Poster Speaker and Abstract Information for

2024 Onsite Wastewater Mega-Conference

October 2024

Updated 8/2/24

All speakers listed alphabetically by last name. Subject to change.

Salil Raj Aryal, University of South Alabama

Passive Onsite Disinfection Using a Gravel Conveyance System

Poster

Abstract:

In the Alabama Black Belt, the majority of engineered onsite wastewater treatment facilities are expensive. Furthermore, conventional onsite wastewater disinfection methods (UV or tablet chlorine, post-treatment) are expensive, energy-intensive, and require significant operation and maintenance (O&M). In Alabama (and elsewhere), there is a growing need for innovative effluent disposal solutions (IEDS) that are constructed and designed for the on-site application of treated and disinfected wastewater to the ground surface. With the need for a low-cost, low-maintenance disinfection system, IEDS surface discharge presents an opportunity to improve general sanitation conditions, especially in clay soil areas and in high groundwater table areas. Fecal coliform and E. Coli removal from treated onsite effluent (from an onsite aerated treatment system) has been evaluated at a pilot scale using a new, passive disinfection system known as a "gravel conveyance system" that requires almost no O&M. Tests were conducted by applying synthetic wastewater containing E. coli and Fecal coliform to a shallow gravel basin by hydraulic retention time (HRT), via. applied flow rate, was used as the design variable, and disinfection performance was evaluated. For testing, approximately 1 gallon of E. coli/FC spike dose prepared in the laboratory (ranging from 50-150 CFU/1 ml [â‰… 10,000 CFU/100 mL] and similar to treated effluent concentrations) was poured into the influent port of the pilot scale system all at once. Over 24 hours, a pump administered five doses of tap water, around five gallons each dose, to the gravel conveyance (to achieve a 1.1-day HRT). While minimal FC concentrations (less than 6 cfu/1mL) show up in the effluent port at 24 hours, no E. coli was measured in the conveyance effluent at 24 hour. The Alabama Department of Public Health (ADPH) has recommended that a full-scale system be developed where the size of the full scale system will be 30ft.x6ft.x1.25ft. for onsite disinfection

Bio:

I am currently pursuing a Master of Science in Civil Engineering at the University of South Alabama working as a graduate assistant. We are working on an onsite decentralized wastewater treatment system.

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Lilith Astete Vasquez, San Diego State University

Microbial Community Dynamics in Response to Alternative Waste Introduction to Onsite Sanitation Systems

Poster

Abstract:

Onsite sanitation systems (OSS) are overdue for sustainable, site-appropriate improvements to better serve users and promote protection of public and environmental health. Microorganisms within these systems - responsible for various roles including the hydrolysis of organic materials and converting or consuming nutrients and harmful contaminants, may survive in different abundances dependent upon the chemical conditions within these systems. This study assessed the response of microbial communities in bench-scale anaerobic digesters simulating the use of real-world OSS. Microbial consortia were identified at several stages of operation (4, 6, 10, 22 and 26 months) during two years of non-dilute waste introduction under the following scientifically and culturally relevant schemes: 1) with subtle intermittent mixing, 2) traditionally unmixed with settled solid contents, 3) employing urine diversion for sequestering nutrients, and 4) practicing external discarding of toilet paper. DNA extraction followed by 16S rRNA sequencing identified organisms present in each of the four systems at the time of these operational snapshots. Preliminary results illustrate the development of archaea communities within the urine diversion tank, which are responsible for the production of potentially capturable greenhouse gas, methane. Several classes of bacteria capable of fermentation presented the lowest quantities in the urine diversion tank and increased in all other tanks over time, except for alphaproteobacteria. As alternatives to traditional waste introduction have been explored to enhance the sustainability of OSS, understanding their impacts upon important microbial communities can highlight the advantages or disadvantages of their implementation.

Bio:

Lilith is a 6th year doctoral student pursuing a degree in Mechanical & Aerospace Engineering. Her research involves three topics, centered around the improvement of sanitation systems for use in rural and developing regions. She has studied the effects of alternative waste introduction methods to onsite sanitation systems, including the impacts upon degradation of organic solids and contaminants of emerging concern. Further, she has studied the prevalence and treatment of antibiotic resistant bacteria in Brazil, and the use of anammox systems for improving decentralized wastewater treatment for reuse applications. Lilith is a veteran of the US Navy, and prior to her graduate studies she completed a BS in Environmental Engineering and worked in both private and public sectors of water management.

