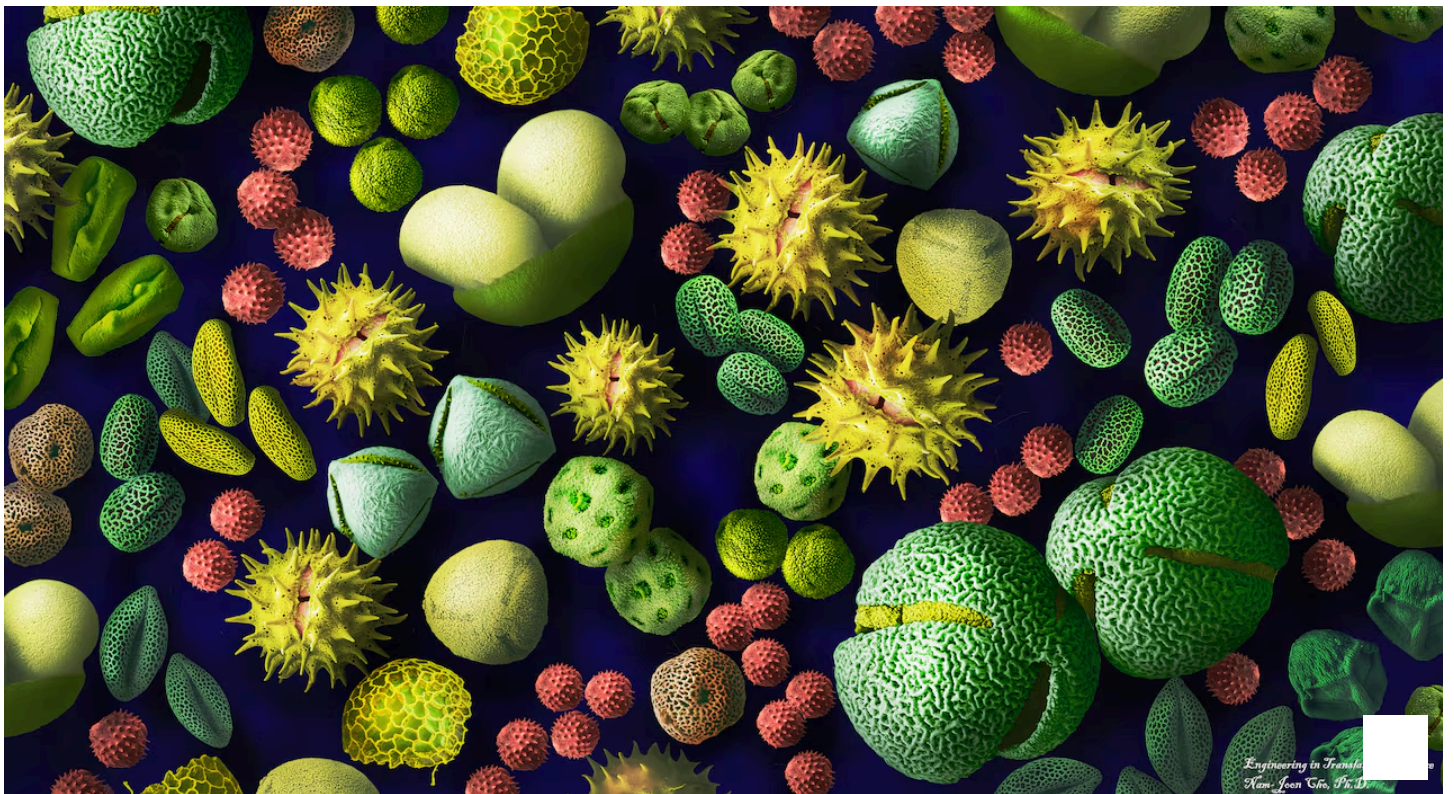


[New Tech] Korean Scientists Develop a Cooling Pollen Sunscreen

Researchers at Nanyang Technological University in Singapore have developed a camellia pollen sunscreen that lowers skin temperature by 5 degrees, blocks marine pollution, and is harmless to coral reefs. Capsules can also be transformed into gel form to deliver drugs.



Pollen, photographed under an electron microscope. From a nuisance that triggers spring allergies, it's being transformed into drug capsules and sunscreens that protect people. / Nanyang Technological University, Singapore

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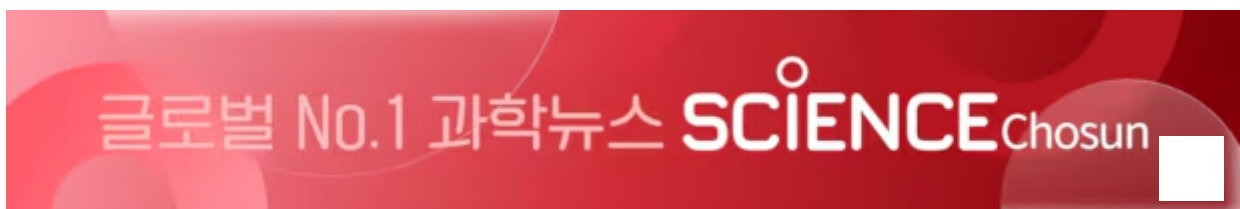
Sunscreen blocks UV rays, preventing burns and skin cancer. However, some products contain chemicals that have been criticized for being harmful to marine ecosystems. A Korean scientist has developed a natural sunscreen using pollen that offers enhanced UV protection and is environmentally friendly.

