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Organic coatings on engineered inorganic nanoparticles

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Engineered inorganic nanoparticles (EINP) are being implemented in a wide variety of fields and products due to their unique properties compared to their bulk material. The increasing use and production of engineered inorganic nanoparticles escalates the risk for their unintended release into the environment. Coating of nanoparticles like natural organic matter play an important role for the stability, toxicity and transport of nanoparticles. Surface-enhanced Raman spectroscopy (SERS) has been proved to be a promising method to detect the coating on noble metal nanoparticles.

The objective of this study is to study the exchange and competition of different coating agents with different binding abilities on metallic nanoparticles to simulate the release of nanoparticles into a water body with a number of potential coating agents. The organic coatings on Ag0 and TiO_2 nanoparticles were characterized using SERS. Suwannee River Natural Organic Matter (SRNOM), 4-mercaptobenzoic acid (4-MBA) and 4-Mercaptopyridine (4-MPY) were selected molecules for the experiments. It was shown, 4-MPY has a higher binding affinity than SRNOM and 4-MBA through the presence of simultaneous sulfur and nitrogen atoms which leads to dominating the coating process when two coating agents are present in the media at the same time. Furthermore, 4-MBA and 4-MPY make bonds to the SRNOM coated nanoparticle despite that SRNOM coating has been previously formed.