DEPARTMENT OF CHEMICAL & ENVIRONMENTAL ENGINEERING

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Nucleic acid-based biomarkers to validate biodegradation of 1,4-dioxane in contaminated aquifers

1,4-Dioxane is an emerging groundwater contaminant with chemical and physical properties that promote rapid transport in impacted aquifers and resistance to conventional treatment strategies. While previous research has identified bacterial and fungal isolates capable of degrading 1,4-dioxane under laboratory conditions, microbial attenuation of this environmental contaminant remains veiled. Furthermore, 1,4-dioxane contamination is commonly associated with chlorinated solvent plumes adding an additional layer of complexity when determining whether bioremediation is an appropriate strategy. Molecular biological tools provide an analysis of microbial activity at the genetic level and can be used to connect the effectiveness of 1,4-dioxane biodegradation in the laboratory with the limitations encountered in complex environments. This presentation will highlight the utility of molecular biological tools for advanced site characterization to determine the presence, abundance, and activity of specific microbial populations required for biodegradation to proceed. Monooxygenase and dehydrogenase genes were identified as biomarkers for 1,4-dioxane biodegradation and studied under diverse conditions using both pure and mixed cultures. Characterization of these genes revealed key associations among gene abundance, gene expression, and kinetic rates of 1,4-dioxane biodegradation. In addition, the influence of co-occurring contaminants on 1,4-dioxane biodegradation activity in pure culture experiments revealed a dose-dependent response with the expression of biomarker genes. These findings emphasize the importance of site characterization using molecular biological tools as additional lines of evidence supporting bioremediation as a feasible, sustainable, and cost-effective treatment strategy for contaminated environments.

Biosketch: Dr. Phillip Gedalanga is a Postdoctoral Scholar in Civil and Environmental Engineering at the University of California, Los Angeles. He earned his Ph.D. in Environmental Health, Science, and Policy from the University of California, Irvine where he studied ecological interactions among microbial groups for the optimization of wastewater treatment. Currently, his primary field of research is in the area of biodegradation processes in natural and engineered systems with a particular focus on applied environmental biotechnology to characterize microbial degradation of emerging groundwater contaminants.

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9:30—10:30 AM

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