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Nanoparticles help paint resist germs

Nanotechnology

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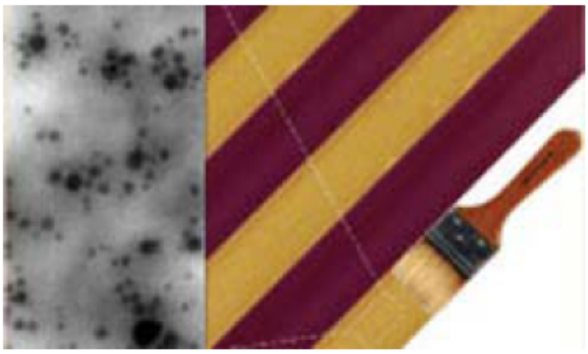
Polymer coatings embedded with metals or metal nanoparticles have shown promise in applications where surfaces are needed to resist microbial growth. But manufacturing techniques used so far have been complicated, expensive, or even environmentally hazardous.



Transmission electron micrograph of nanoparticles in paint colored yellow with Ag nanoparticles. Similar Au nanoparticles are present in the paint tinted red. (Courtesy of George John and Praveen Kumar Vemula/CCNY.)

Now researchers at the The City College of New York (CCNY), the City University of New York, and Rensselaer Polytechnic Institute have created antimicrobial paints that contain Au or Ag nanoparticles that totally resist the growth of bacteria using an environmentally friendly single-step process [Kumar *et al.*, *Nat. Mater.* (2008) doi: 10.1038/nmat2099].

The simple approach developed by the researchers adds Ag or Au metal salts to commerially available paints based on vegetable oils. As the paints dry, they change color to yellow in the case of Ag and pink in the case of Au, indicating the presence of nanoparticles.

When sprayed with either the gram-positive bacteria *Staphylococcus aureus* or the gram-negative bacteria *Escherichia coli*, the coatings completely kill the microbes because of the high surface area of the suspended particles.

The growth of the nanoparticles results from the presence of fatty acids such as linoleic acid, which have unsaturated carbon-chain backbones. As the paint dries, free radicals are generated along the carbon chains, reducing the dissolved metal ions and nucleating nanoparticles.

“Free radicals are known to reduce Au, Ag, and many other metal ions to metal nanoparticles,” says George John of CCNY who lead the research. They used the natural phenomenon of autoxidation, or the oxidative drying of oils, he explains.

“This process is well studied as a cascade reaction mediated by very active free radicals formed by the oxidation process in nature. We are efficiently using the in situ-formed free radicals to reduce metals during the drying process of paints.”

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