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A Silver Coating in the Fight Against Microbes

Silver nanoparticles could be the next step forward in antibacterial products.

By Monica Heger

PAINT IT DEAD: Could paint containing puny particles of silver hold the key to wiping out bacteria in hospitals and other places?
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A new technique in paint making could soon make almost any surface germfree. Researchers have made paint that is embedded with silver nanoparticles known for their ability to kill bacteria and other microbes, in the hope that hospitals will coat their walls and countertops to fight infection.

According to the U.S. Centers for Disease Control and Prevention (CDC), more than one million people a year contract bacterial infections in hospitals. Silver itself is an excellent bacteria fighter, and in nanoparticle form it is even more potent at killing microorganisms. So far it has not shown any adverse effects in humans.

Some scientists, however, are concerned that silver nanoparticles may not be as harmless as they appear. Little research has been done on their health and environmental effects, and silver kills good microorganisms along with the bad. Also, there are currently no restrictions on using silver nanoparticles, which are already popping up in a range of consumer products that tout their antibacterial properties.

"Nanoparticles are very small and they are interacting with the bacteria and rupturing the cell wall," says chemist George John of The City College of New York and lead author of the study, published recently in the journal *Nature Materials*. This rupturing kills the bacteria, he explains.

A silver nanoparticle is a small cluster of silver atoms less than 100 nanometers, or 100 billionths of a meter, wide. Because of their size, nanoparticles exhibit different properties than their bulkier counterparts. They react more readily

with their surroundings, which makes them dissolvable in paint. Nanoparticles are also being studied for their potential medical uses, particularly in drug delivery, because they are able to pass easily through cell membranes.

Silver has long been known to be a good antimicrobial, and nanoparticles consisting of this metal are no different. John tested the paint on both *Escherichia coli* and *Staphylococcus aureus* bacteria. In both cases, when the strains were added to a glass slide coated with the silver-infused paint and incubated at favorable conditions, there was no growth of either organism. In contrast, slides without the paint and slides with silver-free paint both showed bacterial growth.

"It is more or less like a soaping or detergent effect," says Lucian Lucia, associate professor of chemistry at North Carolina State University. The nanoparticle destroys the cell wall of the microbe.

Lucia and John both agree that bacteria cannot build up a resistance to silver nanoparticles as they can to antibiotics, because of the way the it attacks—destroying the physical structure of the cells, which kills them. Antibiotics, on the other hand, suppress the activity of bacteria but don't necessarily exterminate them. "That's the beauty of silver," Lucia says. "There's no way to develop a resistance to it."

John says he is also experimenting with different size nanoparticles. Changing the size also changes the color. So, a blue paint would use different size nanoparticles than a red paint. Currently, the size of the silver nanoparticles he is using turns the paint yellow.

The next step is to do more health and safety tests and to determine how long the paint retains its bactericidal properties. John believes it will keep its germ-killing abilities for up to three years but says it could be longer.

Silver's ability to kill bacteria has long been known, but not everyone is sold on the idea of using its nanoparticle version in consumer products. Limited research has been done on how long the nanoparticles keep their antimicrobial properties and how they interact with other organisms, which is critical because of the particles' ability to penetrate cell membranes. Some people may be uncomfortable lathering on sunscreen if it contains silver nanoparticles.