

Aggregation and dissolution of silver nanoparticles in a laboratory based freshwater microcosm under simulated environmental conditions

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Abstract

Silver nanoparticles (NP) are used in several applications, including their use as antimicrobial agents in textiles, personal care, and other domestic products. As such, there is a high potential for the release of silver nanoparticles (AgNP) in the aquatic environment. In aquatic ecosystems, nanomaterials are affected by abiotic factors, such as temperature, that alter their chemistry and influence their fate in the environment. Preliminary studies indicate that NP tend to form aggregates which are potentially more recalcitrant than unaggregated NP. These and other fate processes are largely dependent on both the characteristics of the NP and that of the environment. In this study, lab experiments were conducted to investigate the physicochemical properties and temperature solubility of AgNP (<100 nm) that may potentially influence the fate and behavior of AgNP in the aqueous environment. Results indicated that, under these tested conditions, AgNP may be transformed in size and thereby affect fate, bioavailability, and toxicity. In this study, a novel method was used to determine whether AgNP would form agglomerates, or behave as isolated particles, or dissolve when in aqueous media and under different environmental conditions. The new aspects evaluated in this study demonstrated that AgNP are transformed in both size and state under variable environmental conditions.