Experiment 5: Determination of COD of waste water

Significance of the experiment: In environmental chemistry, the chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compounds in water. Most applications of COD determine the amount of organicpollutants found in surface water (e.g. lakes and rivers) or wastewater, making COD a useful measure of water quality.[1] It is expressed in milligrams per liter (mg/L) also referred to as ppm (parts per million), which indicates the mass of oxygen consumed per liter of solution. The chemical oxygen demand (COD) test is extensively employed as a means of measuring the pollution strength of industrial wastes.[2] Chemical oxygen demand is a measure of the total quality of oxygen required for oxidation of organic compounds of wastes to CO_2 and water by a strong oxidizing agent.This parameter is particularly valuable in surveys designed to determine and control losses to sewer systems. Results may be obtained within a relatively short time and measures taken to correct errors on the day they occur. Oxygen demand is an important parameter for determining the amount of organic pollution in water. The test has its widest application in measuring waste loadings of treatment plants and in evaluating the efficiency of treatment processes.[3]Other applications include testing lake and stream water samples for organic pollution. Oxygen demand testing does not determine the concentration of a specific substance; rather, it measures the effect of a combination of substances and conditions. Because oxygen demand is not a pollutant, it poses no direct threat to fish or other life. It can, however, pose an indirect threat to living organisms by reducing the level of dissolved oxygen.

Aim : To determine chemical oxygen demand (COD) of the given waste water sample using standard FAS solution.

Principle : Waste water contains organic and inorganic impurities, which include straight chain aliphatic compounds, aromatic hydrocarbons, straight chain alcohols, acids, pyridine and other oxidizable materials. Straight chain compounds, acetic acid etc., are oxidized more effectively when silver sulfate is added as a catalyst. Mercuric sulfate reacts with chlorides in the waste water to form precipitates which are oxidized only partially by this procedure. This difficulty is overcome by adding mercuric sulfate to the sample.

Procedure:

Part A: Preparation of standard Mohr's salt solution (FAS solution)

Weigh Mohr's salt accurately into a 250 cm^3 volumetric flask. 3-4 ml of dilute sulphuric acid and dissolve the crystals. Dilute the solution with ion exchange water upto the mark and shake well. Calculate the normality of FAS solution.

Part B: Back Titration:

Pipette out 25 cm^3 of the waste water sample into a conical flask. Add 10 cm^3 of standard potassium dichromate solution followed by 2 test tube of 1:1 sulphuric acid (containing silver sulphate) with constant shaking. Add boiling chips to the flask. Attach a reflux condenser and reflux the mixture for half an hour. Cool, wash the condenser with ion exchange water and transfer the washings to the flask. Add 2-3 drops of ferroin indicator and titrate against standard Mohr's salt solution until the solution turns from blue green to reddish brown. Repeat the same procedure for agreeing values.

Part C: Blank Titration:

Pipette out 10 cm^3 of standard potassium dichromate solution. Add 2 test tube of 1:1 sulphuric acid (containing silver sulphate) followed by 2-3 drops of ferroin indicator. Titrate against standard Mohr's salt solution until the colour turns from blue to reddish brown.

Result:

The COD of the given industrial waste water sample is ....mg of O_2/litre

Links to the external sources of information about the topic:

1. http://en.wikipedia.org/wiki/Chemical_oxygen_demand
2. http://science.jrank.org/pages/1388/Chemical-Oxygen-Demand.html
3. https://www.gov.uk/government/uploads/system/.../**COD**-215nov.pdf

Experiment 5: Observation and Calculations

Part A: Preparation of standard solution of Ferrous Ammonium Sulfate (FAS or Mohr's salt).

1. Weight of bottle + FAS crystals= W_2 = --------------- g

2. Weight of empty bottle = W_1 = --------------- g

3. Weight of FAS crystals = W_2-W_1 = ---------------- g

$Normality\ of FAS\ = \frac{Weight\ of\ salt\ (W2-W1)\ X\ 4}{Equivalentweight\ of\ FAS\ (392)}$ = ...(a)

Part B: (a) Back titration

Burette reading	**Trial** I	**Trial** II	**Trial** III
Final reading			
Initial reading			
Volume of FAS run down (mL)			

Volume of FAS consumed in back titration = ----------- mL (b)

[Alternatively, the volume of FAS consumed by the unreacted $K_2Cr_2O_7$ in the solution].

(b) Blank titration

Burette reading	Trail I
Final reading	
Initial reading	
Volume of FAS run down (mL)	

Volume of FAS consumed in blank titration = ----------- mL (c)

[Alternatively, the volume of FAS consumed by the total amount of $K_2Cr_2O_7$ in the solution available for reaction with industrial waste water].

1000 mL of 1NFAS solution = 1 equivalent of oxygen = 8 g of oxygen.

1mL of 1N FAS solution= 8 mg of oxygen.

(c-b) mL of `a' N FAS solution = 8 x (c-b) x a = ------------- mg of oxygen.

1000 mL of industrial waste water sample contains = $\frac{8000\ X\ (c-b)\ X\ a}{25}$mg of O_2.

Result:

The COD of the given industrial waste water sample is ....mg of O_2/litre