Micah J. Green, Department of Chemical Engineering, Texas Tech University

Carbon nanotube characterization through microwave-induced heating

Quantitative carbon nanotube (CNT) characterization in biological and environmental systems is a pressing need, given the potential for widespread CNT usage and exposure. First, we discuss a novel technique recently developed for quantitative detection of CNTs in biological samples by utilizing the thermal response of CNT under microwave irradiation. In particular, rapid heating due to microwave absorption was employed to quantify CNT uptake in both alfala (Medicago sativa) samples and earthworms (Eisenia fetida) with excellent sensitivity. We injected control samples with a known quantity of CNT and exposed them to a microwave field to generate standard temperature-CNT concentration relationships; this detection method was then used to accurately determine CNT uptake by organisms in CNT-laden soil. This unique and practical method yields a threshold for detectable CNT concentration that is lower than common analytical methods such as electron microscopy and Raman spectroscopy. Second, we discuss the broader issue of controlling the CNT dispersion state and understanding toxicity mechanisms in exposure, fate, and transport studies, particularly in light of novel needs and applications in composites, fibers, and oil recovery. Finally, we will discuss the need for increased communication between the nanomaterial and environmental toxicology communities.

Highlights of Micah J. Green bio

- NSF CAREER Award 2012, AFOSR Young Investigator Award 2011
- Expertise in dispersion of nanomaterials for use in advanced composites
- Led NSF-funded interdisciplinary nanotoxicology collaboration