



Boltac Jar Test Guide

Practical Methodology for Water Treatment Plant Optimisation

Introduction

Jar testing remains one of the most practical methods for evaluating coagulation, flocculation, and settling performance in water treatment plants. The purpose of the jar test is to use laboratory results to optimise the performance of the full-scale treatment plant.

In effect, the jar tester operates as a series of miniature clarifiers under controlled conditions. The key to obtaining meaningful results is not simply observing floc development but understanding how to relate the results back to plant operation.

Why Jar Testing Matters

A jar test is only valuable when the laboratory result can be translated into reliable plant operation. Correct stock preparation, controlled mixing, and accurate back-calculation of plant dosing are what turn jar testing from a visual exercise into a practical process-control tool.

bruce@boltac.co.nz

P.O. Box 8048
Urlich, Hamilton 3245
New Zealand



This guide outlines practical methodology for:

- Preparing coagulant and polymer stock solutions
- Carrying out staged jar test procedures
- Selecting optimum chemical doses
- Interpreting floc development
- Converting laboratory results into plant dosing rates

Solution Preparation

Most jar test methods use 1-litre jars, making a 10,000- g/m³ stock solution practical for coagulant testing.

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Quick Reference Matrix

Chemical Type	Form	Preparation Method	Resulting Strength
Alum	Solid	Dissolve 10g into 1L water	10,000 g/m ³
Alum	Liquid (47%)	16 mL into 1L water	≈ 10,000 g/m ³
PAC	Solid	Dissolve 10g into 1L water	10,000 g/m ³
PAC	Liquid (35%)	24 mL into 1L water	≈ 10,000 g/m ³
Polymer	Plant Tank	50 mL (of 2000 g/m ³ tank) into 1L	100 g/m ³

Key Conversion: 1 ppm = 1 mg/L = 1 g/m³ | 1000 litres = 1 m³

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Specific Calculations:

- **Liquid Alum (47%):** $470,000 / 0.7575 = 620,500 \text{ g/m}^3$. Dilution: $620,500 \times 16 / 1000 = 9,928 \text{ g/m}^3$ ($\approx 10,000 \text{ g/m}^3$).
- **Liquid PAC (35%):** $350,000 / 0.8333 = 420,000 \text{ g/m}^3$. Dilution: $420,000 \times 24 / 1000 = 10,080 \text{ g/m}^3$ ($\approx 10,000 \text{ g/m}^3$).

Solution Storage

- **10,000 g/m³ Alum:** Stable for at least one week when stored cool and dark.
- **10,000 g/m³ PAC:** Should be prepared daily.
- **100 g/m³ Polyelectrolyte:** Should be kept no longer than two days; store cool and dark.

Jar Test Procedure

A typical sequence should replicate plant conditions (hydraulic behavior and retention times). If retention times of each “zone” is known, apply those or similar for better outcomes.

Step 1 — Fill the Jars, Fill the jars to 1L mark with the raw water to be tested.

Step 2 — Rapid Mix and Coagulant Addition Set the jar tester to **100 - 200 RPM** (small vortex visible but not reaching the paddle).

- *Note: Too fast may break floc; too slow prevents adequate dispersal.* Using a 10,000 g/m³ stock solution and a 1-litre jar: **1 ml = 10 g/m³ dose.**
- **Example Series:** 0, 10, 15, 20, 25, 30, 35 g/m³. (Or 4 steps for 4-place stirrer.)
- **Run Time:** If you know the flash mix contact time, apply that, if not, use 60 seconds.

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Step 3 — Slow Mix for Floc Development Reduce stirrer speed to half the **initial RPM** for 5 mins to account for shape of settling tanks hopper bottom if applicable, then reduce to 30 **RPM**. Allow floc to develop (typically 10 minutes, up to 30 minutes). Stop the stirrer.

Step 4 — Select the Optimum Coagulant Dose Choose the jar with even floc development, water clarity, and best settling. If "pin floc" is present, adjust dosing and repeat.

Step 5 — Determine the Polyelectrolyte Dose Using fresh raw water and the optimum coagulant dose identified in Step 4:

1. Run as per Test 2 above with all jars dosed at the selected "optimum" dose rate.
2. Add polyelectrolyte (100 g/m³ stock): **1 ml = 0.1 g/m³**.
3. **Example Series:** 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 ml. (Or 4 steps for 4-place stirrer).
4. Run at 100 RPM for 1 minute, then reduce to 30 RPM.

Relating Results to Plant Operation

Example Plant Calculation:

- **Plant Flow:** 200 m³/hr.
- **Doses Required:** 20 g/m³ Alum / 0.15 g/m³ Polyelectrolyte
- **Tank Strengths:** Alum (20% by volume) / Polyelectrolyte (0.2%)

Coagulant Pump Rate: 20 g/m³ × 200 m³/hr / 200 g/L = 20 L/hr



Polyelectrolyte Pump Rate: $0.15 \text{ g/m}^3 \times 200 \text{ m}^3/\text{hr} / 2 = 15 \text{ L/hr}$

For advice on jar testing equipment designed for practical plant and laboratory use, contact ¹Boltac Industries.

www.boltac.co.nz

¹ E&OE

bruce@boltac.co.nz

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