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Transport of DNA-tagged Microparticles in Surface Water

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One of the ways to study transport mechanisms in surface waters is to apply artificial tracers. However, given the growing pressure on surface water systems due to anthropogenic pollution, the number of available artificial tracers is limited. Recently, a micro-particle tracer was developed with unique synthetic DNA strands sealed by an environmentally friendly silica coating. However, due to mass loss issues, it is hard to interpret the DNA micro-particle breakthrough curve due to our limited understanding of the fate and behaviour of the microparticles during migration.

This research focuses on understanding the transport behaviour of silica coated synthetic-DNA-tagged microparticles in surface water in order to gain insight into mass transport processes in surface water environments. Given the inherent complex media in surface water, the particle is likely to encounter a variety of bio/geo-colloids and natural organic matter, which could alter its fate and behaviour during transportation in the aqueous phase and at the aqueous phase-sediment boundary. In this respect, we will assess the behaviour of microparticles in contact with common bio and geo-colloids of varying concentration in different surface waters with varying organic matter and sediments. In particular, we look at breakthrough curve behaviour and associated mass recoveries in laboratory batch and injection experiments. A one-dimensional advection and dispersion model will be used to simulate transport processes.