

Turbulent Tube Flocculator (FReTA II)

Detailed Task List

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1. By Tuesday, June 18
 - (a) Order materials: different types of tubing and clamps
 - In order to determine which materials we will use to construct this apparatus, we will purchase short lengths of different types of tubing and clamps to test out and decide how flow constraints will be implemented.
 - (b) Research source (tap water) and treatment plant flow rates
 - We need to measure these values to make sure we can get a high enough flow rate
2. By Thursday, June 20
 - (a) Verify energy dissipation, Reynolds number and pipe diameter calculations
 - (b) Perform literature review on flocculation, previous turbulent pipe flow designs, FReTA and analysis methods
3. By Monday, July 8
 - (a) Experiment with materials in order to determine design and construction specs of apparatus, considering:
 - Shapeholding and flexibility parameters
 - Different clamps and tubing: do they provide adequate compression, is there sliding, do they maintain shape?
 - (b) Explore different designs for the flocculator support structure, considering:
 - Circumference
 - Number of coils
 - Height
 - Multiple stacks of coils vs. coils within other coils
 - Amount of space the apparatus will require
 - Possibility of moving to other labs?

Further Tasks

Flow Design

1. Devise a method to measure and regulate water flow rate
 - (a) Use tap water as a source and use a valve to regulate flow
 - (b) Consider use of a constant head tank with a large float valve to provide a constant pressure source of water to accommodate for fluctuations in tap water pressure
 - (c) Consider lack of temperature control in using tap water
 - Discuss option of creating temperature control by mixing hot and cold water with Paul Charles
 - Requires larger solenoid valves
 - Requires a more direct plumbing connection
 - (a) Consider installation of an orifice and pressure sensor to monitor head loss (and consequently flow rate)
2. Consider plumbing requirements for greater temperature control (talk to Paul Charles)
3. Measure performance as a function of time
 - Tube settler vs. FReTA
 - Tube Settler: easy to change capture velocity by varying flow rate of a sample of flocculated water using a peristaltic pump placed after the tube settler and after the turbidimeter
4. Measure total head loss across flocculator by using a pressure sensor
5. Develop design algorithms:
 - (a) Refer to Patience and Margaret's work from last semester
 - (b) Find head loss equation for one flow restriction (expansion losses)

Space Requirements

- Determine layout and size of entire apparatus

Analysis Methods

Two detectors required, connected in parallel

1. To measure particle size and flow
 - Image analysis of flow between two glass plates
2. To measure sedimentation efficiency
 - Determine how to divert flow without floc break up
 - Connection between tube and viewing square plates
 - Circle to square transition?
 - Evaluate usefulness of using a turbidimeter
 - Decide on what pumps will be needed to provide flow
 - Calculate size of view square necessary to prevent floc break-up
 - Determine what percentage of flow will be diverted for each task