Geophysical Research Abstracts
Vol. 20, EGU2018-15079, 2018
EGU General Assembly 2018

Nanoparticle distribution in aquatic-terrestrial systems: (What) can we (not) learn from mesocosm studies?

Gabriele E. Schaumann (1), Kurtz Sandra (1), Metreveli George (1), Klitzke Sondra (2), Seitz Frank (3), Rosenfeldt Ricki (3), Baumann Thomas (4), Bundschuh Mirco (5), Luederwald Simon (3), Lang Friederike (6), Manz Werner (7), Schulz Ralf (3), and Vogel Hans-Joerg (8)

(1) University Koblenz-Landau, Institute for Environmental Sciences, Group of Environmental and Soil Chemistry, Landau, Germany (schaumann@uni-landau.de), (2) Berlin University of Technology, Institute of Ecology, Department of Soil Science, Berlin, (3) University of Koblenz-Landau, Institute for Environmental Sciences, Group of Ecotoxicology and Environment, Landau, (4) Technische Universität München, Institute of Hydrochemistry, Munich, (5) University of Koblenz-Landau, Institute for Environmental Sciences, Group of Aqautic Functional Ecotoxicology, Landau, (6) Albert-Ludwigs-Universität Freiburg, Institute of Forest Sciences, Chair of Soil Ecology, Freiburg i.Br., (7) University Koblenz-Landau, Institute of Integrated Science, Department of Biology, Koblenz, (8) Helmholtz Centre for Environmental Research UFZ, Department of Soil Physics, Halle/Saale

Distribution and biological functioning of engineered inorganic nanoparticles (EINP) are more or less strongly determined by masking and catching mechanisms in aquatic, terrestrial systems and their transition zones. Although increasing understanding on fundamental processes and mechanisms is generated, it is still a challenge to use this knowledge for reliable fate and effect predictions in the environment. Mesocosm studies can help to close the gap between lab-based knowledge and complex environmental conditions. A number of limitations have to be overcome for a comprehensive assessment, like the limited number of replicates, natural background levels of EINP in different compartments and thus the difficulty to differentiate between engineered and natural particles, detectability and the possibility to characterize aged EINP in the system despite very low concentrations and high background.

Using the example of a newly designed floodplain mesocosm system equipped with river Rhine water and soil from an adjacent floodplain, in which regular flooding events and input phases for EINP were simulated over a total duration of 33 weeks, we studied fate and effects of Ag NPs and TiO_2 NPs. We focused on bioaccumulation, mass balances, transport in soil and mobility in aquatic and aquatic-terrestrial transition zones. Significant parts of the EINP were found in algae and in sediment and in the floodplain soil as well as in the aqueous phase. Although effects on gammarids were low, accumulation in algae and soil are alarming results for long-term environmental impact assessments. Additionally, the long lifetime in the aqueous phase suggests long-range transport of Ag-NP in rivers.

In this contribution, we want to present implications of our findings in the context of possibilities and limitations of mesocosms and suggest strategies to overcome the mentioned challenges.