



## **Sorption of untreated and humic acid coated silver nanoparticles to environmental and model surfaces**

Priya M. Abraham (1), Thomas Baumann (2), and Gabriele E. Schaumann (1)

(1) University Koblenz-Landau, Environmental and Soil Chemistry, Landau, Germany (schaumann@uni-landau.de), (2) Technische Universitaet Muenchen, Institute of Hydrochemistry, München, Germany (tbaumann@tum.de)

The environmental fate of engineered nanoparticles is controlled their colloidal stability and their interaction with different environmental surfaces. Little is known about sorption of nanoparticles to environmental surfaces under quasi-equilibrium conditions. Nevertheless, sorption isotherms may also be a valuable means of studying nanoparticle-sorbent interactions. We investigated sorption of engineered silver nanoparticles (nAg) from stable and unstable suspensions in presence and absence of natural organic matter (NOM) to model surfaces (sorbents with specific chemical functional groups) and environmental materials (plant leaves and sand). Morphology and nanomechanical parameters of the surfaces covered with nanoparticles were assessed using atomic force microscopy (AFM) and scanning electron microscopy (SEM). The sorption of nAg from stable suspensions and in absence of NOM was non-linear and best described by a Langmuir model, where Langmuir coefficients varied with sorbent surface chemistry, which suggests monolayer sorption (Abraham et al. 2013). For nAg sorption from an unstable suspension, the sorption isotherms did not follow any classical sorption models, suggesting interplay between aggregation and sorption (Abraham et al. 2013).

In contrast, sorption was strongly suppressed and exhibited linear sorption isotherms in the presence of NOM. The difference in sorption isotherms suggests predominance of different sorption mechanisms depending on presence or absence of NOM, which can be only partly explained by the NOM coating alone. On the basis of the current results, a partial release of NOM coating for sorption of certain surfaces cannot be excluded. The validity of the Langmuir isotherm suggests monolayer sorption, which can be explained by the blocking effect due to electrostatic repulsion of individual nanoparticles. In unstable suspensions, aggregates are instead formed in suspension, formed on the surface and then sorbed, or formed in both ways.

Reference: Abraham, P.M.; Barnikol, S.; Baumann, T.; Kuehn, M.; Ivleva, N. & Schaumann, G.E. (2013). Interaction of silver nanoparticles with environmental and model surfaces. *Environmental Science & Technology*, 47, 5083–5091.