Probing the differential fates and bioavailabilities of silver ion and silver nanoparticle in pond microcosmos by using isotope tracer

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Silver ion (Ag^+) and silver nanoparticle (AgNP) are widely used in various consumer products because of their antimicrobial properties [1]. It is generally accepted that the bioavailability and toxicity of Ag^+ is much higher than that of AgNP. However, many environmental factors (e.g. Cl^-, Ca^{2+}, and organic matter) could affect the fates of Ag^+ and AgNP. Therefore, the fates and bioavailabilities of Ag^+ and AgNP evaluated under controlled laboratory conditions (considering only one or two environmental factors) may not predict their behaviours in natural environments [2]. In this work, we investigated the differential distributions and bioavailabilities of Ag^+ and AgNP in pond microcosmos by using isotope tracer. It was observed that the half-life of Ag^+ (<1 h) in water column is much shorter than that of AgNP (~3 h), possibly owning to the formation AgCl precipitation. Accordingly, the uptake of AgNP by floating plants (*Pistia stratiotes* and *Salvinia natans*) was much higher than that of Ag^+. While, for submerged plant (*Ceratophyllum demersum*), the uptake of AgNP was comparable with that of Ag^+. *Pseudorasbora parva* can accumulate more AgNP than Ag^+, with higher concentration in liver and brain than other tissues. However, the uptake of Ag^+ by freshwater snail (*Procambarus clarkia*) was much higher than that of AgNP.

[1] Chernousova et al. (2013) *Angew. Chem.-Int. Edit.*, 52, 1636-1653. [2] Furtado et al. (2015) *ES&T*, 49, 8441-8450.