1. Scope and Objectives

The process is applicable to Water Treatment Plants.

To determine the optimum dosage of coagulants and pH correction chemicals in a Water Treatment Plant

Principle:

The **Jar Test** is based on the principle of **coagulation and flocculation**. When a coagulant (such as alum, ferric chloride, or polymer) is added to water, it neutralizes the negative surface charges on suspended and colloidal particles. This destabilization allows the fine particles to come together (coagulation) and form larger, visible aggregates called **flocs** (flocculation).

Many impurities in water (like clay, silt, organic matter, and microorganisms) are colloidal particles. These colloids are very small (1 nm – 1 µm) and carry a negative surface charge, which keeps them suspended in water (they repel each other and resist settling). A coagulant (such as alum, ferric salts, or polyaluminium chloride) is added to neutralize these charges. Once the charges are neutralized, the particles can come closer and stick together, forming microflocs. With gentle mixing, these microflocs combine into larger, heavier flocs (flocculation).These flocs then settle by gravity during sedimentation, leaving clear water on top.

The formed flocs then settle under gravity during sedimentation. The Jar Test simulates these processes in a laboratory under controlled mixing and settling conditions, helping to determine:

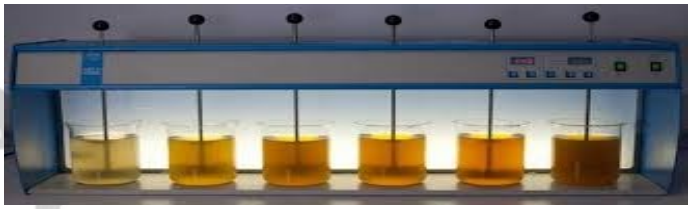
1. The **optimum coagulant type**.
2. The **optimum coagulant dose**.
3. The **pH and alkalinity adjustment** needed for effective coagulation.
4. The expected **settling rate and turbidity removal** efficiency.

2. Equipment and materials

1. Jar Test Apparatus (multiple paddles stirring at the same speed in parallel beakers)
2. Beakers (2 liter).
3. Coagulant solutions-PAC 1% solution-10,000mg/L PAC solution
4. pH correction chemical: 1% lime
5. Raw water sample.

3. Procedure

1. **Prepare coagulant solution**: 10,000mg/L PAC solution (1% solution)
2. Measure the turbidity, pH, Total Alkalinity, Iron content of Raw water and record the values. If the pH of raw water is less than 7 adjust with lime to increase the pH to >7
3. **Prepare samples**: Fill 1 L of raw water in 6 beakers.
4. **Add coagulant** – Dose each beaker with increasing amounts of coagulant. Add the PAC dosage of 10,000 mg/L solution to each beaker.
5. **Note**: Inject 0, 0.5, 1, 1.5, 2, 3 ml as 0, 5, 10, 15, 20, 30mg/L
6. **Rapid mixing:** Stir at high speed at 160 rpm for 2 minutes.
7. **Slow mixing**: Stir slowly at 60 rpm for 10 minutes
8. **Sedimentation:** Allow the samples to stand for 10 minutes
9. **Observation**: Observe each beaker during the test, the floc formation status and the settling status. Sample the supernatant. Measure the turbidity, pH value, alkalinity of the supernatant sampled**.**
10. **Determine optimum dose**: The dose giving the lowest turbidity and good floc settling is selected. Determine the appropriate injection rate with considering actual plant operation.
11. **Report to Water treatment plant.**



Record Sheet: (Coagulation Study)

Test No.	Dosage (mg/L)	Floc Size	Settling Rate	Supernatant Clarity	Comments
1					
2					
3					

References:

Jar Tests for Water Treatment Optimisation: How to Perform Jar Tests – a handbook | eBooks Gateway | IWA Publishing. doi: 10.2166/9781789062694_0015

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