Revolutionizing Jar Testing – An Automated, High-throughput Approach

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Introduction

What is jar testing? The jar test is a commonly applied tool in the water industry used to simulate coagulation, flocculation, and sedimentation processes at the bench-scale[1,2]. These processes are often applied in drinking water and wastewater treatment plants.

Why is it needed? Jar testing can help optimize chemical dosage, coagulant type, use of polymer aids, mixing intensities, and in some cases may be a regulatory requirement[3,4]. This tool is becoming increasingly important with climate change and its impacts on water quality leading to poorer treatment performance and increased costs[5].

Challenges? Conventional jar testing is a time and material intensive procedure which is limited to a one-factor-at-a-time approach, limiting the capacity to evaluate a range of conditions and interactions[6]. In this work, we developed an automated, high-throughput method to improve the state of jar testing by allowing rapid response to changing water quality conditions within water treatment plants.

Validation

The high throughput jar tester was conceptualized and designed in collaboration with MANTECH Inc., with the goal of realizing an automated system that could streamline conventional jar testing methods and improve response time acute water quality changes and increase water treatment resiliency. To validate this system, the following framework was developed:

Phase 1: Mechanical Validation

- Verify physical components (e.g., mixing, dosing) of the system and the uniformity of performance across the jars

Phase 2: Analytical Validation

- Determine if the performance is repeatable and reproducible

Phase 3: Operational Performance Assessment

- Quantify the advantages provided over conventional jar testing (time savings, method precision, throughput, etc.)

Phase 4: Experimental Application

- Apply prototype for treatment optimization of two distinct source waters for side-by-side comparison with conventional jar testing

Prototype

Figure 1: Automated Jar Test Prototype[7]

Key Features:

- **Continuous monitoring** of pH and conductivity
- ***In-situ*** turbidity and COD analysis
- **Automated** dosing and pH adjustment
- **High-throughput** capacity
- **Flexible** jar testing programs to enable a range of experiments

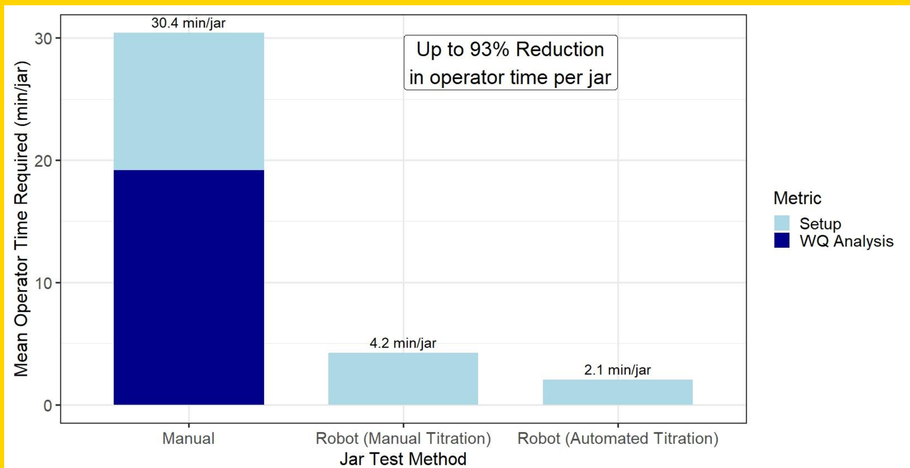
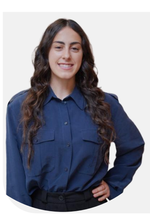


Figure 2: Comparison of operator time requirements across jar test methods

Conclusions

- The importance of jar testing as an optimization tool for water treatment is becoming more apparent with climate change and its implications for water treatment
- Conventional jar testing can be limited in its experimental capacity and has low efficiency. Through automation, the barriers to use can be significantly reduced
- In-situ and continuous analysis of key water quality parameters allows for increased data throughput to support operator decisions

Contact



Questions or comments?
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Find References Here