Interactions between engineered nanoparticles in aquatic systems: Roles of engineered capping agents and natural organic matter

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Abstract:

The overarching objective of our work is to develop an improved understanding of the roles of synthetic capping agents and natural organic matter (NOM) in controlling the homogeneous and heterogeneous aggregation of ENPs in aquatic environmental systems. Using a suite of ligand-stabilized gold nanoparticles (AuNPs) various NOM isolates and model colloids, the specific aims of the project are to: (1) Correlate the physicochemical properties of capping agents with interactions between capped ENPs in aquatic systems; (2) Correlate the physicochemical properties of capping agents and NOM with interactions between capped ENPs and NOM in aquatic systems; and (3) Correlate the physicochemical properties of capping agents, NOM and suspended particulate matter with the interactions between capped ENPs and suspended particulates in aquatic systems. Results to date indicate that NOM adsorbs to AuNPs regardless of the capping agent (for the particles tested) and that in most instances this coating by NOM enhances nanoparticle stability. However, the type and concentration of NOM, as well as the original coating also influence this behavior. For example, large molecular weight and more hydrophobic NOM more effectively stabilizes AuNPs with respect to homoaggregation.