Floc Filtration

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Abstract

According to the data from the field, the filter in Tamara tends to perform better than the laboratory filter in Cornell. Therefore, we would like to examine the reason behind it, and possibly come up with a performance model. The main focus of our experiment is to understand the flow distribution of the filter column, as well as the "self-healing" properties of sand media, therefore to better understand the filtration mechanism.

Detailed Task List

The experiment will be conducted with two 2.5cm-columns with alum and clay feed to the system, backwash, and flow sensor and turbidity meter for measurement. As a first experimental goal, we would like to re-examine the flow distribution between two filter columns, since according to the previous experiments, uneven flow distribution between two filter columns has been observed. After we have made any needed changes to our experimental apparatus, we will start the experiments with clay and alum.

Part I. Experiment to Approach an Equal Flow

Based on the previous experimental apparatus (Figure 1), we will run the experiment with clean water, equal amount of same sand media, with approach velocity as 1.8mm/s, which is similar to the approach velocity in the field, to study the flow distribution among the two filter columns and try to figure out the reason why the previous experiment did not obtain an even flow distribution, then modify the apparatus so that equal flow can be obtained from both filter columns.

Part II. Flow Distribution Study

We will study the flow distribution between the two filter columns when the flow contains suspended clay dosed with coagulant. We will consider parallel columns with equal media properties (grain size and bed depth) and unequal properties. In both of these cases we will evaluate the effect of up-flow or down-flow on flow distribution.
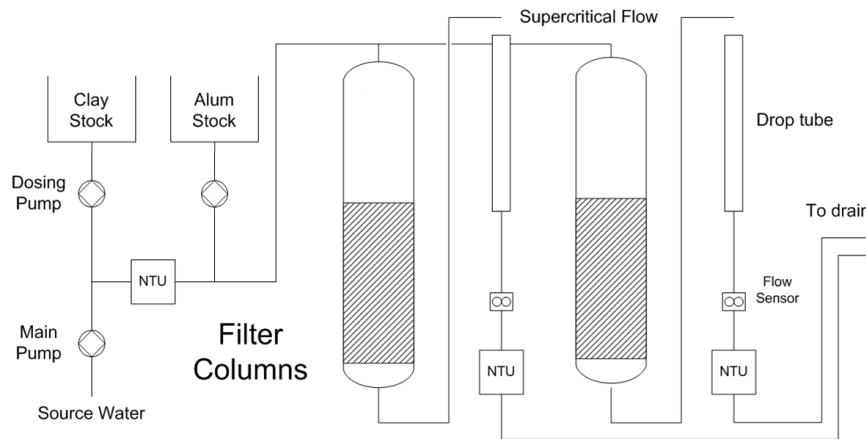
Figure 1: Experimental Setup from Spring 2012

For this experiment, we will start with experimental parameters similar to what was used in the previous experiments, such as a range of 5 - 10 NTU as the influent turbidity, 1 mg/L as coagulant concentration, 5g/L of clay concentration for the stock solution, 1.8mm/s as approach velocity.

Then, we might want to see if a different approach velocity will have a different result, such as a lower or greater approach velocity, taking into account of the sand fluidization effect if the approach velocity is too large.

We will conduct the experiment with equal media and find out the pattern first, then we will conduct the experiment with unequal media, such as different kind of sand grain with same volume in the two filter column, and compare the result with equal media For each of the experiment, we will repeat that experiment 3 to 5 times, depending on the result similarity to the other results.

Part III. Run Experiments with Flocculation

We will run the experiment with flocculation before filtration, and evaluate the differences in filter performance between with and without flocculation, for both equal and unequal sand media.