

Technical University of Denmark



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

Skjolding, Lars Michael; Winther-Nielsen, M.; Baun, Anders

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Skjolding, L. M., Winther-Nielsen, M., & Baun, A. (2013). Trophic transfer of differently coated zinc oxide nanoparticles using crustaceans (*Daphnia magna*) and zebrafish (*Danio rerio*). Abstract from SETAC Europe 23rd Annual Meeting, Glasgow, United Kingdom.

DTU Library
Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

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-C₁₈H₁₇ 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-C₁₈H₁₇). 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 ($k = -0.13 \text{ d}^{-1}$) was observed reaching steady state after 3 d of depuration. The calculated BioMagnificationFactor (BMF) was 0.15 with a biological half-life time ($t_{1/2}$) of 5.3 d. In contrast, ZnO-C₁₈H₁₇ 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 ($k = -0.32 \text{ d}^{-1}$) compared to ZnO NP. The BMF for ZnO-C₁₈H₁₇ was 0.42 and a $t_{1/2}$ 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.