

Bioaccumulation and toxicity of silver nanoparticles and silver nitrate to the soil arthropod *Folsomia candida*

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Abstract

The growing use of silver nanoparticles (Ag-NP) triggered an increasing interest in their environmental fate and possible ecotoxicological impacts. To investigate the potential risk of Ag-NP to soil organisms, the springtail *Folsomia candida* was exposed to Ag-NP (reported diameter size 3–8 nm) and AgNO₃ in Lufa 2.2 natural soil for 28 days to determine effects on survival and reproduction. Also, the kinetics of uptake and elimination of Ag were studied for *F. candida* exposed in Lufa 2.2 soil to Ag-NP (at 168 mg Ag/kg dry soil) and AgNO₃ (at 30 and 60 mg Ag/kg dry soil).

AgNO₃ was toxic with an LC₅₀ was 284 mg Ag/kg dry soil for effects on survival and EC₁₀ and EC₅₀ values of 47.6 and 99.5 mg Ag/kg dry soil, respectively for the effect on reproduction. These values did correspond with porewater concentrations of 0.801, 0.042 and 0.082 mg Ag/l, respectively. No effects on survival and reproduction of Ag-NP were observed up to 673 mg Ag/kg dry soil, although porewater concentration was similar to the EC₅₀ for AgNO₃. Exposure to both Ag forms caused a fast uptake of Ag, but the Ag elimination rate was significantly higher for Ag-NP than for AgNO₃. Bioaccumulation factor was higher for AgNO₃ (on average 5.64) than for Ag-NP (1.12). These findings indicate that silver ions are more toxic than Ag-NP and have a higher potential to accumulate in *F. candida*.

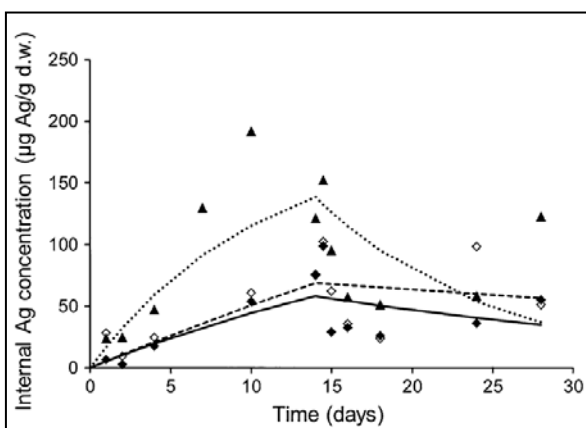


Fig. 2 Uptake and elimination kinetics of Ag in *Folsomia candida* exposed for 14 days to Lufa 2.2 soil spiked with AgNO₃ at 30 (closed diamond) and 60 (open diamond) mg Ag/kg dry soil or 168 mg Ag/kg dry soil (closed triangle). After 14 days, the animals were transferred to clean soil. Data points show mean concentrations measured in ten replicate samples; see Table S3 in the supporting information for the corresponding standard deviations. Lines represent the fit of the first order one-compartment kinetics model

Reference

Waalewijn-Kool et al. (2014). Bioaccumulation and toxicity of silver nanoparticles and silver nitrate to the soil arthropod *Folsomia candida*. *Ecotoxicology*, 23(9), 1629-1637

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