Advice note 1 – NanoFATE has demonstrated an effect of coating on the behaviour and toxicity of ZnO NPs to springtails.

Advice notes to answer the big five questions

NanoFATE has identified five "Big Questions" important to our understanding of the ecotoxicology of engineered nanoparticles and will help provide key information required to assess the risk that these materials may pose to the environment.

This advice note is in response to the question:
What effects do coatings have on fate, behaviour & toxicity?

Rationale & Methods

To assess the effect of long term dissolution on bioavailability, triethoxyoctylsilane coated and uncoated zinc oxide nanoparticles, non-nano ZnO and zinc chloride ($ZnCl_2$) were equilibrated in natural soil for up to 12 months. Porewater zinc concentrations were determined as it was hypothesized that both ZnO nanoparticle and $ZnCl_2$ toxicity is attributable to soluble Zn (<100 kDa) concentration.

Results & Conclusions

In this long term soil experiments (>one year) we showed that porewater concentrations of total zinc peaked at intermediate uncoated zinc oxide ENP concentrations (~1000 mgZn/kg dry weight)and that for coated ZnO particles the release of Zn into the porewater was delayed (Figure 1). These results that a surface coating coating could delay the dissolution of ZnO nanoparticles in soil.

More information

These results along with other further examples of our work in this area can be found in our public summary "D4.3 Research report and associated research paper addressing the current state-of-the-art in analysis of ENP property effects on toxicity property–effect relationships.", and in the paper in Environmental Pollution, vol. 178; pp. 59-64.

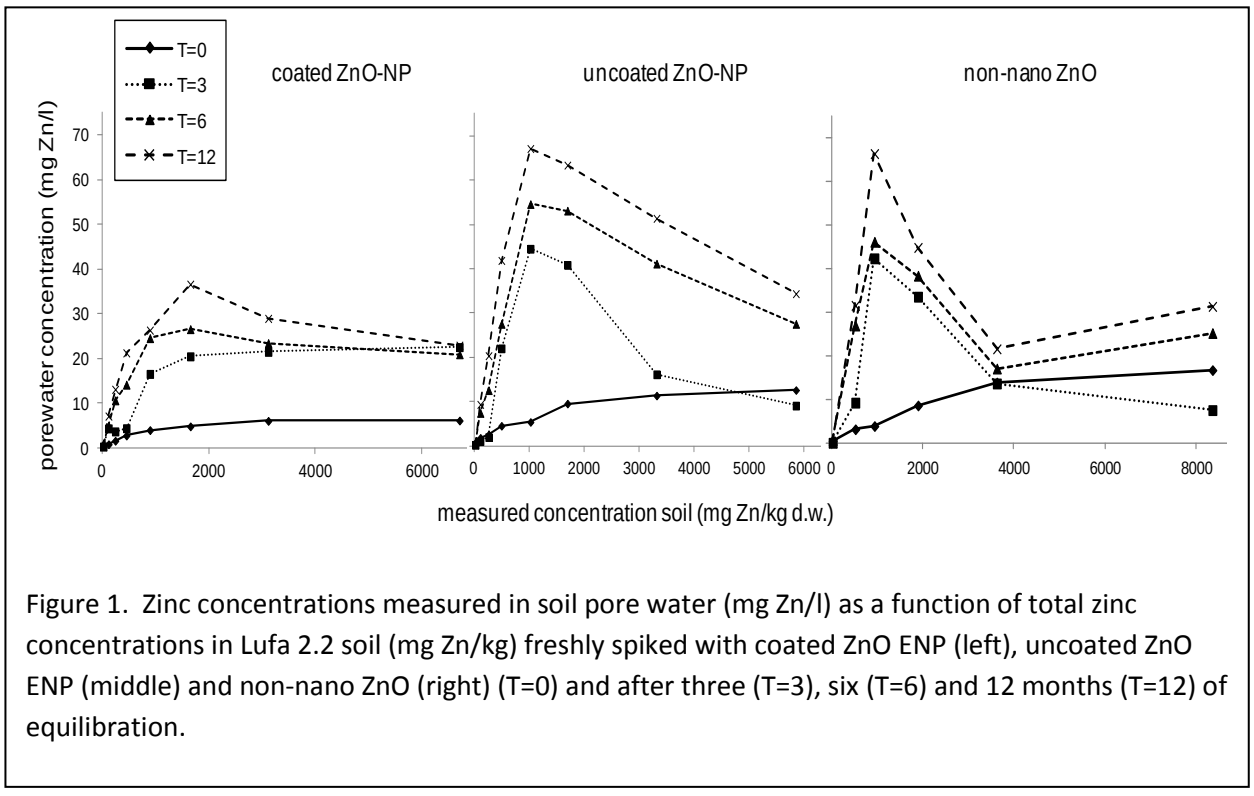

Figure 1. Zinc concentrations measured in soil pore water (mg Zn/l) as a function of total zinc concentrations in Lufa 2.2 soil (mg Zn/kg) freshly spiked with coated ZnO ENP (left), uncoated ZnO ENP (middle) and non-nano ZnO (right) (T=0) and after three (T=3), six (T=6) and 12 months (T=12) of equilibration.

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