

Experiment Name : Determination of Chemical Oxygen Demand (COD) of Wastewater

Objective: To determine the Chemical Oxygen Demand (COD) of a given wastewater sample as per Indian Standards (IS 3025: Part 58).

Introduction: Chemical Oxygen Demand (COD) is a critical parameter for assessing the organic pollution load in wastewater. It measures the amount of oxygen required to chemically oxidize organic matter in the sample using a strong oxidizing agent under acidic conditions.

Principle: In this method, the organic matter in the sample is oxidized by potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) in the presence of sulfuric acid (H_2SO_4) and a catalyst (silver sulfate). The residual potassium dichromate is titrated against a standard ferrous ammonium sulfate (FAS) solution to determine the COD.

Materials Required:

1. Reagents:

- Potassium dichromate (0.25 N)
- Ferrous ammonium sulfate (FAS, 0.1 N)
- Sulfuric acid with silver sulfate catalyst
- Mercuric sulfate (HgSO_4)
- Ferroin indicator
- Distilled water

2. Apparatus:

- COD digestion apparatus (reflux setup or block digester)
- Burette (50 mL)
- Pipettes (10 mL and 20 mL)
- Conical flask (250 mL)
- Volumetric flask (1000 mL)
- Measuring cylinder

Procedure:

1. Sample Preparation:

- Filter the wastewater sample to remove suspended solids, if required.
- If the chloride concentration exceeds 1000 mg/L, add 1 g of mercuric sulfate to the sample to prevent interference.

2. Reflux Digestion:

- Pipette 20 mL of the wastewater sample into a reflux flask.
- Add 10 mL of 0.25 N potassium dichromate solution.
- Add 30 mL of sulfuric acid with silver sulfate catalyst slowly along the sides of the flask to prevent local heating. Swirl gently to mix.

- Attach the flask to the reflux condenser and heat the setup in a COD digester for 2 hours at 150°C.
 - After digestion, allow the setup to cool to room temperature.
3. **Titration:**
- Transfer the contents of the reflux flask to a conical flask and dilute with 20-30 mL of distilled water.
 - Add 2-3 drops of ferroin indicator.
 - Titrate the solution with 0.1 N ferrous ammonium sulfate (FAS) solution until the color changes from blue-green to reddish-brown.
4. **Blank Determination:**
- Perform the same steps as above using distilled water instead of the wastewater sample.

Calculations:

The COD is calculated using the formula:

$$\text{COD} = (B \times N \times V \times 8000) / S$$

Where:

- **B** = Volume of FAS used for the blank (mL)
- **S** = Volume of FAS used for the sample (mL)
- **N** = Normality of FAS
- **V** = Volume of the sample (mL)

Precautions:

1. Handle sulfuric acid and potassium dichromate with care, as they are highly corrosive.
2. Ensure proper ventilation while performing the experiment.
3. Avoid any contamination during sample handling.
4. Use gloves and safety goggles throughout the experiment.

Result: Report the COD of the wastewater sample in mg/L.

References:

- IS 3025: Part 58 - 2006: Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater.
- APHA Standard Methods for the Examination of Water and Wastewater, 23rd Edition.