TREATABILITY WASTEWATER TESTING

A POWERFUL TOOL

ADVANCED DIAGNOSTIC TOOLS

WHAT IS TREATABILITY TESTING?

Treatability is a term that describes all the ways wastewater is treated within a wastewater treatment system, including components such as settling, precipitation, screening, degradation, bioaccumulation, filtering, and adsorption. Treatability testing is a broad term that encompasses all the ways a wastewater treatment process can be modeled on a laboratory scale. By scaling down the system in a lab rather than testing in the field, the particular problem or question of interest can be tested in a controlled environment to limit outside factors that may cloud the interpretation of data, such as process upsets.

Environmental Business Specialists, LLC (EBS) has a dedicated treatability lab with highly versatile capabilities to model and test almost any field condition. Treatability testing can be done many different ways depending on the problem or question that needs to be addressed. For biological systems, EBS most commonly utilizes closed system respirometry, Surcis© open system respirometry, and scale reactors as the base for the modeled system and then adds components unique to the system. Treatability testing in these units provides an effective way to troubleshoot problems encountered in the field and can provide information for future treatment conditions, ultimately helping optimize the wastewater treatment process.

CLOSED SYSTEM RESPIROMETRY

EBS uses closed system respirometry (Figure 1) for a variety of applications related to the overall treatability of wastewater. Closed system respirometers measure the oxygen uptake of the microorganisms in a sample bottle representing one batch, or one cycle through the system, in each bottle. Closed system respirometry can be utilized to address a variety of questions:

- How will the use of supplemental products such as nutrients, polymer, chemicals, and bioaugmentation benefit or adversely impact my treatment process?
- I have, or will have, a new waste stream entering my treatment system. How will this impact my treatment process?
- I have experienced an upset at our wastewater treatment plant. Do I have toxic or inhibitory compounds affecting my microorganisms?
- How will temperature impact the biology of the treatment plant?

If you have ever faced one of these questions, or a similar question, then closed system respirometry may be the solution. Closed system respirometry is very useful when a large number of samples need to be analyzed simultaneously, or if there are multiple variables to consider, such as multiple influent streams or comparative values to address. At EBS, we can analyze up to 48 samples under six different temperature scenarios, allowing multiple scenarios to be run simultaneously. Closed system respirometry is incredibly effective in root cause investigation and future treatment efficiency prediction.

Figure 1

OPEN SYSTEM RESPIROMETRY

EBS uses open system Surcis respirometers (Figure 2) to provide precise measurements and track minute changes in parameters, such as pH, oxygen uptake rates (OUR), and temperature, during biological treatment.

These precise measurements allow questions specific to the biology to be addressed such as:

- What is controlling/limiting the nitrification rate of my system?
- How does temperature change the rate of biodegradation?
- What is the COD fractionation of easily degradable, slowly degradable, and non-degradable substrates and how does it relate to BOD?

Open system respirometry also allows us to easily remove a sample from the modeled system during a treatment study. These samples allow additional analyses to be performed that provide supplemental information such as the remaining concentration of a particular chemical. Conversely, open systems also allow wastewater or chemicals to be added during a study to observe the immediate biological reaction compared to previous conditions. If you are interested in analyzing the characteristics of a particular parameter or chemical as treatment occurs, open system Surcis respirometers can provide the answers.

Figure 2

BENCH-SCALE REACTORS

EBS uses bench-scale reactors (Figure 3) to provide information on biomass quality and quantity over several sludge ages. Long-term impacts, or chronic effects, of chemicals and influent changes often take three to seven sludge ages to appear in a wastewater treatment plant. Unlike respirometers, scale reactors accommodate testing that extends over several weeks or even months to assess chronic effects of process changes in activated sludge systems such as settling characteristics, SVI, MLSS, MLVSS, and effluent quality as well as biological health in terms of bacterial activity and growth. Scale reactors can be used to answer questions such as

- Will altering upstream process chemistry impact dewatering?
- Will changing a process control parameter decrease effluent turbidity?
- Can I control filaments with a new supplemental chemical and improve SVI?
- There are no observed acute effects of a new chemical I want to use, but are there chronic impacts that will appear later in the system due to bioaccumulation?
- What is the specific rate of degradation (k rate) for different waste streams?

Scale reactors include an aeration basin and clarifier as the base model following the typical characteristics of an activated sludge treatment plant. Modifications can be made to mimic aeration, RAS, WAS, and flows specific to the modeled system. Influent and biomass from the modeled system are used in the reactors to closely model the conditions at the treatment facility and chemicals of interest can be added to the reactors as a slipstream to monitor long-term impacts. Scale reactors provide valuable information on the full potential impacts of a chemical or condition on wastewater treatment to allow changes in the wastewater treatment system to be made with confidence.

Figure 3

CONCLUSION

Treatability testing is a tremendous tool that EBS uses to generate valuable data and results during our consulting process. Treatability testing defines how a particular component, chemical, or process control variable will impact treatment in the wastewater treatment plant. Laboratory controlled conditions ensure the data is not influenced by external factors such as changes in weather or process upsets that often plague field-based studies. Treatability methods are also beneficial for evaluating potential process changes and their effect on wastewater treatment before these changes actually occur so that one can proactively avoid upset conditions at the wastewater plant. The data obtained from treatability studies can be used to make changes to a treatment system to optimize performance, or to make adjustments in preparation for an upcoming process change.

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