Stevens Institute of Technology

Nanotechnology Graduate Program

Stevens Nanotechnology Roundtable: Environmental Nanotechnology Research at Stevens

Wednesday October 22, 2008
Burchard 118, 11 am

In this Nanotechnology Roundtable, colleagues from the Stevens Center for Environmental Systems will present an overview of current nanotechnology research efforts of the Center. For example, in one effort the acute toxicity of four different nanosized particulate materials (titanium dioxide, boron nanoparticles, and two types of aluminum nanoparticles) were evaluated for the species *Daphnia magna*. The results were analyzed in order to calculate LD_{50} at 24 and 48 hours. While here it was found that titanium dioxide nanoparticles show low level of toxicity, boron nanoparticles with EC_{50} ranging from 56 to 66 mg/L, depending upon age of solution, can be classified as "harmful" to aquatic microorganisms (EC_{50} in the range 10-100 mg/L). Such results can be interpreted in terms of possible mechanisms of nanoparticle toxicity and potential problems in ecotoxicological testing of nanomaterials. In a second study, the fate and transport of nano boron, a promising solid fuel and propellant, under various aquatic systems was investigated in aggregation and deposition experiments. Column experiments were performed to examine the effects of electrolyte concentration and flow velocity on the transport of boron nanoparticles under saturated conditions, whereas aggregation tests were conducted to assess the effects of electrolytes on the aggregation of the boron nanoparticles. Aggregation tests indicated the presence of different reaction-controlled and diffusion-controlled regimes and yielded critical coagulation concentrations (CCC) of 200 mM, 0.7 mM and 1.5 mM for NaCl, $CaCl_2$, and $MgCl_2$, respectively. Aggregation and deposition experimental data corresponded with the classic Derjaguin-Landau-Verwey-Overbeek (DLVO) model and the constant attachment efficiency filtration model, respectively. Theoretical calculations indicated that both the primary and secondary energy minima play important roles in the deposition of nano boron in sand columns.

The **Center for Environmental Systems (CES)** is dedicated to applied, interdisciplinary research for the solution of pressing, real-world environmental problems. Through advanced knowledge and in-depth professional expertise, CES is recognized as a leader in the development, evaluation and implementation of new environmental technologies. The researchers at the CES, through collaborations with government agencies and industrial partners, work to generate new scientific knowledge, which leads to the creation of innovative technologies, sound enivonrmental policy and sensible resource management. Over the years CES has played an instrumental role in establishing new technologies for environmental control.

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