Researchers at Singapore's Nanyang Technological University (NTU) announced on the 4th (local time) in the online edition of the international academic journal in the field of energy and materials, "We have developed a 'natural cooling sunscreen' using pollen extracted from camellia flowers for the first time in the world that not only blocks UV rays but also lowers skin temperature by 5 degrees Celsius."

Pollen, once a spring allergen, is being transformed into a material that protects people. When softened, pollen can be used as a drug delivery capsule or wound care product. It can even be combined with cosmetic ingredients to create sunscreen. Pollen is a natural ingredient, so it poses no harm to humans or the environment, and its abundance makes it affordable.



A Korean research team at Nanyang Technological University (NTU) in Singapore has developed a natural sunscreen that uses pollen to block UV rays and is harmless to the environment. / Harvard School of Public Health, USA



◇Empty the pollen and make a cosmetic gel

Professor Nam-Joon Cho's research team at NTU's Department of Materials Science and Engineering used a water-based process, eliminating the internal components of camellia and sunflower pollen without high temperatures or harmful chemicals, and con

verted them into a cosmetic gel formulation. When applied to the skin, the pollen gel formed a transparent protective film thinner than a human hair.

In an animal experiment conducted in collaboration with Professor Lee Jeong-ryeol and his research team at Seoul National University College of Medicine, pollen sunscreen effectively blocked UV rays and reduced skin cell damage and inflammation. Camellia pollen sunscreen, in particular, performed better than sunflower pollen sunscreen.

Compared to commercial sunscreens, the pollen sunscreen showed similar or higher UV protection. Furthermore, in sunlight exposure tests, it demonstrated a cooling effect, lowering skin temperature by up to 5 degrees. The researchers explained that this was because pollen absorbs less visible light and near-infrared energy.

Professor Cho Nam-jun said, “Pollen can also be eaten as a health supplement, and the pollen shell is designed to protect the inside from environmental stresses such as ultraviolet rays.” He added, “Pollen sunscreen blocks ultraviolet rays at a similar level to titanium dioxide or zinc oxide used in regular sunscreens.”



Close-up image of sunscreen applied to skin (left) and camellia pollen (right)./NTU

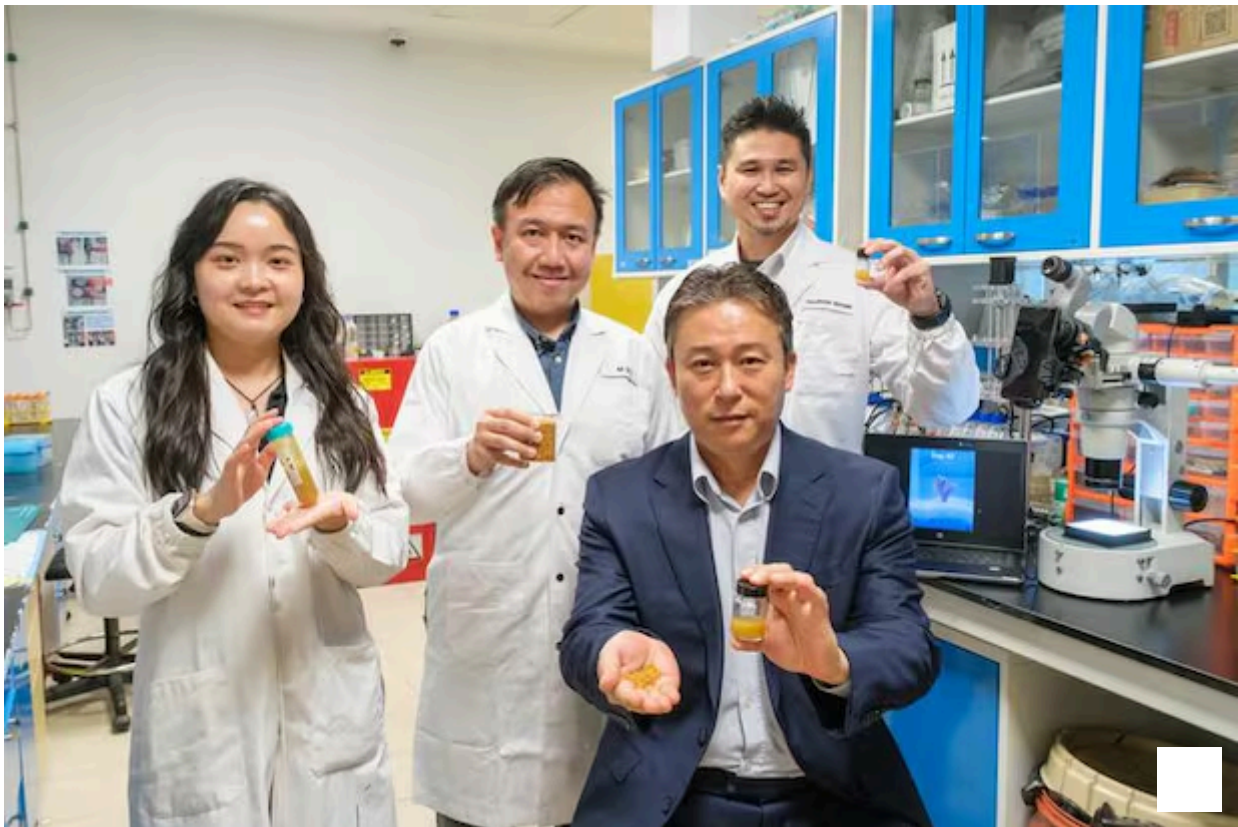
◇ Sunscreen that kills coral while trying to block sunlight

