Stony Brook University
The Graduate School

Doctoral Defense Announcement

Abstract

A systematic understanding of nutrients removal in biofilters

treating onsite wastewater

By

Zahra Maleki Shahraki

More than 60 million people and about one third of houses in US are served by onsite wastewater treatment systems (OWTSs). The quantity and composition of accumulated nitrogen (legacy nitrogen) within and surrounding the conventional OWTSs (i.e., leaching pools) were evaluated. Leaching pools may act as a source of nitrogen contamination and the quantity/composition of leached nitrogen under two environmentally relevant scenarios was evaluated: (i) the concrete leaching pool serves as the final discharge unit for aerobic treatment unit (ATU) effluent; (ii) extreme rainfall events. Nitrogen Removing Biofilter (NRB) is an alternative passive approach to remove nitrogen from on-site wastewater. The effectiveness of the top sand layer (i.e., nitrification layer) plays a significant role in the nitrogen removal performance of the overall system. The effect of the top layer depth, alkalinity availability, and nitrogen/hydraulic loading changes on nitrification performance of the system were studied. The changes in the microbial community abundance and distribution were investigated as well. To further improve the nutrient removal efficiency, biochar was tested as an amendment to the NRB. Biochar has the potential to facilitate efficient nitrogen removal from OWTSs through various mechanisms. The nitrogen transformation and phosphorus removal performance in bench-scale sand columns with biochar amendment was investigated. The phosphorous removal was not effective with the current NRB setup, while modified biochar holds the potential to improve the phosphorous removal efficiency. Zinc oxide (ZnO) modified biochar was developed and tested for its role in enhancing phosphorous removal in the sand layer of NRBs. Collectively, the nutrients removal performance, microbial community abundance and distribution in NRBs were systematically studied under various operation conditions.

Date: February 10, 2022 **Program**: Civil Engineering
Time: 9:00 am **Dissertation Advisor**: Dr. Xinwei Mao
Place: Room 173, Light Engineering Building