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Shiloh Bolden, San Diego State University

Combining Anammox Bacteria with Anaerobic Baffled Reactors for Sustainable Nitrogen Removal

Poster

Abstract:

Anaerobic baffled reactors (ABRs) are low-cost and low-maintenance decentralized wastewater treatment systems (DEWATs) that specialize in biologically degrading organic carbon. They have potential for reusing wastewater, replacing septic tanks, and supplementing larger centralized treatment systems in dense populations. Despite their promise, anaerobic technologies can not remove nitrogen from wastewater that may lead to potential health and birth defects such as methemoglobinemia. We seek to pair the difficult-to-grow ammonium oxidizing bacteria (anammox) with a lab scale ABRs-in-series system to sustainably remove nitrogen. With synthetic wastewater containing influent chemical oxygen demand (COD) and ammonium concentrations of 442Â±167 mg/L and 47.5Â±12.8 mg/L, respectively, a 70% COD removal through ABR 1 was achieved in 234 days. The second ABR contained a consortium of denitrifying and nitrifying bacteria, as well as intermittent aeration to stimulate partial nitritation necessary for the growth of anammox bacteria. After 100 days, ammonium removal reached 33% through ABR 2 and 25% through the whole system. Ongoing work is evaluating system optimization using cathodic nitrate reduction with a bioelectrochemical system in ABR-2 to increase the degradation of ammonium. Once a stable anammox community is established, the removal of pharmaceuticals by anammox will be evaluated. These results will provide insight into the feasibility of low-cost, low-energy, and carbon-neutral water treatment alternatives and how they can be implemented to improve water sanitation and reduce the discharge of contaminants of emerging concern.

Bio:

Shiloh Bolden, an undergraduate environmental engineering student at San Diego State University, conducts research on sustainable decentralized wastewater treatment systems funded by the National Institute of Health through SDSU's Maximizing Access to Research Program. In Dr. Natalie Mladenov's Water and Reuse Lab, he focuses on enhancing anaerobic baffled reactors globally to remove nitrogen and pharmaceutical contaminants. Shiloh aims to pursue a doctorate in environmental engineering and work in the non-profit sector to provide clean water to underserved communities. With practical experience and academic training, he aims to contribute to and promote sustainable water management practices.

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Alissa Cox, University of Rhode Island

Field Evaluation of Layered Nitrogen-Reducing Soil Treatment Areas in Coastal Rhode Island

Poster

Abstract:

For over 15 years, regulations in Rhode Island have required new onsite wastewater treatment systems installed in nitrogen-sensitive coastal areas to include nitrogen reducing advanced-treatment technology. Nearly all of the greater than 6,000 advanced systems installed to date are proprietary technologies, many of which are nitrogen-reducing and approved to discharge no more than 19 mg/L of total Nitrogen in the effluent flowing to the soil treatment area. While proprietary denitrification technologies reduce nitrogen loading in coastal communities, the costs of their design, installation and maintenance remain a significant hurdle to many property owners, and generally discourage voluntary system upgrades to these technologies. Based on lessons learned from field experiments and demonstration systems in nearby Massachusetts and other jurisdictions, staff from a municipal wastewater management program and university researchers collaborated to install and monitor an experimental lower-cost non-proprietary drainfield based nitrogen-reducing technology at four residential sites. These systems, called layered soil treatment areas, consist of a pressure-dosed 18" layer of sand (nitrification zone) above an 18" layer of sand amended with locally sourced hardwood sawdust in a 1:1 ratio (denitrification zone). Data from the first two years of operation show promising results: incoming total Nitrogen concentrations are reduced by as much as 94%, and effluent leaving the nitrogen-reducing drainfield meets the regulatory benchmark of 19 mg/L of total N more consistently than proprietary denitrification technologies in the same region sampled over the same time period. Attention to detail and best practices during installation and routine maintenance seem to be key to consistent performance over time.