The researchers specifically noted that pollen-based sunscreens are harmless to the marine ecosystem. Some existing sunscreens contain chemicals like oxybenzone and octinoxate, which are known to be detrimental to coral reefs, which support approximately one-third of marine life.

In fact, when researchers applied a product containing this ingredient to coral reefs, bleaching occurred within just two days, and by day six, the corals had died. It's estimated that between 6,000 and 14,000 tons of sunscreen containing this ingredient enter the ocean each year. In contrast, coral reefs treated with pollen sunscreen remained healthy even after 60 days.

“This study is a meaningful attempt to protect marine ecosystems and reduce environmental pollution,” said Professor Patrick Martin of NTU’s School of Asian Environmental Studies. “Pollen sunscreen is a promising approach that can protect both human health and marine ecosystems.”

Natural ingredients are often more expensive than synthetic ones, but pollen is different. Plants produce pollen in large quantities to increase their chances of reproductive success. A single corn kernel contains only a few hundred grains, but it releases up to 5 million pollen grains to produce its desired result. Pine trees produce 2.2 kg of pollen in just a few weeks. While polylactic acid (PLA), the raw material for making plastic, costs \$3 per kilogram, pollen costs a mere \$0.01.



Professor Nam-Joon Cho (right) of the Department of Materials Science and Engineering at Nanyang Technological University and his research team hold bottles of pollen sunscreen./NTU

◇ Also popular as a drug delivery and cell culture material

Pollen is called the "diamond of plants" because its internal cells remain intact even after hundreds of thousands or millions of years. This makes it a valuable medical material for cell growth, drug delivery, and even fracture support. In 2020, Professor Nam-Joon Cho announced in the international journal "Nature Communications" that he had developed a method to transform pollen into capsules that deliver drugs into the body.

Pollen grains tightly cling to the pistil when deprived of moisture. When they reach the pistil and encounter moisture, they open and release sperm. The research team mimicked this process. By treating the pollen grains with the alkaline substance potassium hydroxide, they increased their volume and formed a soft, gel-like state. Conversely, when the acidity was increased, the swollen pollen grains contracted and hardened.

The research team expected that once pollen reaches a soft gel state, it could be used in a variety of materials, including wound dressings, food packaging, and drug capsules. While pollen, when in its small particle form, can enter the respiratory system and trigger

er allergic reactions, when transformed into other forms, it is a biological substance and poses no harm to the human body.

Professor Cho also developed a method for printing pollen materials. In 2021, he, along with Professor Song Joo-ha of the same university and Professor Jang Tae-sik of Chosun University, published a paper in "Advanced Functional Materials" that developed a 3D printing ink material using sunflower pollen for tissue engineering, toxicity testing, and drug delivery.

Previously, 3D printers had been used to print three-dimensional medical tissues by layering cells, biopolymers, or ink-like polymers onto a 3D printer. However, maintaining the three-dimensionality after printing proved difficult. Solid pollen solved this problem. The pollen was treated with potassium hydroxide to increase its volume and form a soft gel. Then, hydrogel, a high-moisture polymer similar to ink, was added to create a mixed ink.

Professor Song Joo-ha explained, "Fibers and other particles are added to reinforce the strength, but in this case, the nozzle becomes clogged." He added, "Pollen ink is mechanically strong and does not change the fluidity of the ink, so it can maintain the structure after printing without causing problems to the printer."

References

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