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Effects of carbon-based nanoparticles (CNPs) on the fate of endocrine disrupting chemicals (EDCs) in different agricultural soils.

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Nanotechnology is a major innovative scientific and economic growth area. To date there is a lack about possible adverse effects that may be associated with manufactured nanomaterial in terrestrial environments. Since it is known that on the one hand carbon-based nanoparticles (CNPs) and endocrine disrupting chemicals (EDCs) strongly interact in wastewater and that on the other hand CNPs and EDCs are released together via wastewater irrigation to agricultural soils, knowledge of CNP effects on the EDC fate in the soil environment is needed for further risk assessments. The overall goal of this project is to gain a better understanding of interaction of CNPs with EDCs within the soil system.

Three different soil samples were applied with different CNPs, EDCs and CNP-EDC complexes and incubated over a period of 6 weeks. The EDC mineralization as well as their uptake by soil microorganisms was monitored to describe impacts of the nanomaterial on the EDC fate. As quality control for the biological soil activity soil respiration, enzyme activities and the soil microbial biomass were monitored in all incubated soil samples.

Clearly, EDCs bound in CNP complexes showed a decrease in mineralization. While the free EDCs showed a total mineralization of 34 to 45 %, the nano complexed EDCs were only mineralized to 12 to 15 %. Since no effects of the nanomaterial on the biological soil activity were observed, we conclude that the reduced EDC mineralization is directly linked to their interaction with the CNPs. Since additionally the EDC adsorption to CNPs reduced the EDC uptake by soil microorganism, we assume that CNPs generally form more or less recalcitrant aggregates which likely protect the associated EDCs from degradation.