Optimized analysis of natural colloidal phases with Nanoparticle Tracking Analysis (fluo-NTA)

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Dynamic light scattering (DLS) is frequently used as fast method for determining particle size distribution (PSD) of suspended particles in sub micrometer scale. However, it comprises several disadvantages especially in determining PSD of polydisperse natural samples [1]. Nanoparticle Tracking Analysis (NTA) is an established alternative in nano-metrological investigations. Only a few NTA studies are published so far focussing on PSD measurements and particle concentration of potentially occuring colloidal compounds in surface- or groundwater and soil pore water [2, 3].

The aim of this work was to develop a NTA protocol for the reliable measurements and validation of PSD, particle concentration and scattering properties of polydisperse, multimineral natural pore water samples. Comparing measurements of standard suspensions of clay minerals, goethite, (fluorescent) silica particles and purified humic acids as well as natural pore water samples were conducted with NTA, Laser Induced Breakdown Detection (LIBD) and DLS. Additionally Atomic Force Microscopy (AFM) was applied to determine independently number-weighed size distribution as well as shape factors and aspect ratios of the suspended particles. NTA measurements were improved through adapting settings detailed in the presentation. It was possible to reproducibly measure standard suspensions and scattering behavior. Additionally, particle populations were more precisely distinguished in mixed standard suspensions. Results of this methodological comparison show the well known disadvantages of DLS regarding polydisperse samples. The determination of size distribution and concentration of polydisperse samples with NTA were less prone to sample composition compared to the other methods. PSDs determined with LIBD agree well with most standard suspensions. Scattering properties will be discussed in detail.

[1] Maguire *et al.* (2018), *Sci Technol Adv Mater* **19**, 736. [2] Gallego-Urrea *et al.* (2014), *J Nanopart Res* **16**, 2383. [3] Sanchís *et al.* (2015) *Anal Bioanal Chem* **407**, 4261-4275.