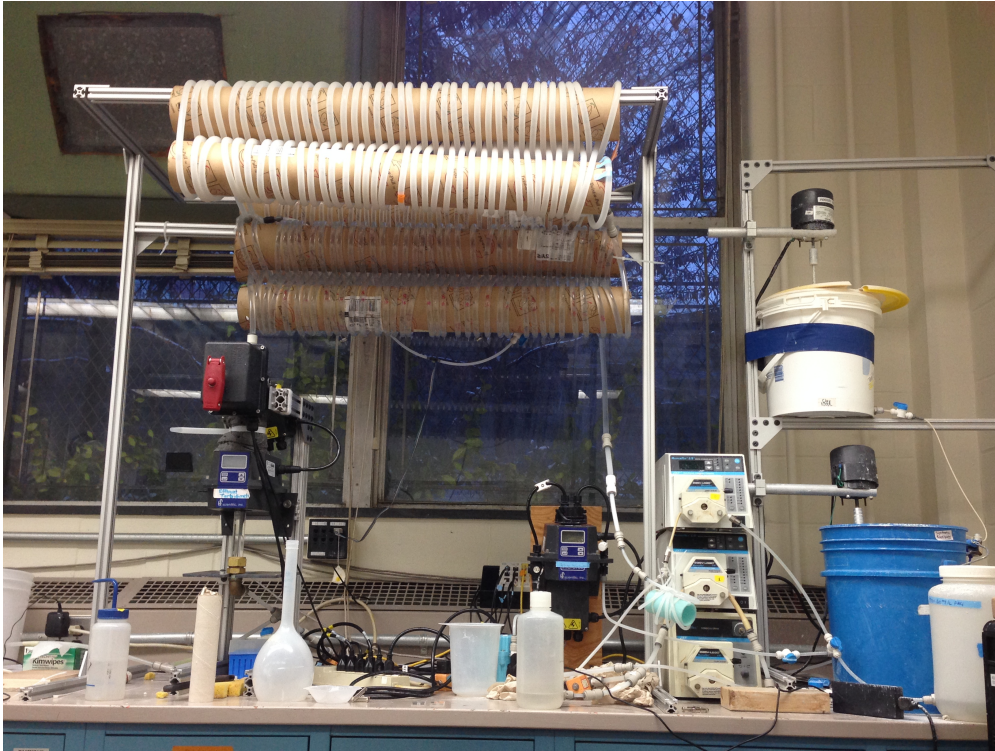


Laminar Tube Floc

Laminar Tube Flocculator



Introduction

In the flocculation process, suspended particles collide with each other to coagulate and transform into larger flocs, with the help of a coagulant, that can be removed by sedimentation. To improve the performance of flocculators, we need to research how the design and operational parameters affect the aggregation and settling velocity of the flocs. These parameters include energy dissipation rate, hydraulic residence time, coagulant dose, influent turbidity, etc. One of the goals for the AguaClara team is to develop a sedimentation tank that will form a fluidized floc blanket, which will help clean water as it flows into the sedimentation tank from the flocculator. To develop this floc blanket the flocculator must produce flocs that fall within a particular range of settling velocities. Our apparatus (flocculation residual turbidity analyzer or FReTA) is capable of measuring both settling velocity and residual turbidity under different flocculator operating conditions. Complete description and sketches of current apparatus setup can be found [here](#).

The goals of the Laminar Tube Floc Team are to determine the parameters that will affect influent turbidity removal and to develop flocculation models as a guideline for flocculation design.

If you are new to the team or would like to know more about the upkeep of our experimental setup, check out the [basics](#). An excellent resource for information on tube flocculator is Ian Tse's M.S. thesis: [Fluid shear influences on hydraulic flocculation systems characterized using a newly developed method for quantitative analysis of flocculation performance](#). Detailed information on the [ProCoDA Software](#) as well as descriptions of the data analysis process can be found in the appendix of this M.S. thesis.

Ongoing Research

* Determine the optimal orifice size for floc break up systems with four, eight, and sixteen clamps by gradually decreasing the clamp size based on the relationships between energy dissipation rate, floc size, terminal velocity, and clamp size until the flocculator performance worsens.

- Determine optimal positioning for floc break up points by comparing the residual turbidity of an evenly distributed clamp system with clamp systems that gradually decrease the number of clamps toward one or both ends of the flocculator. As residual turbidity decreases the flocculator performance improves.
- Compare the performance of tapered tube flocculation with regular tube flocculation. Design a tapered system -- small tube at the beginning, medium tube in the middle, and large tube at the end (same length for each size of the tubing) using 10 mg/L PACl dose and 28 m tube flocculator length (N://files.Cornell.edu/EN/aguaclara/RESEARCH/Tube Floc/Spring 2013/Experiments/Single PACl 10 mgL.pcm/). As tube size (diameter) increases, energy dissipation rate decreases, allowing flocs to continue to grow. The larger that flocs can grow, the lower the residual turbidity will be. 2. Determine optimal positioning for floc break up points by comparing the residual turbidity of an evenly distributed clamp system with clamp systems that gradually decrease the number of clamps toward one or both ends of the flocculator. As residual turbidity decreases the flocculator performance improves.

Current Research (Spring 2015)

* Design and implement a settled water turbidity (SWaT) measurement system that can more accurately measure low turbidities than the previous FReTA system. Using this new SWaT system, repeat experiments using only one clamp of variable size on the middle of the tubing arrangement. Compare the results of these experiments with the results of the same experiments run using the FReTA system from the Fall 2013 research.

* Depending on the results of the middle-clamp testing, either run more experiments with variable number of clamps to further test the effects of clamps, or design and implement a tapered flocculator system with energy dissipation rates starting from 1000 mW/kg.

Challenges for Future Semesters

- Special Skills Needed:
 - [CEE 4540](#): This course could provide a fundamental understanding about municipal drinking water treatment.
 - [MathCAD](#): We use this software to do the calculation for the research.
 - [Lyx](#): This software is helpful when writing a scientific report.

More Information

[Troubleshooting of the apparatus, Process Controller and Data Processor.](#)

Experimental methods

Checklist

[Fall 2011 Research](#)

[Fall 2010 Research](#)

Current Members

[Kevin Shao](#)
[Tanvi Naidu](#)
[Luyan Sun](#)

[Email Team](#)
[Documents](#)

	Challenges	Tasks	Symposium	Final Presentation
Spring 2015		? Unknown Attachment	? Unknown Attachment	? Unknown A
Fall 2014				
Summer 2014	? Unknown Attachment	? Unknown Attachment		
Spring 2014	? Unknown Attachment	? Unknown Attachment	? Unknown Attachment	? Unknown A
Fall '13	? Unknown Attachment	? Unknown Attachment	? Unknown Attachment	? Unknown A
Summer 2013				

Spring 2013		? Unknown Attachment	? Unknown Attachment	? Unknown A
Fall 2012	? Unknown Attachment	? Unknown Attachment	? Unknown Attachment	? Unknown A