The effect of pH on the toxicity of Zinc Oxide nanoparticles to *Folsomia candida* in amended field soil.

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Abstract

The effect of soil pH on the toxicity of 30 nm ZnO to Folsomia candida was assessed in Dorset field soils with pHCaCl2 adjusted to 4.31, 5.71, and 6.39. To unravel the contribution of particle size and dissolved Zn, 200 nm ZnO and ZnCl2 were tested. Zinc sorption increased with increasing pH, and Freundlich kf values ranged from 98.9 (L/kg)1/n to 333 (L/kg)1/n for 30 nm ZnO and from 64.3 (L/kg)1/n to 187 (L/kg)1/n for ZnCl2. No effect of particle size was found on sorption, and little difference was found in toxicity between 30 nm and 200 nm ZnO. The effect on reproduction decreased with increasing pH for all Zn forms, with 28-d median effective concentrations (EC50s) of 553 mg Zn/kg, 1481 mg Zn/kg, and 3233 mg Zn/kg for 30 nm ZnO and 331 mg Zn/kg, 732 mg Zn/kg, and 1174 mg Zn/kg for ZnCl2 at pH 4.31, 5.71, and 6.39, respectively. The EC50s based on porewater Zn concentrations increased with increasing pH for 30 nm ZnO from 4.77 mg Zn/L to 18.5 mg Zn/L, while for ZnCl2 no consistent pH-related trend in EC50s was found (21.0–63.3 mg Zn/L). Porewater calcium levels were 10 times higher in ZnCl2-spiked soils than in ZnO-spiked soils. The authors' results suggest that the decreased toxicity of ZnCl2 compared with 30 nm ZnO based on porewater concentrations was because of a protective effect of calcium and not a particle effect.

Reference

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