



AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

Aqua-Aerobic Systems, Inc. In-House Bench Filterability Testing Overview

Aqua-Aerobic Systems, Inc. (AASI) has conducted hundreds of in-house laboratory-scale investigations over the years and have the ability to tailor our studies according to each customer's treatment objectives. We believe these studies represent a rapid and cost-effective way of providing valuable preliminary data although we do recognize such data represent a "snapshot" of filter performance taken during a single set of operating conditions. Even so, these results provide direction on how best to proceed. Since the bench tests are not always conclusive and influent stream conditions often vary, lengthier full-scale pilot testing is sometimes recommended in order to generate performance data under a broader spectrum of operating conditions and to verify the preliminary bench results.

Most evaluations require about 10 to 20 gallons of representative sample, however there are exceptions. We ask that biologically active samples be collected and shipped the same day by next-day delivery to minimize possible spoilage that could adversely affect test results. For non-active samples that are unlikely to degrade – cooling tower blowdown, river water, and groundwater – less expensive ground shipment is generally acceptable. We prefer composite samples to grab samples but realize that collecting them isn't always possible. Below are the preferences for some applications:

- Phosphorus Reduction Applications - Grab Samples – Due to the 48-hour holding limit for phosphorus speciation.
- Primary Treatment – Grab Samples – Due to BOD analysis and activity of sample.
- Wet-Weather Treatment – Grab Samples – Due to BOD analysis and activity of sample.

Our general policy is that AASI will cover the cost of the bench testing and preparing the subsequent technical report, but the client will be responsible for shipping costs. The client can supply their own non-returnable shipping containers or we can provide plastic coolers each containing a five-gallon carboy. Most of our clients use either red label UPS or FedEx for next-day services but FedEx is preferable because UPS requires all containers of non-potable water to be boxed whereas FedEx doesn't. Their only requirement is that nothing leaks. The shipping address is:

Blake Hoffmann, c/o
Manager of Research and Development
Aqua-Aerobic Systems, Inc.
6306 N. Alpine Road
Loves Park, IL 61111
Phone: (815) 639-4491

We work on a first-come, first-served basis and can sometimes get booked up weeks in advance so please contact AASI **before** arranging to have any samples collected and shipped. We want to make sure we have all the appropriate resources in place so we can begin work on your sample as soon as it arrives.

As mentioned, we are able to tailor our investigations according to the discharge requirements specified by the customer. The most common test requires 10 gallons of representative sample and can be referred to as our standard no-chemical test. In this – or any – study, we first characterize the as-received water by conducting the appropriate analyses. Our in-house analytical capabilities include the following:

- TSS
- Turbidity
- Particle population distribution (8-channel instrument)
- pH, total alkalinity
- UVT
- COD
- Phosphorus speciation:
 - Total, total soluble, reactive, soluble reactive, acid-hydrolysable, soluble hydrolysable

For other analyses below, we utilize TestAmerica, Inc. in suburban Chicago.

- BOD
- Metals

We also employ Particle Technology Labs, Ltd. (Downer's Grove, IL) whenever more comprehensive particle analyses are warranted. The fees associated with these independent analyses are usually covered by AASI.

The remaining water is passed through a 3.5" square of hydrated virgin OptiFiber® pile filter medium that is secured vertically in a hydraulically-controllable table top filter apparatus. The filter medium is selected based on the stated treatment objectives as well as the analysis of the as-received sample. Most testing incorporates using one of the following media:

- OptiFiber PA2-13®
- OptiFiber PES-13®

- OptiFiber PES-14®
- OptiFiber PF-14®
- OptiFiber UFS-9®

In some cases, the testing might incorporate more than one media for comparison. Of course, testing more than one filter medium would require more representative water.

The resulting filtrate stream is collected as a profile of consecutive composites and as an overall composite. Those filtrate samples are then analyzed to determine reduction rates over the course of the single abbreviated run. In addition, we monitor headloss through the apparatus during the study. After the laboratory work is concluded, we prepare a formal technical report that includes all test data as well as discussions and recommendations. The time required to complete this type of study and the accompanying report is typically about five to ten days unless we require analyses by third-party labs.

We also have the ability to, on a limited basis, evaluate filter aid chemicals should their use be deemed necessary. We do this through jar testing followed by direct gravity filtration through cloth media. Because of time limitations dictated by potential sample spoilage, we seldom investigate broad spectrums of chemicals, chemical combinations, chemical dosages, mixing strategies, and detention times. However, we do investigate those combinations we think will provide the greatest chance of achieving the treatment goals. To maximize the chemical selection process, we recommend that clients also work with their local chemical suppliers whose representatives are often experienced conducting jar tests.

In addition to being able to investigate coagulants and flocculants, we can perform chemical precipitation tests with aluminum and ferric iron salts whenever phosphorus removal is of interest and the influent analysis indicates a portion of the stream's total phosphorus is soluble. These studies provide stoichiometric data that aid in estimating chemical consumption and cost. For wet-weather studies, we may also add a coagulant to look at improved removal of colloidal particles that may pass through the media to determine whether this would add in further TSS, COD and BOD removal.

Below is the test apparatus setup used for the testing:

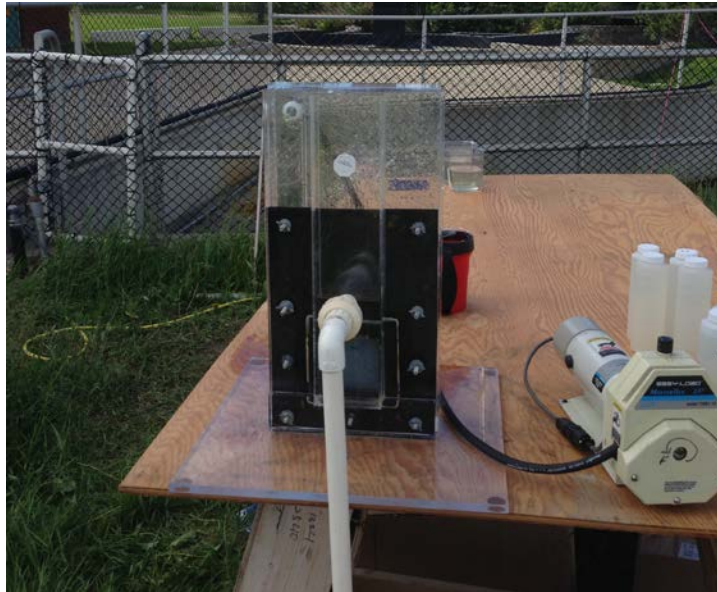


Figure 1: Bench-Scale Filterability Test Apparatus



Figure 2: Side View of Bench-Scale Filterability Test Apparatus