BIOGRAPHICAL SKETCH

Grace E. McClellan (Tinker) was born on July 4th in White Plains, NY, but grew up in Lebanon, TN. She graduated third in her class from Lebanon High School in May of 2000. Her academic career began at 16 years old at Cumberland University. She later transferred to MTSU, where she majored in Biology and minored in Mathematics and Photography and earned her Bachelor of Science in May 2004. In 2013, she enrolled at TTU where she studied engineering and later joined the graduate program in 2014. She has presented her research at various local and national conferences, including the Water Research Federation Technical Exhibition and Conference (WEFTEC). She loves dancing, especially with her family and friends.

EDUCATION

B.S. Biology: Genetics and Biotechnology Middle Tennessee State University	2004
Ph.D., Civil and Environmental Engineering Tennessee Technological University {*expected*}	2020

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College of Engineering

TENNESSEE TECH

The Department of

Civil and Enviromental Engineering

Announces the Dissertation Defense

of

Grace E. McClellan

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Engineering

April 1, 2020

10:00am

Held in

Prescott Hall Room 225

Tennessee Tech University

Zoom Link: https://tntech.zoom.us/j/729630116

or call # 1-312-626-6799, Meeting ID: 729 630 116

FIELD OF STUDY

Civil and Environmental Engineering: Wastewater

DISSERTATION TOPIC

MICROBIAL COMMUNITY STRUCTURAL AND FUNCTIONAL RESPONSE TO OPTIMIZATION OF A WATER RESOURCE RECOVERY FACILITY FOR BIOLOGICAL NUTRIENT REMOVAL

EXAMINING COMMITTEE

Dr. Tania Datta (chairperson)

Dr. John Gunderson

Dr. Benjamin Mohr

Dr. Justin Murdock

Dr. Donald Walker

Dr. Lenly Weathers

Guest: Mr. Kevin Young

ABSTRACT

As regulatory limits on nutrient discharge from water resource recovery facilities (WRRFs) become more stringent, understanding the microbial communities in biological nutrient removal (BNR) systems can become beneficial for process improvements. Unconventional BNR includes optimizing a single reactor, such as an oxidation ditch, to have a dissolved oxygen gradient to accommodate these processes simultaneously. Process optimization often encounters instabilities that can be averted by understanding the factors contributing to the structure, function, and stability of the BNR community, especially with regards to polyphosphate accumulating organisms (PAOs). Therefore, to contribute to the body of knowledge of unconventional BNR microbiology and process performance, this study evaluated how microbial communities adapt to unconventional operations of oxidation ditches and assessed whether the community and process stabilize over time after an optimization. Full and lab-scale studies were conducted to address the research goals. The full-scale optimized WRRF of this study modified aerations patterns of the oxidation ditches to accommodate BNR. Two additional facilities were investigated to establish how a community changes over time without influence of optimization. The community of the optimized facility changed differently compared to the other WRRFs, implicating that changes were in response to optimization. Diversity and core community structure of the optimized facility were similar to the BNR-designed facility. Dissolved oxygen correlated with diversity of the optimized facility, whereas temperature was correlated with control facilities. PAOs were active in the optimized oxidation ditch when the facility did not exhibit characteristics that would support PAOs. During the lab-scale study, *Dechloromonas* and a glycogen accumulating organism were detected as active and possibly more important to the denitrifying EBPR process than the well-known PAO, *Candidatus* Accumulibacter phosphatis. These outcomes suggest that optimization of oxidation ditches for BNR has the potential to be successful and reliable.