Researchers: English ivy may give sunblock a makeover

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When Mingjun Zhang was watching his son play in the yard, he was hit with a burning question: "What makes the ivy in his backyard cling to the fence so tightly?"

That simple question has led to a pioneering discovery that the tiny particles secreted from ivy rootlets can be used in many breakthrough applications in items such as military technologies, medical adhesives and drug delivery, and, most recently, sun-block.

Zhang, an associate professor of biomedical engineering at the University of Tennessee, Knoxville, along with his research team and collaborators, has found that ivy nanoparticles may protect skin from UV radiation at least four times better than the metal-based sunblocks found on store shelves today.

"The discovery of ivy nanoparticles' application to sunscreen was triggered by a real need. While hearing a talk at a conference about toxicity concerns in the use of metal-based nanoparticles in sunscreen, I was wondering, 'Why not try naturally occurring organic nanoparticles?'" Zhang said.

Zhang speculated the greenery's hidden power lay within a yellowish material secreted by the ivy for surface climbing. He placed this material onto a silicon wafer and examined it under an atomic force microscope and was surprised by what they found -- lots of nanoparticles, tiny particles 1,000 times thinner than the diameter of a human hair. The

properties of these tiny bits create the ability for the vine leaves to hold almost 2 million more times than its weight. It also has the ability to soak up and disperse light which is integral to sunscreens.

"Nanoparticles exhibit unique physical and chemical properties due to large surface-to-volume ratio which allows them to absorb and scatter light," Zhang said. "Titanium dioxide and zinc oxide are currently used for sunscreen for the same reason, but the ivy nanoparticles are more uniform than the metal-based nanoparticles, and have unique material properties, which may help to enhance the absorption and scattering of light, and serve better as a sun-blocker."

The team's study indicates that ivy nanoparticles can improve the extinction of ultraviolet light at least four times better than its metal counterparts. Furthermore, the metal-based sunscreens used today can pose health hazards. Zhang notes some studies have shown that the small-scale metal oxides in sunscreen can wind up in organs such as the liver or brain.

Ivy nanoparticles, on the other hand, exhibit better biocompatibility with humans and the environment. The team's studies indicate that the ivy nanoparticles were less toxic to mammalian cells, have a limited potential to penetrate through human skin, and are easily biodegradable.

"In general, it is not a good idea to have more metal-based nanoparticles for cosmetic applications. They are a significant concern for the environment. Naturally occurring nanoparticles originated from plants seem to be a better choice, especially since they have been demonstrated to be less toxic and easily biodegradable," Zhang said.

Sunscreens made with ivy nanoparticles may not need to be reapplied after swimming. That's because the plant's nanoparticles are a bit more adhesive so sunscreens made with them may not wash off as easily as

traditional sunscreens. And while sunscreens made with metal-based nanoparticles give the skin a white tinge, sunscreens made with ivy nanoparticles are virtually invisible when applied to the skin.

Provided by University of Tennessee at Knoxville