vc256

Vicki Chou's Individual Contribution Page

StaRS Sand Segregation Team

Spring 2015 Semester Contributions

Semester Goals:

The StaRS Sand Segregation team's goal for the Spring 2015 semester is to quantify under what conditions sand segregation occurs by changing the H. filter/D ratio, filter angle, and sand size ratio. First, a water recycle system will be built to reduce the amount of air bubbles in the water, and experiments that were ran last semester will be replicated to see if the air bubbles altered the sand segregation data. Different parameters of the sand filter will be tested to see when sand segregation occurs.

Progress:

StaRS Backwash Team

Fall 2014 Semester Contributions

Semester Goals:

The StaRS Backwash team's goal for the Fall 2014 semester is to research the sand sizes and ratios for the most efficient backwash of the stacked rapid sand filters. Preliminary research will be done on gradations of sand and possible sand sizes that follow the current ideology of 1.5 ratio and 11 mm/s backwash. A experimental apparatus emulating a filter bed needs to be designed and fabricated to test theories and different sands. Once the filter apparatus is made and troubleshooted for issues, experiments can be run to collect data on backwash.

Progress:

The team designed and fabricated an experimental apparatus consisting of a clear PVC pipe connected to the sink as the water source. Sand segregation tests were ran at different backwash velocities to see when the sand segregated. Normal colored sand was combined with pink sand, with each sand color with the same sand size range in order to qualitatively discern is the sand segregated during backwash. Sand sizes of 20-30, 20-40, and 30-40 were tested at different backwash velocities for sand segregation and bed fluidization. The team found that the sand size range of 30-40 at a backwash velocity below 15 mm/s yielded unsegregated sand.

Laminar Tube Floc Team

Spring 2014 Semester Contributions

Semester Goals:

The team's goals for the Spring 2014 semester include designing and setting up a new settled water turbidity (SWaT) measurement system to replace the flocculator residual turbidity analyzer (FReTA) system. Once the SWaT system is properly installed and running, we will repeat clamp tests that we had performed last semester to compare the performance results of the two different systems. After these experiments are analyzed, we will decide what experiments will best help us progress in understanding the consequences of floc breakup.

Progress:

The SWaT system was designed and implemented. The SWaT system consists of a tube settler that leads to a turbidimeter, and the water is driven by a peristaltic pump linked up after the turbidimeter. The tube settler length was calculated to be 1.04 m, based on a critical capture velocity of 0.5 mm/s and an angle of 60 degrees. The tube settler flow rate is approximately 90% of the plant flow rate, with the remaining 10% of the flocculator effluent flowing straight to the drain. The entire tube flocculator setup has been lowered to accommodate for the tube settler, so that the final tubing flows linearly into the tube settler to reduce minor losses. A new t-fitting for the entrance of the tube settler was designed to allow for a better waste flow stream to pick up built up flocs at the bottom of the tube settler. Base case testing was done to troubleshoot the SWaT system, but resulting effluent turbidities were much higher than desired. More work must be done on the SWaT system before experiments can be performed.

Fall 2013 Semester Contributions

Semester Goals:

The Laminar Tube Floc Team is extending the work of previous semesters testing the hypothesis that "large flocs are useless." To do so, we are first testing a base case as a control experiment. The setup of the laminar tube flocculator is a series of three coiled tube arrangements (83m long). Our experiments will consist of testing the effects different sized clamps and different numbers of clamps on the middle tube arrangement have on floc breakup and residual turbidity. The results from our experiments will be used to further understand floc breakup and how to better improve the laminar flocculation system.

Progress:

The team ran three base case experiments. One with PACl dosages of 0, 5-10 mg/L (increments of 1 mg/L) and two with PACl dosages according to the power law: PACl dosage = coefficient x base^maxreps (where coefficient = .25, base = 1.25, and maxreps = 10)

Preliminary results from the base case described above suggest that a PACl dose of 2 mg/L is sufficient in achieving the desired mean residual turbidity because PACl doses above 2 mg/L yield similar results for residual turbidity of around 1 NTU (+/- .5 NTU) for the effluent.

Using this dosage range, we conducted another base case with dosages of 0, .8, and 1.8 mg/L of PACl. We then began one clamp tests, where we placed one clamp in the middle of the tubing arrangement. The purpose of the clamp is to breakup flocs by increasing the energy dissipation rate where the clamp is located. Clamp sizes of 4 and 5 mm were tested. These two sizes were chosen from the results of the summer research, where they found 4 and 5 mm clamps showed significant floc breakup.

The results of our one clamp testing has shown that a 4 mm clamp significantly increases residual turbidity and a 5 mm clamp decreases the residual turbidity, as compared with the base case, where no clamp was used. Our results suggest that perhaps a 4 mm clamp breaks up flocs too much, to a point where they cannot fully recover and collect more colloids. The results for the 5mm clamp testing showed no significant difference from the base case with no clamp. The results from our one clamp testing suggest that floc breakup may actually decrease flocculator performance, but more testing should be done with larger clamp sizes to test our theory about the 4 mm clamps breaking up the flocs too much.

Our progress was greatly hindered by challenges with malfunctioning equipment and software errors. The pump for the synthetic raw water was replaced, the code in Mathcad was edited, and various changes have been made in Process Controller to fix the problems we have encountered.