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The fate of nanoparticles in soils and saturated systems

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Nanoparticles (NP) enter soils through various pathways. In soils, they undergo different interactions with the liquid and the solid phase. These interactions may govern the chemical and colloidal stability of the NP and hence affect their prospective fate. Understanding NP fate in saturated systems is of relevance in order to assess any potential risks for the contamination of groundwater, which often serves as a drinking water resource.

In the literature, a fair body of knowledge has been established on the individual impacts of dissolved organic matter (DOM), multivalent ions, and intrinsic particle size on NP colloidal stability. However, little is known about the interactive effects of these parameters as well as the impact of the type of soilborne DOM. In batch studies, using different types of soil solutions, we investigated some of these interactions as well as the effect of DOM characteristics on NP stability.

Further, the potential risk for a breakthrough of both environmentally 'aged' NP and synthetically coated NP in an artificial riverbank filtration system was studied. In addition, factors leading to the remobilization of initially immobilized particles were identified.

The presented work provides an overview on how environmentally-induced changes in NP' surface characteristic control their fate in soils and water resources.