Assessment of chemical oxygen demand(COD) levels in effluent water

Expt No. 05

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17BIT0028

Principle:

The chemical oxygen demand determines the amount of oxidizable organic pollutants found in surface water, making COD a useful measure of water quality. It is expressed in milligrams per litre (mg/L), which indicates the mass of oxygen consumed per litre of solution. The COD is determined by refluxing the sample in the presence of excess $K_2Cr_2O_7$, which serves as oxidizing agent. The solution is acidified with H_2SO_4, and Ag_2SO_4 is added as a catalyst to speed the oxidation of low-molecular-weight fatty acids. Mercuric sulfate, $HgSO_4$, is added to complex any chloride that is present, thus preventing precipitation of the Ag^+ catalyst as AgCl. After refluxing for 30 min, the solution is cooled to room temperature, and the excess $Cr_2O_7^{2-}$ is determined by a back titration, using ferrous ammonium sulphate(FAS) as titrant and ferroin as indicator. Since it is difficult to completely remove all traces of organic matter from the reagents, a blank titration must be performed. The difference in the amount of FAS needed to titrate the blank and the sample is proportional to COD.

Requirements:

Reagents and solutions: $K_2Cr_2O_7$ (0.1N) solution, standard FAS solution (0.1N), silver sulphate–sulphuric acid solution (2 g silver sulphate dissolved in 1000 mL of 20% sulphuric acid solution), $HgSO_4$, ferroin indicator.

Apparatus: COD digester setup, burette, pipette, conical flask, and burette stand.

Procedure

Pipette out 10 mL of the given water sample into a clean sample tube. Add 20 mL of potassium dichromate solution, 30 mL of silver sulphate – sulphuric acid mixture and 0.5 g of mercuric sulphate to it. Add one porcelain bit to the reaction vessel. Insert the reaction vessel into one of the holes of COD digester, which has attained 150 ^{0}C. Fix the air condenser on reaction vessel. Reflux the contents for 30 min, cool to room temperature and transfer the contents to 200 mL conical flask.Titrate the excess potassium dichromate present with standard ferrous ammonium sulphate solution

using 4 to 5 drops of ferroin indicator. The end point is the color change from yellow to reddish brown.

Repeat the same procedure with blank using distilled water instead of sample.

OBSERVATION AND CALCULATIONS

Burette: Standard solution of FAS

Conical Flask: Digested sample+4 drops of Indicator

End point: Yellow to reddish-brown

Type of water	Volume of Sample taken (mL)	Burette reading (mL)		Volume of FAS (mL)
		Initial	Final	
Sewage water	10	0	1.2	V_2 1.2
Blank (distilled water)	10	0	10.9	V_1 10.9

Calculations:

Volume of standard FAS consumed for blank titration (V_1) = 1.2 mL

Volume of standard FAS consumed for sample titration (V_2) = 10.9 mL

Strength of standard FAS (N_1) = 0.1 N

Volume of sample water (V_3) = 10 mL

$$COD = \frac{(V_1 - V_2) \times N_1 \times 8 \times 1000}{V_3} \text{ ppm}$$

$= (9.7 \times 0.1 \times 8 \times 1000)/10$

$= 776$ ppm

Result

COD of the given sample of water = 776 ppm

3½

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