Forward predictions of particle fate in soils

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Particles play a key role in the transport of nutrients, strongly sorbing contaminants, bacteria and viruses and particulate contaminants such as engineered nanomaterials or nanoplastics are increasingly in focus. Accurate models to predict the fate of particles in soils can enhance our understanding of nutrient bioavailability, improve risk assessments of nanomaterials and improve the effectiveness of terrestrial nanotechnology. There are, however, no models that can *forward* predict the fate of particles in the field. Current models are only fitted *backward*, i.e. calibrated, to column outflow data. The attachment efficiency is probably the only kinetic fate descriptor that is currently useable for forward modelling particle fate in soils, because there is both a functional test (column tests) to quantify this parameter and a well-developed theory to apply it beyond the functional test. All practically usable fate descriptors aim to strike a balance between accuracy and practical usability. This presentation will therefore discuss how well can an accurately determined attachment efficiency predict particle transport in a field soil. It will be shown that tools are available to routinely and accurately determine the attachment efficiency, but predictions based only on this predictor likely deviate too much from the situation in the field to be practically sustainable. It will also be shown why the attachment efficiency is not sufficient to calculate the bioavailable fraction of particles in soils. Finally, a realistic pathway to achieve forward predicting models for particles in soils will be disucssed.

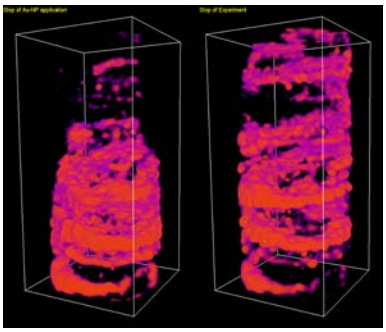

Figure 1. Gold nanoparticles migrating in a column test visualised using X-ray tommography.