Chemical and Petroleum Engineering

SEMINAR NOTICE

Justin Hutchinson

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Justin M. Hutchison is an Assistant Professor in Civil, Environmental, and Architectural Engineering at the University of Kansas. His current research focuses on sustainable technologies for water reuse and the development of biocatalysts to address micropollutant contamination.

His awards include the National Science Foundation Graduate Research Fellowship (2012), the American Water Works Association Larson Aquatic Research Support Scholarship (2016), and the Richard S. and Mary E. Engelbrecht Fellowship (2017).

"Advancing biocatalytic technologies for degradation of micropollutants in drinking water"

Abstract

Micropollutants have toxic effects realized at microconcentrations, threatening safe access to drinking water. The micropollutants' recalcitrant nature and lower concentration versus the higher concentration of competing co-contaminating compounds hamper current drinking water treatment technologies. To address the threats posed by micropollutants, innovative treatment technologies must be developed. Biocatalysts harness the advantages inherent in enzymes for rapid and selective degradation of perchlorate, a model micropollutant, into innocuous chloride and oxygen. This talk will present an iterative methodology used to develop sustainable biocatalytic perchlorate reduction for drinking water treatment. First, a comprehensive experimental analysis was performed to understand the biocatalysts' kinetics and the effects of groundwater matrix composition on the perchlorate biocatalysts. Experimental results demonstrated that biocatalytic perchlorate reduction operated in a wide range of conditions relevant to groundwater. Second, these results informed the development of deterministic performance models based on first principles. The model was run using simulated groundwaters for which contaminant and anion concentration distributions were created from US Geological Survey inventory data to assure real-world relevance. Third, an assessment of the sustainability (economic and environmental life-cycle analysis) of the biocatalytic technology was applied to identify key technology development goals. Fourth, the sustainability of the biocatalysts was compared to four treatment technologies: non-selective ion exchange, selective ion exchange, whole-cell biological reduction, and chemical catalyst reduction. Upon realizing two key technology development goals, biocatalytic technologies have the potential to be a competitive option for drinking water treatment. Ongoing work to achieve one of the goals, reuse of the biocatalysts, will be highlighted to demonstrate the iterative nature of the methodology for sustainable technology development.

Tuesday March 19th

1:00 – 1:50pm | Spahr Auditorium (2 Eaton)