FACT SHEET

Bench Scale vs Pilot Scale Dewatering Testing

How to determine which method is best suited for your project

By: James Hanson, Keith Hamilton and Robert Rhea

Background

Solids processing performance is a critical parameter in the selection of technology and defining realistic specifications. This performance, which includes assessment of achievable solids concentrations, polymer (or chemical) demand, percent capture, and power consumption, can be estimated in either bench scale testing or pilot scale testing. The most appropriate type of testing for a specific project depends on the goals of the tests and desired results. This fact sheet briefly describes the differences in bench scale and pilot scale testing, with considerations on which testing method meets specific needs.

Define goals

The first consideration should be defining the goals for the testing. Some questions that should be asked to determine whether bench scale or pilot scale testing is most appropriate include:

- What information do you require?
- What decisions are you trying to make?
- What drives your economic decisions?
- What level of accuracy and consistency are you seeking?
- Are you already familiar with how the equipment under consideration operates?
- What budget do you have to assess processing performance?
- What is the project schedule?

Once these questions are answered, the decision between bench scale and pilot scale testing may be clearer. Both types of tests will provide varying degrees of information regarding:

- How will the liquid and solid phases of the material to be processed separate.
- How easily the phases separate and how much separation can be achieved.
- What type and how much polymer or other chemical (ie. Ferric) might be needed for reliable separation to occur.
- The solids capture efficiency.
- The amount of moisture expected in the dewatered solids

The differences in testing and potential results are highlighted below.

Bench Scale Testing

Bench scale testing is performed in a laboratory with a solids sample or series of solids samples collected from the treatment plant at a single point in time. Bench scale testing is the first step in determining which technology can achieve a desired result, and what realistic performance might be for a certain technology. The use of bench scale tests is critical for industrial wastes and when assessing achievable processing performance for new processes. Many manufacturers provide off-site bench scale testing using their technology. Samples (1/2 to 5 gallons) are typically gathered by plant staff and shipped in coolers per manufacturers' instructions to the manufacturers' laboratories. Care must be taken to gather representative samples and store and ship samples in a manner that minimizes changes in the samples during transport.

Benefits of bench scale testing

- Quick
- Low cost
- Multiple sources for multiple opinions

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Limitations of testing

- Single snap shot in time
- Small data set

Analytics

- Volumetric concentrations of feed
- Mass concentrations (%TS, %TDS, %TSS) of feed, cake and centrate/filtrate
- pH
- Volatiles
- Polymer/chemical dosage rate

Pilot Scale Testing

Pilot scale testing includes on-site portable equipment temporarily installed at the treatment plant. A pilot is generally less than one week in duration and uses equipment in the 20-200 gpm range. Pilot scale testing provides continuous operation and an opportunity for treatment plant operators to participate in actively running equipment. The pilot test must be coordinated with the manufacturer and scheduled several months in advance because pilot test trailers are typically limited in number. Furthermore, the pilot test trailers must be able to fit somewhere on site, in a location that is feasible for connections to process lines (solids feed, drains), power supply, and removal of processed solids. Samples must be collected, stored, and analyzed either through trailer-mounted analytical equipment or the plant's laboratory. Pilot test protocols and plans should be coordinated ahead of time to make sure that the plant's goals for testing will be met. The costs for testing will vary depending on the required testing duration and testing protocol.

Benefits of pilot scale testing

- More data and data that accounts for variability in feed stream
- Longer term so data outliers are more apparent and results can be considered more reliable for longer term operation
- Hands on demonstration
- Power demand can be assessed
- Improved ability to observe cause/ effect relationship of various parameters (i.e. mixing, detention time)
- Multiple sources for multiple opinions

Limitations of testing

- More costly than bench testing
- Extensive coordination required
- Time intensive for planning, execution and reports
- Quantity of representative product
- Disposal of generated product

Analytics

- Volumetric concentrations of feed
- Mass concentrations (%TS, %TDS, %TSS)of feed, cake and centrate/filtrate
- pH
- Volatiles
- Polymer/chemical dosage rate
- Energy usage rate

Alternatives to Testing

Neither bench scale nor pilot scale testing is necessary for every project. Options for projecting performance without such testing include:

- Analysis of existing plant data
- Optimization of existing equipment
- Site visits
- Internet research
- Expert opinions
- Comparison to other facilities

How to determine which method is best suited for your project

Ultimately, the decision to test is dependent upon the project time frame, budget constraints and risk management profile. The more extensive the testing, the lower the project risk. If project risk is pushed to the supplier, then the supplier may insist on testing of representative product to mitigate their exposure. If the project risk is low, then the cost of testing may outweigh the risk and testing would be limited.

Reviewers

Ed Fritz, P.E.
Rashi Gupta, P.E.
David Oerke, P.E., BCEE
Dr. Richard Tsang, PhD, P.E., BCEE

Additional Resources

- EPA design manual – Dewatering Municipal Wastewater Sludge
- Decanter Centrifuge Handbook, Records and Sutherland
- Solids Process Design and Management, WEF, WERF, EPA
- Design of Water Resource Recovery Facilities

Contact

Water Environment Federation
601 Wythe Street
Alexandria, VA 22314
703-684-2400
biosolids@wef.org

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