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Comparative Study of the Sensitivity of Two Freshwater Gastropods, Lymnaea Stagnalis and Planorbarius Corneus, to Silver Nanoparticles: Bioaccumulation and Toxicity

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Abstract : Metal-based nanoparticles (NPs) are considered detrimental to aquatic organisms due to their potential accumulation. However, little is known about the mechanisms underlying these effects and their species-specificity. Here, we used stable silver (Ag) NPs (20 nm, from 10 to 500 µg/L) with a low dissolution rate (≤2.4%) to study the bioaccumulation and biological impacts in two freshwater gastropods: Lymnaea stagnalis and Planorbarius corneus. No mortality was detected during the experiments. Ag bioaccumulation showed a dose-related increase with an enhanced concentration in both species after 7d exposure. L. stagnalis displayed a higher accumulation for AgNPs than P. corneus (e.g., up to 18- and 15-fold in hepatopancreas and hemolymph, respectively), which could be due to the more active L. stagnalis having greater contact with suspended AgNPs. Furthermore, the hepatopancreas and stomach were preferred organs for bioaccumulation compared to the kidney, mantle and foot. Regarding biological responses, the hemolymph rather than hepatopancreas appeared more susceptible to oxidative stress elicited by AgNPs, as shown by significantly increasing lipid peroxidation (i.e., formation of malondialdehyde). Neurotoxicity was detected in L. stagnalis when exposed to high concentrations (500 µg/L). Comparison with impacts elicited by dissolved Ag revealed that the effects observed on AgNPs exposure were mainly attributable to NPs. These results highlighted the relationship between the physiological traits, bioaccumulation, and toxicity responses of these two species to AgNPs and demonstrated the necessity of species-specificity considerations when assessing the toxicity of NPs.

Keywords : nanotoxicity, freshwater gastropods, species-specificity, metals, physiological traits
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