Environmental and Water Resources Engineering, and Center for Water and the Environment Seminar Series Presents:

TEXAS

Thursday, April 2nd 2025, 3:30-4:30 pm, ECJ 1.324

Zoom Link: https://utexas.zoom.us/j/81263061920

Propylene Glycol, a Slow Burn to the Nitrification Process
Nitrification Inhibition Study at South Austin Regional Wastewater Treatment

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Bachelor's in SUNY Stony Brook University, Chemical Engineering, Master's in UT Austin (Ongoing)
Advisor: Dr. Xavier Fonoll Almansa

Nitrification inhibition observed at the South Austin Regional Wastewater Treatment Plant (SAR) during winter 2024 was identified as nitrite lock, a condition in which ammonia oxidation proceeds while nitrite oxidation is suppressed, leading to nitrite accumulation and reduced nitrate production. This phenomenon coincided with elevated propylene glycol (PG) concentrations in the aeration basin. Although PG is generally considered readily biodegradable, its role in triggering nitrite lock under continuous exposure remains unclear. Batch experiments were conducted first by using mixed liquor from SAR and it showed no inhibition of nitrification at PG concentrations up to 100 mg/L, indicating that PG is not directly toxic to ammonia-oxidizing or nitrite-oxidizing bacteria. To better represent full-scale conditions, a lab-scale sequencing batch reactor (SBR) was operated under controlled temperature and solids retention time. Under continuous PG loading, nitrite lock occurred at an influent concentration of 20 mg/L, characterized by sustained nitrite accumulation and depressed nitrate formation. The system gradually recovered after approximately 2–3 sludge retention times, suggesting microbial adaptation. In contrast, short-term spike loading at concentrations up to 100 mg/L did not induce nitrite lock. Further analysis revealed that PG accumulates in activated sludge despite rapid degradation in the liquid phase. A threshold of approximately 2.5 mg/L PG in mixed liquor was identified as a critical level associated with nitrite lock. These findings indicate that nitrite lock is driven by sustained PG exposure and biomass accumulation rather than acute toxicity, highlighting the need to monitor in- reactor PG levels and manage continuous low-level inputs.

Power in Numbers: Microbial Diversity and Biofilter Resiliency

Carlo Garcia, Master's Student

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Advisor: Dr. Mary Jo Kirisits

Biofiltration is a treatment process used in drinking water plants across the US, though it is not fully understood. Biofilters utilize microbial communities colonized within the filter media for biodegradation of certain contaminants in influent waters. In other environments, the microbial richness of a community has been linked to its stability and resiliency. This project, sponsored by the Water Research Foundation, connects this idea with biofilters.

The project, officially titled "Evaluation and Demonstration of Biotechnological Tools and Methods for Improving Biofiltration Operation and Optimization," aims to utilize microbial community measures as indicators of biofilter performance, especially with regards to organic matter removal measures. Especially of interest is the role that microbial richness plays in biofilter stability and resiliency. To further test this, bench-scale biofiltration columns will be established and then challenged with conditions a full-scale biofilter may face: cold influent temperatures, an increased dissolved organic carbon (DOC) concentration, and an algal bloom. This presentation will explain the basics of biofiltration, organic carbon in water and its measurement with the liquid chromatography with organic carbon detection (LC-OCD) system, microbial ecology in biofilters, and progress on this project. There will also be a brief overview of water quality parameters of the utilities participating in this project. Finally, insights and expected results of this project will be discussed.