DEPARTMENT OF **CHEMICAL & ENVIRONMENTAL ENGINEERING**


# SHAILY MAHENDRA

**ASSISTANT PROFESSOR**
**CIVIL AND ENVIRONMENTAL ENGINEERING**
**UCLA**


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# MOLECULAR BIOLOGICAL AND STABLE ISOTOPIC TOOLS FOR MONITORING BIODEGRADATION OF 1,4-DIOXANE

1,4-Dioxane, a probable human carcinogen, is an emerging contaminant in surface water and groundwater resources. It is used as a stabilizer in chlorinated solvents, as a solvent in paper and textile processing, and in the manufacture of organic chemicals and personal care products. Improper disposal of industrial waste and accidental solvent spills have resulted in the contamination of groundwater with 1,4-dioxane. While biodegradation of 1,4-dioxane has been previously reported in a number of laboratory studies, reliable analytical tools to assess natural attenuation and bioremediation in the field are lacking.

Compound specific isotope analysis (CSIA) has been used as a monitoring tool to assess the biodegradation of various organic contaminants. We recently developed a novel analytical method for determining the enrichment of $^{13}C$ in 1,4-dioxane, and determined kinetic carbon isotopic fractionation factors ($\varepsilon$) according to Rayleigh model. This method was successfully applied for monitoring biodegradation of 1,4-dioxane in microcosms constructed using 1,4-dioxane-contaminated industrial activated sludge.

*Pseudonocardia dioxanivorans*, which can grow using dioxane as its only source of carbon and energy, was isolated and characterized in our previous work. The role of monooxygenase enzymes in catalyzing dioxane degradation was confirmed using several independent lines of evidence, and biochemical degradation pathway was described. Recently, the genome of *P. dioxanivorans*, assembled and annotated in collaboration with UC Berkeley and DOE Joint Genome Institute, revealed multiple monooxygenase genes. We are now developing molecular biological probes targeting monooxygenase genes to serve as monitoring tools for 1,4-dioxane bioremediation in contaminated environments.

**Biography:** Dr. Shaily Mahendra is an Assistant Professor in the UCLA Department of Civil and Environmental Engineering. She received Ph.D. from University of California, Berkeley, and post-doctoral fellowship from Rice University. Her research areas are microbial processes in natural and engineered systems, applications of molecular and isotopic tools in environmental microbiology, environmental impacts of nanomaterials, and biodegradation of emerging groundwater contaminants.