

UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

CIVE 6111 Graduate Seminar

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Acute Toxicity of Graphene Nanoplatelets on Biological Wastewater Treatment Process

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2:45 pm - 3:45 pm

CBB 120

Abstract: Diverse industrial and biomedical applications of graphene (G) are leading to increasing production of this nanomaterial. Therefore, it is inevitable the fate of this nanomaterial in wastewater treatment plants. Since biological wastewater treatment process depends heavily on the functions of diverse microbial communities, systematic investigation of any potential acute toxic effects of G in wastewater microbial communities is essential. In the present study, we investigate the potential short term adverse effects of G on wastewater microbial communities and on the microbial functions related to the biological wastewater treatment process. This study aims to understand how graphene interacts with activated sludge in biological treatment process at the acute toxicity level. In this study, the activated sludge was collected directly from a wastewater treatment plant, and then acclimated in the lab for 44 h with synthetic wastewater before running the reactors with concentrations of graphene suspensions varying from 0 to 300 mg/L. The performance of the reactors in the removal of organic matter, ammonia, phosphate, nitrate and chemical oxygen demand were determined. The changes in ammonia oxidizing bacteria, nitrifiers, and phosphate accumulating bacteria were analyzed using quantitative real time PCR. Changes in the microbial community structure in the presence and absence of graphene was determined through 16S rRNA Metagenomics

analyses. Initial results show that graphene inhibits the nutrient removal in the wastewater treatment and has the potential to affect microbial community structure in the activated sludge.

About the speaker:

Hang Nguyen obtained her master degree in Environmental Engineering at University of New Haven, Connecticut under the supervision of Joseph J. Pignatello at the Connecticut Agricultural Experiment Station. In her MS studies, she investigated the application of adsorbent bio-char for remediation of crude oil in marine environments. She is currently a Ph.D. student in the Environmental Engineering program at the University of Houston under the supervision of Dr. Debora Rodrigues. Hang's research focuses on understanding the impact of carbon-based nanomaterials, such as graphene and graphene oxide to microorganisms and microbial communities in the environment. She has investigated the toxicity of these nanomaterials to different types of fungus and more recently she also has determined the impact of graphene and graphene oxide to microbial communities in biological wastewater treatment. This understanding has been essential to develop safe applications for these nanomaterials. She has successfully incorporated these nanomaterials with newly synthesized adhesive polymers to develop antimicrobial coatings that are safe for applications involving human contact.