Influence of organic molecules on aggregation of TiO_2 nanoparticles

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Nanotechnology is a rapidly growing industry, which leads to an increased amount of synthetic nanoparticles released into the environment. However, the fate and behavior of synthetic nanoparticles in the environment are not well-known. Titanium dioxide (TiO_2), a naturally occurring mineral, is one of the most used metal oxide nanoparticles due to its special properties. Nanoparticles generally have higher reactivity than larger particles of the same material. As the particle size is decreased to the nanometer size range (1-100nm), the surface chemistry changes and this might influence the surface charging and aggregation behavior. Further, nanoparticles can interact with natural organic material (NOM), such as humic and fulvic acids, which is present in most natural waters. Adsorption of NOM affects the surface speciation and net charge of the nanoparticles and is therefore of great importance for their colloidal stability. This might alter the mobility of nanoparticles in surface waters and in soils, thus determing their bioavailability and toxicity.

The focus of the present study was to investigate the aggregation behavior of synthetic nanoparticles in aqueous solution as a function of time and pH in the presence of organic molecules. Synthesized and well-characterized TiO_2 (anatase) nanoparticles were used as test nanoparticles and selected phenolic carboxylic compounds were used as model substances to mimic the interactions of nanoparticles with NOM. The aggregation and surface charging of the particles were studied by simultaneously monitoring the changes in particle size and zeta potential during the reactions. Results show that the concentration of organic molecules, and the type and number of functional groups affect the aggregation behavior of TiO_2 nanoparticles in aqueous solution.

Testing accuracy of combined zircon ($^{238}U/^{230}Th$) and (U-Th)/He dating against radiocarbon dating

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Combined $^{238}U/^{230}Th$ disequilibrium and (U-Th)/He dating of zircon [1] is a novel approach for dating young (<350 ka) volcanic eruptions. This method has been successfully applied in various settings [2,3], however its accuracy has not been rigorously tested and validated by independent methods.

In this study we apply the combined $^{238}U/^{230}Th$ disequilibrium and (U-Th)/He zircon dating to the deposits of the coeval Rotoiti (ROR) and Earthquake Flat (EQF) eruptions in the Taupo Volcanic Zone, New Zealand, to investigate consistency of the method. In addition, wood sampled below and above the Rotoiti tephra is dated by high-precision radiocarbon method to provide independent constraints on the accuracy of the zircon eruption ages.

The two independent methods revealed concordant ages, which are also in accord with the stratigraphic position of the samples. Based on these results we assign new ages of ~45 ka to the ROT and EQF eruptions, which is by ~16 kyr younger than the currently accepted age, which has implications for paleoclimatic reconstructions and hazards assessment. This study proves the combined $^{238}U/^{230}Th$ disequilibrium and (U-Th)/He dating of zircon reliable at late Quaternary time scale and also demonstrates reliability of the radiocarbon dating method at higher end of its sensitivity at ~50 ka.

[1] Schmitt *et al*.. (2006) J. Volcanol. Geoth. Res. 158 (3-4), 281-295. [2] Schmitt *et al*.. (2010) Earth Planet. Sci. Lett. 295 (1-2), 91-103. [3] Schmitt *et al*.. (2011) Contrib. Mineral. Petrol. 162 (6), 1215-1231.

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