confections, foods, and drinks within the next 5 years. But it's now 2022, and the company's M&M candies are still bright thanks to blue 1 lake, yellow 6, red 40, and seven other artificial colors.

Phytolon sees a business opportunity here. The 4-year-old Israeli start-up is developing fermentation-derived betalain pigments that its founders say can offer food makers the hues they want with the processability they need and at prices they are willing to pay.

Phytolon has its roots in the research of Asaph Aharoni, a professor in the Department of Plant and Environmental Sciences at the Weizmann Institute of Science. Aharoni and his team identified key genes in the metabolic pathway to betalains, pigments that are found abundantly in fruits and vegetables such as beets, swiss chard, and cactus fruit.

As part of their research, the scientists introduced the relevant genes into baker's yeast to see how well the pigments would be expressed. They were surprised to find that yeast cells not only expressed betalains

well but also spontaneously expelled them into the fermentation broth, making them easy to recover. “This is when they recognized the potential of the technology,” says Halim Jubran, Phytolon’s CEO.

Trendlines Group, a venture capital firm that had worked with the institute before, brought on Jubran, who was a postdoctoral fellow at Weizmann in a lab near Aharoni’s and was working for another start-up, and Tal Zeltzer, a PhD graduate from Technion—Israel Institute of Technology who is now Phytolon’s chief technology officer. Guy Polturak, a Weizmann scientist at the time, is another cofounder.

Phytolon is developing two yeast strains, one expressing the yellow pigment indicaxanthin and the other expressing the purple pigment betanin. By mixing the two pigments in various ratios, Jubran says, the company can create 75% of the colors demanded by food manufacturers, including purples, yellows, pinks, oranges, and reds.

Food companies can also create many of the colors they want from plant extracts, but not without difficulty, according to Jubran. Many plant extracts are insoluble and must be made soluble to work in industrial-scale food production. “It’s a pretty complicated and expensive process,” he says. Other issues with plant extracts, he adds, include deterioration or fading, off-tastes, and texture changes.

And to achieve the colors they desire, food manufacturers often must combine two or three plant materials—say, paprika, curcumin, and beetroot extract—that don’t easily combine. “These pigments, they chemically don’t really mix,” Jubran says. “You have to force them to mix.” The water-soluble betalains don’t present such problems, he says.

Phytolon isn’t the only start-up using fermentation to create natural colors. For example, another Israeli company, Lycored, uses the fungus *Blakeslea trispora*

to express carotenoid pigments. The US firm Spira derives a blue pigment from the cyanobacterium *Arthrospira platensis*. And Argentina-based Michroma is isolating red pigments expressed by fungi.

But Jubran says it’s telling that the food ingredient giant DSM led Phytolon’s recent series A funding round, in which it raised \$14.5 million. “I think in our space we are the first start-up that offers fermentation that has obtained a serious contract with a serious entity,” he says.

Another participant in the funding round was Ginkgo Bioworks, a synthetic biology specialist that is contributing fermentation services rather than cash. The Boston-based company is helping Phytolon maximize the efficiency of the two yeast strains, according to Jubran. Phytolon is tackling fermentation and purification improvement on its own.

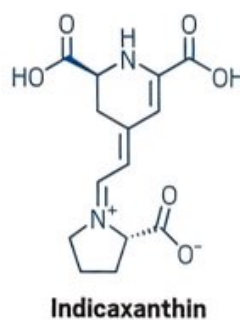
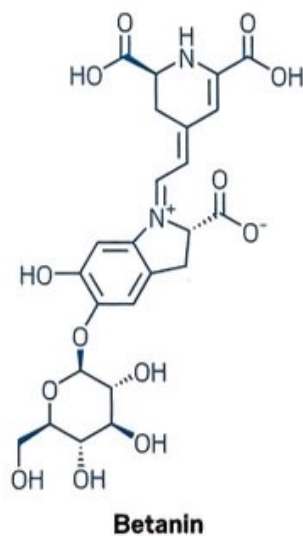
But even without improvements, Phytolon is ready to go, Jubran maintains. The firm, which has about 25 employees, is demonstrating the production of its pigments at a European contract manufacturing firm in 15 m³ reactors, a size that he says is very close to commercial scale. It is focused on penetrating the dairy,

confectionary, bakery, and plant-based meat markets and hopes to win US and European regulatory clearances in 2023.

Jubran knows that natural colors still don’t always offer the vibrancy of synthetics, and they are more expensive. “We are getting there,” he says. “We have closed some gaps that current natural colors cannot close.” That’s news that the M&M team at Mars should be happy to hear.—MICHAEL MCCOY

At a glance

- **Publicly launched:** 2018
- **Headquarters:** Yoqne’am ‘Illit, Israel
- **Focus:** Natural colors
- **Technology:** Yeast fermentation of betalain pigments
- **Founders:** Halim Jubran, Tal Zeltzer, and Guy Polturak
- **Funding or notable partners:** \$14.5 million in series A funding from DSM, Ginkgo Bioworks, the Trendlines Agrifood Fund, and other firms



Phytolon says its two betalain pigments can create food colors ranging from yellow to purple.