Removal of Engineered Nanoparticles During Drinking Water Treatment

Supporting/Contributing Agency: U.S. EPA

In 2008, Professor Paul Westerhoff with Drs. Crittenden, Chen, Zhang, and Hristovski published a series of papers on the mechanisms of removal during water treatment for several classes of engineered nanoparticles. Calcium, aluminum, and other divalent metals in water supplies and/or added during water treatment reacted with functionalized 5-nm-sized quantum dots fabricated from cadmium and selenium (CdTe) to form large aggregates that could be settled out during treatment and effectively removed. Based upon the functionalized portion of the CdTe quantum dot, we could model this important complexation mechanism, which resulted in enhanced removal of the quantum dot nanoparticle.

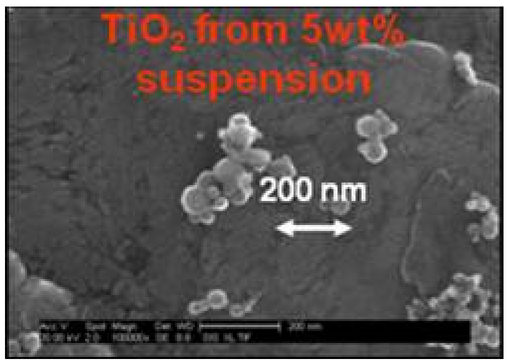

Figure 4.x. Aggregation of 5-nm-sized quantum dots fabricated from cadmium and selenium (CdTe) to facilitate removal from water during treatment.

Metal and metal oxide nanoparticles, including silica-, iron-, titanium-, nickel- or zinc-based particles, undergo different reactions with salts present in our water supply that affect their removal during water treatment. With the exception of silica dioxide nanoparticles, the remaining engineered nanoparticles aggregated in tap water are of modest salt content. Upon settling or addition of common coagulant chemicals used during water treatment, greater than 90% of the engineered nanoparticles could easily be removed. The results were interpretted based upon classic colloid theory and measurable values that could easily be obtained for other nanoparticles as they become mass-produced.

References/Publications

Zhang, Yang; Chen, Yongsheng; Westerhoff, Paul; Crittenden, John, "Stability and Removal of Water Soluble CdTe Quantum Dots in Water." *Environmental Science and Engineering Environ. Sci. Technol.*, 42 :1 :321-325 (2008)

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