Experiment Name : Determination of Biochemical Oxygen Demand (BOD) in Wastewater

Objective

To determine the Biochemical Oxygen Demand (BOD) of a wastewater sample over a 5-day incubation period at 20°C, as per Indian Standard IS 3025 (Part 44): 1993.

Principle

BOD is a measure of the amount of oxygen required by microorganisms to decompose organic matter in a water sample under aerobic conditions. The test involves measuring the dissolved oxygen (DO) content before and after a specified incubation period. The difference in DO values represents the BOD of the sample.

Apparatus and Materials

1. **Reagents:**
    - Phosphate buffer solution
    - Magnesium sulfate solution
    - Calcium chloride solution
    - Ferric chloride solution
    - Sodium sulfite solution (for dechlorination, if required)
    - Distilled water
2. **Apparatus:**
    - BOD bottles (300 mL) with airtight stoppers
    - Incubator or BOD incubator (set at 20°C ± 1°C)
    - DO meter or titration setup for dissolved oxygen measurement
    - Pipettes and measuring cylinders

Procedure

1. Sample Preparation:

1. If the sample contains residual chlorine, dechlorinate it by adding sodium sulfite solution.
2. Dilute the sample with distilled water if the BOD is expected to be high, ensuring sufficient oxygen is present during the incubation period.
3. Add 1 mL each of phosphate buffer, magnesium sulfate, calcium chloride, and ferric chloride solutions per liter of sample or dilution water to provide necessary nutrients for microbial growth.

2. Initial DO Measurement:

1. Fill two BOD bottles (300 mL) with the prepared sample or diluted sample, ensuring no air bubbles are trapped.
2. Measure the initial dissolved oxygen (DO0) of one bottle using a DO meter or Winkler method.

3. Incubation:

1. Stopper the second bottle tightly to prevent air ingress.
2. Place the bottle in a BOD incubator set at 20°C.
3. Incubate the sample for 5 days.

4. Final DO Measurement:

1. After the incubation period, remove the bottle from the incubator.
2. Measure the dissolved oxygen (DO5) using a DO meter or Winkler method.

5. Blank Determination:

1. Prepare a blank using distilled water with the same nutrient additions.
2. Measure the initial and final DO of the blank to ensure oxygen depletion does not exceed 0.2 mg/L.

Observation Table

S. No.	**Vol. Sample (ml)**	**Burette reading (ml)**		**Difference (V1)**	**DO (mg/l)** **(A x N x 8000)/V**
		Initial	**Final**		
Blank				**…… (V2)**	
At 0th day					
At 5th day					

Calculation

The BOD of the sample is calculated using the formula:

$BOD5 = (DO_i – DO_f) \times DF$

Where:

- **DO_i** = Initial dissolved oxygen (mg/L)
- **DO_f** = Dissolved oxygen after 5 days (mg/L)
- **DF =** Dilution factor

Note: If the sample is diluted, then only multiply the result by the dilution factor.

Precautions

1. Ensure all glassware and apparatus are clean to avoid contamination.
2. Avoid trapping air bubbles while filling BOD bottles.
3. Ensure the incubator maintains a constant temperature of 20°C.
4. Dechlorinate the sample if residual chlorine is present.
5. Measure DO immediately after opening the BOD bottle to prevent oxygen exchange with the atmosphere.

Result

Report the BOD of the wastewater sample in mg/L, corrected for dilution, if applicable.

Discussion

- Discuss the significance of the BOD value in assessing the organic pollution load in wastewater.
- Compare the obtained BOD value with standard permissible limits for wastewater discharge.

Conclusion

Summarize the findings and comment on the biodegradability of the organic matter in the analyzed wastewater sample.

Reference

Indian Standard IS 3025 (Part 44): 1993 - Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater: Determination of Biochemical Oxygen Demand.