The Hong Kong Polytechnic University
Department of Civil and Environmental Engineering
Water and Waste Laboratories

Laboratory Worksheet C6 : **Jar Test**.

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Objective : To obtain optimum dosages of coagulants for a specific wastewater sample.

Introduction :

Coagulation is not yet an exact science, although recent advances have been made in understanding the mechanism of the process. Therefore, optimum dosages of coagulants are determined experimentally by jar test. The jar test must be performed on each water sample that is to be coagulated and must be repeated with each significant change in the quality of the given water.

The jar test is performed using a series of glass containers that hold at least 1 L and are uniform in size and shape. Normally, six jars are used with a stirring unit that simultaneously mixes the contents of each jar with a uniform power input and a floc illuminator, which enables observation of the small floc particles.

Each of the six jars is filled to 1 L with water sample whose quality (eg. turbidity) and pH have been predetermined. One jar is used as a control, while the remaining five are dosed with different amounts of coagulants at different pH values until the "pinkpoint" flocs are obtained.

Apparatus :

- Jar test apparatus with six 1 L glass containers.
- Stirring machine.
- Floc illuminator.
- Stock alum solution, 10 g/L.
- Stock lime solution, 10 g/L.
- Diluted $NaOH_{(aq)}$.
- Diluted $H_2SO_{4(aq)}$.
- pH meter.
- Turbidity meter.
- Glass fiber filter.
- Filter apparatus.
- Drying oven.

Procedure :

1. Prepare synthetic water sample using the following formula if real water sample is not available.

   22 L tap water + 4.4g fine clay + 44mL activated sludge

2. Determine the pH and quality (either turbidity or suspended solids or both) of the water sample.

3. Fill the glass containers with the water sample (either 800mL or 1L).

4. Adjust the pH of each samples to the desired values (add 1mL 1N NaOH).

5. Record and mark each containers with its initial conditions.

6. Place the containers with the sample on the stirring machine.

7. Add different dosages coagulant (alum or lime) and record the dosages.

8. Start the stirring machine, operate it for 1 minute at a speed of 80 rpm.

9. Reduce the stirring speed to 30 rpm and continue stirring at this speed for 15 minutes.

10. Observe each containers for the appearance of floc and record the order of settling. Describe the results as poor, fair, good or excellent. A hazy sample indicates poor coagulation. Properly coagulated water contains floc particles that are well formed, and the liquid between the particles is clear.

11. Use a pipette, collect enough volume of supernatant from each containers.

12. Determine the pH and quality of the supernatants after settling.

Analysis :

1. Plot water quality (turbidity and/or suspended solids) against coagulant dosages. Observe and estimate the optimum dosage.

2. Compare the pH values before and after coagulant dose and comment on their effects.

Suggested dosages :

1. Alum : 100 mg/L, 200 mg/L, 300 mg/L, 400 mg /L, 500 mg/L and 600 mg/L.
   Optimum pH is 8 to 8.5

2. Lime : 100 mg/L, 400 mg/L, 600 mg/L, 1000 mg/L, 1200 mg/L and 1500 mg/L.