Silver Nanoparticles: Reducing Environmental Toxicity Through Shape Control

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The increasing usage of silver nanoparticles (AgNPs) in consumer and antibacterial products without regulation raises concerns about their environmental toxicity. Silver nanospheres have been shown to have toxic effects to a variety of organisms but the ecotoxicology of other AgNP shapes has not been established. Different shapes could help solve the problem of the environmental toxicity of AgNPs that are released into the environment. This study found that silver nanocubes and nanoplates were significantly less toxic than silver nanospheres to the model plant species Lemna minor when exposed for 7 days (OECD Guidelines) but displayed no significant difference in growth inhibition using the agar disk diffusion method for the model bacteria Escherichia coli (modified CLSI procedures). Frond fresh weight was measured in milligrams for L. minor by carefully blotting dry on paper towels. Frond area was measured in square millimeters using ImageJ. Silver nanospheres were up to 15.12% more toxic than silver nanoplates and nanocubes. These findings could help in creating new consumer products in the growing industry of nanotechnology that have less environmental toxicity but similar antibacterial effects after their intended use. This study also helps research in many other areas, such as biotechnology, medicine, pharmacy, ecology, electronics due to the new knowledge that the shapes of nanoparticles affect their usefulness.

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