Geophysical Research Abstracts
Vol. 14, EGU2012-1357, 2012
EGU General Assembly 2012

Modes of interaction between inorganic engineered nanoparticles and biological and abiotic surfaces

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Engineered nanoparticles aging and transformation pathways in natural environmental systems are linked with their attachment to surfaces of organisms, plant leaves, biofilms, soil or sediment particles.
In this study we investigated attachment of nAg0 and $nTiO_2$ to plant leaves and organic and inorganic model surfaces and daphnia with the objective to understand the physicochemistry behind these interactions as well as potential ecological effects linked with this attachment.

Surface-nanoparticle interactions were investigated in well-defined sorption studies and compared to conditions in in ecotoxicological test systems. Model surfaces were chosen to cover a wide range of intermolecular interactions considering van-der Waals interactions as well as proton donor and acceptor interactions. The nanoparticle-surface complexes were analysed with microscopic techniques including optical microscopy, environmental scanning electron microscopy and atomic force microscopy (AFM) as well as with respect to physicochemical interactions.
While deposition of nanoparticles in ecotoxicological test systems is often determined by aggregation, and toxicity may be induced by physical effects, sorption of nanoparticle from stable suspensions is controlled by the chemical nature of the model surfaces as well as by the surfaces accessible for the nanoparticles.
The current results show that attachment is determined by an intensive interplay between physicochemical nanoparticle-surface interactions, aggregation stability and physical characteristics. This interplay will mutually affect the ecological relevance, including further fate, transport and effects of the nanoparticles in the environment.