



Comparative chronic toxicity of nanoparticulate and ionic zinc to the earthworm *Eisenia veneta* in a soil matrix

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Abstract

Manufactured nanoparticles (NPs) are increasingly being used in a range of consumer products and are already entering the environment. NP ZnO is one of the most widely used and potentially toxic NPs in aquatic exposures. It is likely that ZnO nanoparticles will also be bioavailable to soil organisms, studies on ZnO NP toxicity in a soil matrix are lacking. We exposed the earthworm *Eisenia veneta* to uncoated NP ZnO (b100 nm) dosed to soil and food at 250 and 750 mg Zn kg⁻¹ for 21 d. Concurrent exposures of equivalent ionic Zn were conducted with ZnCl₂ and for both forms effects on life history traits, immune activity and Zn body concentrations were compared. Despite slightly higher measured body concentrations, NP ZnO generally had less impact than ZnCl₂ on measured traits. At 750 mg Zn kg⁻¹, reproduction declined by 50% when exposed to NP ZnO but was almost completely inhibited by ZnCl₂. Similarly, immune activity was unaffected by NP ZnO but was suppressed by 20% when exposed to ZnCl₂. Scanning electron microscopy analysis of worm tissues following 24 h aqueous exposure showed the presence of ZnO particles suggesting that NPs can be taken up in particulate form. This may explain the reduced effects at similar body concentrations seen in the soil study. Our findings suggest that risk assessments do not need to go beyond considering the metal component of NP ZnO in soils at least for the larger size uncoated particles considered here.

Reference

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