Bio:

Alissa Cox, PhD, is a Clinical Assistant Professor in the Natural Resources Science department at the University of Rhode Island, and the Director of the URI Onsite Wastewater Resource Center, which includes the New England Onsite Wastewater Training Program. She teaches professional and student audiences about onsite wastewater treatment system function, design, installation, maintenance, troubleshooting and performance monitoring. Her applied research revolves around understanding threats posed by groundwater table dynamics and climate change to current and future onsite wastewater treatment systems along the coast, as well as documenting the field performance of diverse advanced residential wastewater treatment technologies. Effective education and community engagement are central to Alissa's interests, and she works with different stakeholders to examine how research and holistic wastewater management approaches can help improve both local water quality and the resiliency of coastal communities facing myriad future changes and threats.

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Mallory Jordan, Auburn University

Wastewater Infrastructure Data Gap: An Inventory of OWTS Data at State and Local Scales

Poster

Abstract:

Onsite wastewater treatment system (OWTS) location data are critical for supporting decision making, informing policy, justifying the allocation of funds, and facilitating research to identify and ameliorate wastewater infrastructure gaps. There is a lack of information regarding the location of OWTSs across the country, limiting the overall evaluation of these systems. Furthermore, locating and acquiring OWTS data, if available, can be an arduous task. We lack a consolidated national inventory of OWTS data at the state and local scale. To fill this knowledge gap, the purpose of this study was to create an inventory of OWTS data to inform the development of a national OWTS data repository. For this inventory we identified (1) where OWTS data are available and (2) the attributes of available data (e.g., data format). The search for OWTS data was an iterative process conducted at the state and local scales. OWTS data were evaluated based on several categories including permitting agency information, data availability, data format, and spatial resolution of the data. Results demonstrate that 38% (19/50) of states published statewide OWTS data, and data varied from webmaps with land parcel scale (i.e., address) locations of systems to tables with county scale estimates of the number of systems. Of the states with available data, 32% (6/19) have publicly available land parcel scale spatial data available. This inventory will aid in quantifying wastewater infrastructure data gaps and provide a centralized resource to acquire currently available OWTS data.

Bio:

Mallory is an Earth System Science PhD student at Auburn University, where she also received her M.S. in Geography. Her research is focused on using spatial methods to investigate and address various water and wastewater related challenges. Some of her recent research includes inventorying onsite wastewater treatment system data across the U.S. and modeling the pollution potential of onsite wastewater treatment systems.

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Quang Tran, Oregon State University

Sustainable Nutrient Water Recovery by a Hybrid Electrodialysis (ED) - Forward Osmosis (FO) Process for Agricultural Application

Poster

Abstract:

As water scarcity continues to worsen, the use of reclaimed water for irrigation has become a necessity in many regions to maintain agricultural production. This study aimed to investigate the feasibility of a novel hybrid electrodialysis forward osmosis (ED-FO) process that recovers nutrients and clean water from anaerobic digester effluent to safely produce food crops. The process was tested and evaluated for hydroponic production of lettuce and kale. The electrodialysis treatment demonstrated impressive nutrient recovery rates, with 84% ammonium, 85% potassium, 97% ortho-phosphate, and 96% nitrate recovered from the anaerobic effluent. The nutrient-rich concentrate from the ED process reclaimed up to 74% of clean water from the ion-stripped diluate through the FO process. The hybrid ED-FO process also retained 76-98% of heavy metals and 83% of total organic carbon (TOC) in the residual waste stream, consistent with non-target analysis, which showed an 88% reduction in organic compounds after the ED-FO process. Both ED and FO demonstrated low-fouling potential. Our economic analysis indicates that the hybrid ED-FO process is promising for scalable implementation, making it highly attractive in terms of resource recovery, waste footprint reduction, and water quality enhancement.

Bio:

Quang Tran is a Ph.D. candidate in Environmental Engineering at Oregon State University with research and application focusing on innovative water and wastewater treatment technologies, specifically membrane separation processes, toward an ecofriendly and circular treatment solutions. A special interest involves the integration of the electrodialysis and forward osmosis membrane systems to achieve concurrent recovery of nutrient and clean water from wastewater. Quang also studied a range of membrane-based water treatment techniques, such as addressing challenges faced by ultrafiltration during harmful algal blooms. In addition to over 5 years of research experience, he also participated in the private sector through internship opportunities as well as teaching activities at OSU.

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