

Experiment Name: Determination of Dissolved Oxygen (DO) in Wastewater

Objective

To determine the concentration of dissolved oxygen (DO) in a wastewater sample using the Winkler method as per Indian Standard IS 3025 (Part 38): 1989.

Principle

The Winkler method involves the oxidation of manganese (II) to manganese (IV) in an alkaline medium by the dissolved oxygen in the sample. The manganese (IV) reacts with iodide in an acidic solution to release iodine, which is then titrated with a standard sodium thiosulfate solution. The amount of thiosulfate used is proportional to the dissolved oxygen content in the sample.

Apparatus and Materials

1. Reagents:

- Manganese sulfate solution (MnSO_4)
- Alkaline potassium iodide solution (containing potassium hydroxide and potassium iodide)
- Concentrated sulfuric acid (H_2SO_4)
- Standard sodium thiosulfate solution (0.025 N)
- Starch indicator solution
- Distilled water

2. Apparatus:

- BOD bottles (300 mL)
- Burette and stand
- Pipettes and measuring cylinders
- Conical flasks (250 mL)
- Dropper

Procedure

1. Sample Collection:

1. Collect the wastewater sample in a 300 mL BOD bottle, ensuring no air bubbles are trapped in the bottle.
2. Analyze the sample immediately to prevent changes in DO content.

2. Fixation of DO:

1. Add 2 mL of manganese sulfate solution to the sample using a pipette.

2. Add 2 mL of alkaline potassium iodide solution to the sample.
3. Stopper the bottle carefully and mix the contents by inverting the bottle several times.
4. Allow the precipitate (manganese hydroxide) to settle.

3. Acidification:

1. Add 2 mL of concentrated sulfuric acid to the bottle.
2. Stopper the bottle and mix thoroughly until the precipitate dissolves and a clear brown solution forms.

4. Titration:

1. Transfer 50 mL of the sample to a conical flask.
2. Add 1-2 mL of starch indicator solution. The solution will turn blue.
3. Titrate the sample with standard sodium thiosulfate solution (0.025 N) until the blue color disappears, indicating the endpoint.
4. Note the volume of sodium thiosulfate solution used (V1 mL).

5. Blank Determination:

1. Perform the same procedure using distilled water instead of the wastewater sample.
2. Note the volume of sodium thiosulfate solution used for the blank (V2 mL).

Observation Table

S. No.	Vol. Sample (ml)	Burette reading (ml)		Vol used of titrant (V1)
		Initial	Final	
Blank			 (V2)

Calculation

The dissolved oxygen (DO) concentration in the sample is calculated using the formula:

$$\text{DO (mg/L)} = (V1 - V2) \times N \times 8000 / \text{Volume of sample (mL)}$$

Where:

- **V1** = Volume of sodium thiosulfate used for the sample (mL)
- **V2** = Volume of sodium thiosulfate used for the blank (mL)
- **N** = Normality of sodium thiosulfate (0.025 N)
- **8000** = Milliequivalent weight of oxygen multiplied by 1000 (conversion factor)

Result

Report the dissolved oxygen concentration of the wastewater sample in mg/L.

Precautions

1. Ensure no air bubbles are trapped in the sample during collection.
2. Handle concentrated sulfuric acid with care to avoid accidents.
3. Use clean and dry glassware to prevent contamination.
4. Perform the analysis immediately after sample collection to avoid changes in DO content.

Discussion

- Discuss the significance of the DO value in assessing the quality of wastewater.
- Compare the obtained DO value with standard permissible limits for wastewater discharge.

Conclusion

Summarize the findings and comment on the oxygenation status of the analyzed wastewater sample.

Reference

Indian Standard IS 3025 (Part 38): 1989 - Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater: Determination of Dissolved Oxygen.