# Accumulation of trace elements in paddy soil and dry land under different geological background

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To establish a rational farming mechanism, it is essential to know the relative contributions of both natural and anthropogenic sources to the trace elements in agricultural soil. Our results indicate that the difference of physicochemical properties in natural soils derived from three types of geological parent material is significant ($p<0.01$), but there are no significant differences between trace element contents. Trace element concentrations in most agricultural soils are far beyond natural soils and most of paddy soils have higher trace element contents than dry land soils, which indicates that anthropogenic input strongly influenced trace elements in agricultural soil and more seriously the paddy soil. In dry land, the basic physicochemical properties of soils are similar to those of natural soils derived from same geological parent material. Trace element contents exhibit high relationships with soil pH, C/N and physical clay (<0.01mm) ($p<0.05$). The soil derived from carbonate rock has relative high contents of trace elements and alkaline condition of the soil make the significant enrichments of Cd, Cr and Hg in dry land. The soil derived from red residua has the highest values of Pb and As contents in dry land, partly because the type of soil has amount of physical clay which could weaken the mobility of trace elements. In the paddy field, the differences of paddy soils derived from different parent materials are fading slowly due to numerous times of irrigation and drainage. The key difference is that most of paddy soils derived from carbonate rocks show neutral to alkaline, others show neutral to acidic in paddy fields. Traced element contents have just a pronounced relationship with cation exchange capacity (CEC) ($p<0.05$). With exception of Cr and Hg in paddy soil derived from carbonate rock, different geological background didn't significantly influence the trace element contents.

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# Transport and aggregation behavior of quantum dots and model nanoparticles in soil environments: Role of soil chemistry and biofilms

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Recent reports underline the potential environmental risks linked to the ‘nano’ revolution, yet little is known regarding the fate and impacts of engineered nanomaterials following their release in natural soils and groundwaters. To better understand the transport and fate of these materials in natural environments, a growing number of experimental studies are being conducted. Studies of nanoparticle transport in soils commonly involve laboratory-scale packed column experiments and more recently, deposition experiments using a quartz crystal microbalance (QCM). Such experimental investigations of nanoparticle transport and deposition provide valuable insights into their migration behavior and, hence, potential risks linked with the release of these materials in the natural environment.

Ongoing studies in our laboratory are aimed at examining the transport and aggregation behavior of commercial quantum dots (QDs) and model polystyrene latex nanoparticles in natural and model soil environments. Well-controlled experiments are conducted over a wide range of soil porewater chemistries to understand the role of salt concentration, ion valence and dissolved macromolecules on nanoparticle transport and stability. Moreover, the mobility of the nanoparticles in the presence of soil biofilms is evaluated using laboratory-scale column studies. Transport and deposition studies are complemented with physicochemical characterization of the nanoparticles and collector surfaces using several techniques (e.g. Kelvin probe force microscopy (KPFM), dynamic light scattering (DLS), transmission electron microscopy (TEM), confocal laser scanning microscopy (CLSM) and laser Doppler velocimetry (LDV)). Taken together, this data is used to interpret the stability of the quantum dots and model nanomaterials in soil environments.