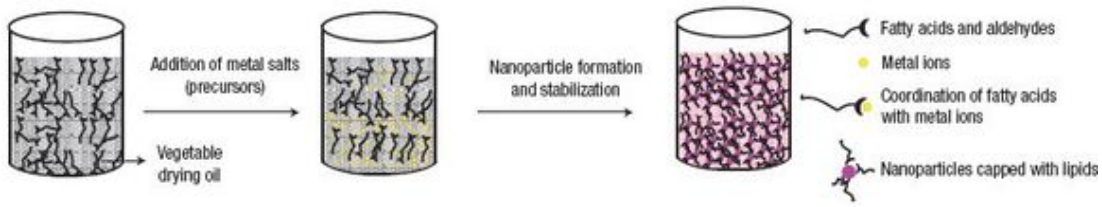
Silver Nanoparticles Deadly to Bacteria



Schematic diagram of in situ synthesis and stabilization of silver nanoparticles in drying oils. Copyright: Nature Materials, 2008.

Hygienic, antibacteria sprays can be harmful to the environment as well as germs. Toxic solvents are necessary to ensure that bacteria is destroyed but now there could be a new way to achieve this without the environment paying the price.

In new work published this month in *Nature Materials*, George John and his team at the City College of New York, in collaboration with Pulickel Ajayan's research group at Rice University, Houston, US, have developed an antibacterial paint based on silver nanoparticles embedded vegetable oils that can be used to coat a wide range of surfaces, including wood, plastic, and glass.

Silver, and silver-based compounds, is highly antimicrobial thanks to its antiseptic properties to several species of bacteria, including the common kitchen microbe, E. coli. Silver nanoparticles interact with the outer membrane of bacteria, causing structural changes that lead to degradation and eventually death of the microbe.

In contrast to the usual methods of producing metal nanoparticles, which involve the use of toxic solvents and highly reactive chemical reducing agents, the paint is produced in a simple, cost-effective, and environmentally safe manner, because the nanoparticles are synthesized directly in the paint itself. The team's new method makes use of a natural, oxidative property of paint that occurs during drying.

In most household paints the binding agent is based on alkyd resin, vegetable-derived drying oils that release free-radical particles during the drying process. When a silver compound is added to the paint, the free radicals act as a natural reducing agent, transforming the metal salt into metal nanoparticles. The nanoparticles are relatively low in concentration and are tightly bound into the polymer network of the binder. The process is simple, inexpensive, and importantly, harmless to the environment.

To test the antibacterial properties of the paint, the team incubated E. coli bacteria overnight on a plain glass slide, a slide coated in normal paint, and a slide coated with the nanoparticle paint. They found that the paint embedded with silver particles killed all the bacteria in comparison to the control slides, a result that confirms that the nanoparticles are toxic to bacteria.

The novel fabrication technique is good news for the environment and the germ-killing paint has far-reaching applications, particularly in the medical, cleaning, and food-preparation industries. "The alkyd paints could be used for both indoor and exterior uses," explained George John. "The excellent antibacterial activity means that the paint could easily be used to coat hospital counter tops, for example, and similar places where there is a potential bacterial contamination."

Article information: *Nature Materials*, 2008, doi:10.1038/nmat2099

Source: by Sophie Ladden, Wiley