Trophic transfer of differently coated zinc oxide nanoparticles using crustaceans (Daphnia magna) and zebrafish (Danio rerio)

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WE083 Trophic transfer of differently coated zinc oxide nanoparticles using crustaceans (Daphnia magna) and zebrafish (Danio rerio) L. Skjolding, DTU / Department of Environmental Engineering; M. Winther-Nielsen, DHI; A. Baun, Technical University of Denmark / Department of Environmental Engineering. During the last couple of years the use of nanoparticles (NP) has dramatically increased. Zinc oxide nanoparticles (ZnO NP) have a wide range of applications e.g. in personal care products, paints and semi conductors. A limited number of studies have so far investigated the ecotoxicity of ZnO NP and to our knowledge the bioaccumulation behavior in regards to difference in functionalization of ZnO NP has not been studied previously. In this study, experiments with trophic transfer using *Daphnia magna* as food source for *Danio* rerio was carried out to test if changes in functionalization of ZnO NP would affect the bioaccumulation behavior compared to ZnO NP. *D. magna* was exposed to pristine and functionalized ZnO NP in concentrations considered non-lethal in a 6341 Daphnia immobilization test. Bioconcentration studies with *D. magna* included a 24h uptake and 24h depuration phase and it was found that steady state in regards to body burden was reached after 24h uptake. The trophic transfer studies were carried out as 14 d of uptake feeding with pre-exposed *D. magna* and 7 d of depuration feeding with non-exposed *D.magna*. For the trophic transfer studies, 5 d old *D. magna* were exposed to 1 mg/L ZnO NP (ZnO NP and ZnO-C_8H_{17} NP) for 24h before feeding to *D. rerio* at a daily rate corresponding to 8% wet weight of the *D. rerio*. *D. magna* not eaten after 2 h was removed and the resulting exposure loading was corrected for in data treatment. The tested ZnO NP was of same primary size (35 nm) but with different functionalizations (ZnO and ZnO-C_8H_{17}). Characterization included ICP-MS, DLS, BET and TEM. Results show a fast uptake of ZnO NP in *D. rerio* reaching steady state after 5 d of exposure yielding a total body burden (BB) of 887±184 mg Zn/kg dw. A fast depuration (k_2 =-0.13 d^{-1}) was observed reaching steady state after 3 d of depuration. The calculated BioMagnificationFactor (BMF) was 0.15 with a biological half-life time ($t_{½}$) of 5.3 d. In contrast, ZnO-C_8H_{17} showed linear uptake in *D.rerio* during the 14 d of uptake thus not reaching steady state. A total BB of 2169±414 mg Zn/kg dw was observed past 14 d of uptake. However, the depuration rate was faster (k_2 =-0.32 d^{-1}) compared to ZnO NP. The BMF for ZnO-C_8H_{17} was 0.42 and a $t_{½}$ of 2.2 d. The studies demonstrate the feasibility of conducting bioconcentration and trophic transfer studies with NP and the results indicate that functionalizing of NP may affect the uptake and depuration of NP in aquatic organisms.