# Flocculation/Sedimentation Optimization

The first goal is to be able to reliably produce a floc blanket using PACl. This January in Honduras we learned that flocculation can fail quickly when the coagulant is injected into small diameter tubes as are used in the demonstration plants. The hypothesized mechanism is that the coagulant forms precipitates that begin to clog the tubing and that the small pores that are left result in high rate of deposition of the coagulant. The rapid fouling of the flocculation tube is a significant problem for the current experimental apparatus. and theoretical analysis suggests that the majority of the coagulant ends up on the flocculator walls rather than on the clay. This may have been one of the causes of the difficulty in producing floc blankets.

There are two options for reducing the loss of coagulant to the tubing walls. One is to redesign the reactor system to handle a flow rate that is identical to that used for FReTA. This would require changing the entire apparatus and thus is not a great option. The second option is to add a large diameter reactor (perhaps a 250 mL bottle) where the raw water and coagulant are mixed using a hydraulic jet on the raw water inlet. This contact tank would provide an opportunity for most of the coagulant to adhere to the clay and thus the existing flocculator could still be used. The hydraulic jet for the raw water should be designed to have an orifice that generates approximately 1 m of head loss. The coagulant should be injected with microbore tubing that discharges directly into the jet.

The second goal is to add imaging capabilities to the apparatus so that the floc blanket status can be monitored in real time. Work with Lesly Yu of National Instruments to identify a camera that would be able to detect the height of the floc blanket. She may be able to arrange for an in kind donation for the AguaClara team. It will be necessary to add back lighting that could be a narrow strip of LEDs with a light diffuser to create a more uniform light source.

Work with Matt Hurst to interface the camera with the computer. Monroe would like to create several external functions for Process Controller that would process the images and return summary values. One function will take a picture and return the average concentration in a region of interest, another will return the height of the floc blanket using the picture taken by the previous function. These functions are also needed by the sed tank hydraulics team. The external functions will use an input file with a LabVIEW data structure. A LabVIEW app that can edit the data structure will be provided. The data structure will include the file path of the images, the region of interest, and a file name of the blank image.

Using the new contact tank, vary the coagulant dose, measure time to build a floc blanket and compare the results with theoretical floc build times based on mass conservation. Once you have developed a method to reliably build a floc blanket and have selected an appropriate coagulant dose for further research, then add floc recycle. Use a coagulant dose that has relatively poor performance so it will be easy to see if floc recycle results in an improvement in performance.

Team Leader
Monroe (mw24@cornell.edu)