

MEDICAL

Sunflower pollen may find use in a better, stronger 3D-bioprinting ink

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The research team, with tubes of the bio-ink (rear) Nanyang Technological University

When it comes to the 3D bioprinting of replacement body parts or other implanted items, the material that's used needs to be strong yet flexible, and also biocompatible. According to new research, sunflower pollen may be the way to go.

For the study, scientists at Singapore's Nanyang Technological University began by incubating sunflower pollen in an alkaline solution for six hours. This process converted the hard pollen grains into softer (but still tough) microgel particles. Those particles were then mixed into an existing hydrogel – such as naturally sourced alginate or hyaluronic acid – boosting the strength of that gel.

In order to test the resulting hybrid "bio-ink," the researchers used it in the 3D printing of a five-layer implantable [bioscaffold](#), which is a three-dimensional structure used to regrow tissue within the body. The structure was able to stand up on its own, unlike items made from some other bio-inks, which are too floppy to support

themselves – this means they have to be printed with supporting structures that are subsequently removed and discarded, adding to both printing time and wasted material.

Next, collagen was added to the bioscaffold, in order to provide anchor points for human tissue cells which were seeded onto the structure. The team found that the bioscaffold was 96 to 97 percent efficient at retaining those cells, which could go on to reproduce and form new biological tissue. Such efficiency is claimed to be similar to that of 3D cell culture platforms made of inverted colloidal crystal hydrogels, which take considerably more time and effort to build.

Additionally, unlike some other strength-boosting additives such as fibers, the pollen microgel particles didn't clog the nozzle of the 3D printer. What's more, because the particles are hollow, they could conceivably be used to transport medication within the body, gradually releasing it as they dissolve. They could even be triggered to dissolve at a certain time or place inside the body, if an acid were introduced.



A tube of the bio-ink, which could have a number of application Nanyang Technological University

"Through tuning the mechanical properties of sunflower pollen, we developed a pollen-based hybrid ink that can be used to print structures with good structural integrity," says Prof. Cho Nam-Joon, who led the study along with Asst. Prof. Song Juha. "Utilizing pollen for 3D printing is a significant achievement as the process of making the pollen-based ink is sustainable and affordable. Given that there are numerous types of pollen species with distinct sizes, shapes, and surface properties, pollen microgel suspensions could potentially be used to create a new class of eco-friendly 3D printing materials."

The research is described in a paper that was recently published in the journal [*Advanced Functional Materials*](#).