

Popular nanoparticle causes toxicity in fish, study shows

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(PhysOrg.com) -- A nanoparticle growing in popularity as a bactericidal agent has been shown to be toxic to fish, according to a Purdue University study.

Tested on fathead minnows — an organism often used to test the effects of [toxicity](#) on aquatic life -- nanosilver suspended in solution proved toxic and even lethal to the minnows. When the nanosilver was allowed to settle, the solution became several times less toxic but still caused malformations in the minnows.

"Silver nitrate is a lot more toxic than nanosilver, but when nanosilver was sonicated, or suspended, its toxicity increased tenfold," said Maria Sepulveda, an assistant professor of forestry and natural resources whose findings were published in the journal *Ecotoxicology*. "There is reason to be concerned."

Sepulveda and doctoral student Geoff Laban exposed fathead minnows to nanosilver at several stages of their development, from embryo to the point where they swim up from the bottom of their habitats to eat for the first time. Even without sonication, nanosilver caused malformations that included head hemorrhages and edema, and ultimately proved lethal.

Using electron microscopy, Sepulveda was able to detect nanosilver particles measuring 30 nanometers or less inside the minnow embryos. Thirty nanometers is more than 3,000 times smaller than the diameter of a human hair.

"These nanosilver particles are so small they are able to cross the egg membranes and move into the fish embryos in less than a day," Sepulveda said. "They had a potentially high dose of silver in them."

Nanosilver is growing in popularity as a component of many products. It is used to kill bacteria in goods such as odor-control clothing, countertops, cutting boards and detergents. Currently, there are few regulations for nanosilver's applications in products, but Ron Turco, professor of agronomy and the paper's co-author, said the Environmental Protection Agency is reviewing the situation.

Turco also indicated there has been little work done to estimate the current level of nanosilver being released into the environment.

"Silver has been used in the past as an antimicrobial agent. It's a known toxicant to microorganisms," he said. "Nanosilver is being considered by the EPA for environmental exposure profiling, much like a pesticide."

Turco said it's unclear how nanosilver exposure might affect human health; however, he said that silver solutions have been considered by some to be a probiotic, and low dosages are sometimes consumed for intestinal health.

"The use of nanosilver could provide a number of sanitary benefits if used properly," Turco said. "However, the indiscriminate inclusion of nanosilver into products to simply allow them to say they are antimicrobial is creating a cautionary issue."

Sepulveda said she plans to develop tests to understand the effect different [nanoparticles](#) have on [fish](#) and other organisms. She also wants to develop testing to determine nanosilver concentrations in the environment.

"How are we going to know the risk unless we know the concentration of these particles?" Sepulveda said.

More information: The Effects of Silver Nanoparticles on Fathead Minnow (*Pimephales Promelas*) Embryos, *Ecotoxicology*, March 2010.

Provided by Purdue University

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