Study on Iron Oxide (Fe_2O_3) Nanoparticles Coated With Humic Acid Using Field-Flow Fractionation and Related Techniques

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***Abstract*:** *Presence of nanoparticles (NP) that contain risk elements to human and environment (water, soil, or sea-sediment) are of great concern in the environmental industry. NPs in aqueous system usually have broad size distributions and, may even exist as aggregates depending on the various parameters (e.g. pH, ionic strength, presences of dissolved organic matter (DOM), etc.). Thus, in application of nanoparticles for environmental treatment, it is important to analyze the particle size and its distribution accurately for characterization and quantification of NPs.*

In order to disperse the nanoparticles in an aqueous system, either a surfactant is usually added or the particles are coated with charged polymers. Recently the 'Green coating' attracts interest, where the nanoparticles are coated with dissolved organic matter (DOM) such as humic acid (HA). HA is a dark-colored organic material that can be extracted from soil with dilute alkali and other reagents, and is insoluble in dilute acid. The advantage of 'Green coating' is eco-friendly, inexpensive and non-toxic.

Field-flow fractionation (FFF) is a family of separation techniques that can provide separation and characterization of macromolecules or particles ranging in size from nanometer to micrometer. In this study, HA-coated Fe_2O_3 nanoparticles were synthesized, and then were analyzed using FFF and other related techniques to determine the particle size distribution and to study the particle stability. Coating of HA on the surface of Fe_2O_3 particles were confirmed by IR spectroscopy. From the change in FFF retention of the particles after the HA-treatment, the thickness of the coated HA layer was determined. The mass and the rate of HA-adsorption was also determined by a UV/VIS spectroscopy.

Keywords: *Humic acid, Iron oxide nanoparticle, coating, Field-Flow Fractionation.*