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Hydrogen Peroxide by Permanganometry

Experiment 17 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To standardise the stated titrant and calculate the content of the named compound from a prescribed titration.

Principle

In the prescribed acidic medium, permanganate oxidises hydrogen peroxide to oxygen while being reduced to Mn(II). Permanganate provides its own colour endpoint. The acidity and reaction conditions must suit the validated method; chloride-containing acid is not substituted for the prescribed sulphuric-acid medium.

Reaction and Calculation Basis

- $2 \text{MnO}_4^- + 5 \text{H}_2\text{O}_2 + 6 \text{H}^+ \rightarrow 2 \text{Mn}^{2+} + 5 \text{O}_2 + 8 \text{H}_2\text{O}$.
- H_2O_2 formula mass ≈ 34.014 g/mol. Mass in mg = $V \times C \times (5/2) \times 34.014$.

Requirements

- Prescribed assay method, balance, burette, pipette, volumetric glassware and labelled test portion.
- Titrant: Approximately 0.02 mol/L potassium permanganate.
- The primary standard or certified standard, prescribed medium and endpoint system named below.

Standardisation of the Titrant

1. Use a primary standard

Accurately weigh certified sodium oxalate on the stated purity basis and dissolve in the prescribed acidic medium.

2. Establish reaction conditions

Apply the method's controlled temperature and addition conditions; oxalate-permanganate reaction rate matters.

3. Titrate

Titrate to the stated persistent faint-pink endpoint. Two moles permanganate react with five moles oxalate. $\text{CKMnO}_4 = (2/5) \times \text{moles oxalate} \div \text{corrected titrant volume in litres}$.

Procedure

1. Prepare the peroxide

Accurately weigh or measure the prescribed test portion, retaining its mass or volume basis. Dilute as directed and account for any aliquot.

2. Acidify

Use the specified sulphuric-acid medium and reaction conditions. Do not substitute hydrochloric acid.

3. Titrate

Add standardised permanganate with mixing to the prescribed faint-pink endpoint and persistence time.

Pharmaceutical Inorganic and Analytical Chemistry**4. Calculate**

Use the 5:2 peroxide-to-permanganate mole ratio. Express peroxide content on the stated w/w or w/v basis.

Observations and Record

Record	Standardisation	Assay
Standard / test mass	___ g	___ g
Initial / final burette	___ / ___ mL	___ / ___ mL
Blank / corrected titre	___ / ___ mL	___ / ___ mL
Concentration / result	___ mol/L	___% on stated basis

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Standardisation example: 0.06700 g $\text{Na}_2\text{C}_2\text{O}_4$, approximately 134.00 g/mol, is 0.5000 mmol oxalate. It reacts with 0.2000 mmol KMnO_4 . A 10.00 mL titre gives 0.02000 mol/L.
- Peroxide factor: 1 mL of 0.02000 mol/L KMnO_4 corresponds to 1.7007 mg H_2O_2 .
- If 1.000 g test solution consumes a corrected 17.64 mL, mass $\text{H}_2\text{O}_2 \approx 30.00$ mg; content = $30.00/1000 \times 100 = 3.000\%$ w/w.

Result

Titrant concentration = ___ mol/L. Corrected titre = ___ mL. Calculated content = ___% on the ___ basis; prescribed criterion comparison: ___.

Precautions

- Use the prescribed acid and endpoint conditions.
- Avoid contamination that decomposes peroxide before assay.
- Record whether the test portion was weighed or measured; w/w and w/v are different bases.
- Use the actual standardised concentration, correct for the prescribed blank and account for any aliquot or dilution. The monograph defines acceptance limits and the as-is, dried or hydrated basis.

Viva Questions and Answers**1. Why is no separate colour indicator required?**

A slight excess of permanganate gives the defined pink endpoint.

2. What is the reaction ratio?

Five moles H_2O_2 to two moles permanganate in the specified acidic reaction.

3. Why avoid an arbitrary acid substitution?

The substituted medium may undergo side reactions or change the valid assay conditions.

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