Impact of soil properties on the geochemical availability of metal-based engineered nanoparticles in soil

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Data from controlled laboratory studies suggest that the fate of engineered nanoparticles (ENPs) in soils is determined by a combination of both soil properties, surface chemistry and size-related properties of ENPs. Studies addressing the geochemical dynamics of ENPs after being added to soils are however scarce.

To study the availability of ENPs under natural soil conditions a pot experiment with 3 soils of variable properties (pH=5.5-8.1; OC=0.80-2.1 %; clay=15-36 %) was performed to determine the geochemical availability as reflected by solubility and reactivity of Ag, Au, TiO_2 and ZnO ENPs added to soils under environmentally relevant conditions. Pore water samples and changes therein during a period of 60 days were determined using 170 nm membrane filter probes at two different depths. Changes in the potential geochemical reactivity after 60 days were measured using a dilute nitric acid extraction. The presence, morphology and (hetero)aggregation of ENPs in pore waters were determined by TEM, SEM, EDX and UV-Vis. The total concentration of Ag, Au, Ti and Zn in pore water was measured by ICP-OES.

In this presentation dynamics of the transformation of these ENPs in soils (notably heteroaggregation and solubility), the interactions of the ENPs with the variable soil components as well as the effect of these factors in controlling the availability of ENPs in porous media, potential transport to water systems and plant uptake will be discussed in detail.

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