nss72

Nadia Shebaro's Individual Contribution Page

Spring 2015 Contributions

This semester I am a member of the StaRS Filter Injection and Extraction team. Our primary goal for the semester is to fabricate a to-scale model filter with newly configured inlet and outlet pipes in order to test the principle of gravity exclusion as a method of keeping sand from entering the piping without having holes or slots that are small enough to be susceptible to clogging. We also will work to determine the head loss through the filter that is associated with the new configuration and determine how this impacts the ability to fluidize the bed and properly backwash.

Summer 2014 Contributions

In summer 2014, I was a member of the laminar/turbulent tube flocculation team.

For the laminar tube flocculator, we implemented a system to better control the dosage of clay to the reactor, in order to maintain a constant and appropriate turbidity, as well as a system to control the addition of hot and cold water into the stock water tank, in order to maintain a temperature in the reactor that was relatively equal to the ambient temperature. Once those systems are in place, we tested the SWaT system to see how it functions and if flocs settle out in the tubing as expected. Finally, we began experimentation with different coagulant concentrations, in order to test the effectiveness and function of the laminar tube flocculator, and these results were compared to previous testing with a different setup.

For the turbulent tube flocculator, we worked to determine the flow rate and head loss throughout the system in order to better understand how the flocculator functions and to determine how the flocs settle out. We also looked to improve the existing system of controlling the water temperature, seeking to maintain a temperature that is constantly equivalent to the ambient temperature. Testing was also done to determine the best way to meter clay into the system and whether or not PID control can be used in order to maintain a constant turbidity in the reactor. Once the system is functioning correctly, experimentation can be done to determine how the flocculator functions with various turbidities, coagulant doses, residence times, and flow rates.

Spring 2013 Contributions

I was a member of the spring 2013 Low Flow Stacked Rapid Sand Filtration research team. As a member of this team, I helped make improvements to the fabrication of the LFSRSF based on problems that were encountered when the unit was brought to Honduras in winter of 2013. One change that was made to the filter was to redesign the manifolds so that they would be more durable during operation, which was done because some of the manifolds broke in Honduras. This was done by changing to a system that uses one-half inch slotted PVC pipe connected by cross and tee sections. Another task was to design a sand drain, through which the sand can be removed when the filter bed is fluidized. The appropriate height, size, and orientation of this drain were determined to most efficiently drain the sand from the system.

The major task of the LFSRSF team in spring 2013 was to prepare for and present at the 2013 EPA Sustainable Design Expo. For this expo, our team designed and built (with significant contributions from Paul Charles) a small-scale demo filter to be brought to D.C. and continuously operated at the expo. The most difficult part of designing this demo filter was determining the flow rate and pipe diameters that would allow for appropriate fluidization of the filter bed during backwash. In D.C., the filter was continuously operated, visibly improving the turbidity of the filtered water, and it was also successfully backwashed several times.

Spring 2012 Contributions

I was a member of the spring 2012 foam filtration research team. As a member of this team, I participated in research on the effectiveness of polyurethane foam as a filtration medium and helped to build the first full-scale prototype of the foam filter. In helping to develop the prototype, my work included determining the proper physical specifications for optimal filtration performance, assisting in the selection of materials and fabrication of the unit, and participating in the development of a backwash method for the filter. Throughout the spring 2012 semester, the foam filtration team was also dedicated to writing a grant proposal for the EPA's P3 competition. My work toward this proposal included researching and describing the necessity and effectiveness of small-scale water filtration units, compiling and organizing data from previous foam filtration research, and detailing the processes and specifications of the filter. I also traveled with the team to the EPA's 2012 Sustainable Design Expo, where we displayed our filtration unit to the public.