Nanoparticle impact on plants

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Nanoparticles of aluminum oxide, commonly found in everything from sunscreen lotions to environmental catalysts that reduce pollution, can stunt root growth in plants, although preliminary findings suggest extremely high concentrations of such particles are necessary for such damage, experts told UPI's Nano World.

"It's not the end of plant life as we know it, but it does look as if we should look further here, and it may be something we need to take seriously," said environmental scientist Daniel Watts at the New Jersey Institute of Technology in Newark.

The report, among the first to study the potential impact of nanoparticles on plants, suggests coating them beforehand could help allay their unintended effects.

"We're not trying to stop nanotechnology, but to understand where there may be problems and to find ways to ameliorate them before they become a serious issue," Watts said.

Nanoparticles might leach into the water from landfill runoff or become airborne as part of garbage that got incinerated, Watts said. He and his colleague Ling Yang tested varying concentrations of aluminum oxide nanoparticles suspended in water against five hydroponically grown species of plants: cabbage, carrot, corn, cucumber and soybean. The particles, each some 13 nanometers wide, are roughly the smallest aluminum oxide nanoparticles commercially available.

At concentrations of two milligrams per milliliter, the researchers saw a significant reduction in root growth. No results were seen at lower concentrations. "Two milligrams per milliliter is a very, very high level. Would you see that in nature? It might be a bit of a stretch," Watts said.

Watts and his colleagues also examined the effects of titanium dioxide and silicon dioxide nanoparticles of roughly equal size, and found silicon dioxide grains promoted root growth while titanium dioxide particles had no obvious effect. Silicon dioxide nanoparticles are used in anti-fogging coatings and potentially as DNA carriers, while titanium dioxide nanoparticles are found in sunscreen. Research is under way to incorporate them into solar panels and wastewater treatment as well.

"As they become more and more popular, I think the risk of exposure from nanoparticles will increase," Watts said.

Since airborne nanoparticles might conceivably get coated with other pollutants in the air, the researchers coated nanoparticles with a common pollutant known as phenanthrene. The pollutant appeared to actually inhibit both the root-stunting effect of aluminum oxide nanoparticles and the root-growth-promoting effect of silicon dioxide nanoparticles.

"That suggests there may be ways to modify the surfaces of nanoparticles to overcome their toxicity," Watts said. Their findings appear in the journal Toxicology Letters.

Future experiments should test nanoparticles and plants under more complete situations, including a larger variety of plant-growing conditions and nanoparticle sizes and exposure mechanisms. "If these nanoparticles are having this kind of effects on the roots, what kind of effect would they have on leaves?" Watts asked.

"It's a start into looking into the toxicity of nanotechnology on plant

functions. There isn't much research in this area," said Barbara Karn, an Environmental Protection Agency scientist currently detailed to the Project on Emerging Nanotechnologies at the Smithsonian Institution in Washington. "It's good to start getting a handle on what effects nanomaterials might have on species aside from humans."