Nanoparticles affect pollutant toxicity

Nanoscience and nanotechnology are relatively new, but already nanoparticles made from C60 (Buckminster fullerenes) are finding potential applications in consumer products ranging from car lubricants to cosmetics and medicines. New research suggests that nanoparticles, when released into water systems, may interact with other common pollutants in aquatic environments with important consequences for their toxicity to plant and animal life.

Other organic (carbon-based) chemicals are known to have an effect on the toxicity of pollutants to plant and animal life. But nanoparticles like C60 have unique and altered properties compared to larger particles, and so they may have a very different effect on the toxicity and availability of pollutant molecules, which can attach themselves to C60. The nanoparticles themselves may also be inherently toxic.

Researchers from the Technical University of Denmark and the University of Copenhagen, Denmark tested the effect of four common pollutant chemicals: atrazine, methyl parathion, pentachlorophenol (PCP) and phenanthrene on green algae and freshwater crustaceans. The researchers found that when C60 nanoparticles were present, they affected the availability of the toxic chemicals to the organisms. When phenanthrene was attached to C60, it was more toxic to algae at lower concentrations, for instance, and was more available to the crustaceans, for whom it is toxic. However, PCP in combination with C60 was less toxic to both algae and crustaceans. The C60 had little effect on the toxicity of the other two pollutants tested.

Nanoparticles affected how quickly and how much of the pollutant was taken in by the organisms. Clumps of the C60 itself also stuck to the crustaceans’ bodies and inside their digestive systems.

The authors recommend that nanoparticle risk assessment take into account not just the toxicity of the particles themselves, but also the possible interaction with other environmental contaminants. They also suggest that further research into the effects of nanoparticles’ different phases (in particular their behaviour in water as they form suspensions or clumps of molecules know as aggregates) is also relevant to their potential toxicity in the aquatic environment.


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