

Determination of Hydrogen Peroxide Concentration (30% to 70%)

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Technical Data Sheet

Scope

This method is designed for the determination of hydrogen peroxide in aqueous solutions containing 30% to 70% hydrogen peroxide.

Principle

Hydrogen peroxide in a diluted portion of the sample is quantitatively oxidized by titration with a potassium permanganate solution of known strength. Compounds which are oxidized by potassium permanganate under acidic conditions interfere. (Ref: Solvay & Cie., Method FN 1167/01).

Reagents

All reagents should be analytical reagent grade, and only deionized water should be used.

- A. Potassium Permanganate (KMnO₄):** 0.1N-Potassium permanganate is a strong oxidizer; wear gloves and safety glasses. Weigh 3.2 g of KMnO₄ into a 1-liter beaker. Add 500 mL of water and stir until all the KMnO₄ is in solution. Boil for one hour, cool, and filter through a fritted glass crucible into a 1-liter volumetric flask. Dilute to volume and mix well. Store in a dark-colored bottle. Standardize using the method given in Procedure, Item A. below.
- B. Sodium Oxalate (Na₂C₂O₄):** Sodium oxalate is toxic; wear gloves and avoid breathing dust.
- C. Sulfuric Acid (1:3):** Wearing gloves and safety goggles, slowly add 50 mL of sulfuric acid (Analytical Reagent Grade 96%) to 150 mL of water in a 250-mL beaker while constantly stirring. Allow the solution to cool to room temperature before using.

Procedure

A. Standardization of Potassium Permanganate (0.1N)

1. Weigh (to the nearest 0.1 mg) about 0.3 g of dry sodium oxalate into a 500-mL Erlenmeyer flask.
2. Add 200 mL of water, 50 mL of H₂SO₄ (1:3), and a few glass beads.
3. Heat the solution to boiling on a hot plate.
4. Remove the flask from heat and add the potassium permanganate solution from a 50-mL Class-A burette until the first appearance of a faint pink color that persists for 30 seconds. Do not let the temperature of the solution in the flask fall below 70°C before the endpoint is reached.

$$\text{Normality of KMnO}_4 = \frac{(\text{Weight Na}_2\text{C}_2\text{O}_4)(2)(1000)}{(\text{mL KMnO}_4)(134)}$$



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B. Determination of Hydrogen Peroxide

1. Weigh a 50-mL beaker to the nearest 0.1 mg.
2. Using a Mohr pipette, add to the 50-mL beaker:
 - ± 5 g of sample for 35% H_2O_2
 - ± 3.5 g of sample for 50% H_2O_2
 - ± 2.5 g of sample for 70% H_2O_2
 - a proportionally larger sample for residual H_2O_2 (e.g., about 20 g for 1% H_2O_2).

Caution: gloves and safety goggles must be worn when handling concentrated peroxide.

3. Immediately reweigh the beaker to the nearest 0.1 mg. Record the gain in weight as W.
4. Transfer the sample to a 500-mL volumetric flask containing about 250 mL of water and 2 mL of H_2SO_4 (1:3). Thoroughly rinse the beaker into the volumetric flask. Dilute to volume with water and mix well.
5. Pipette 20.0 mL of the solution into a 500-mL Erlenmeyer flask containing 15 mL of H_2SO_4 (1:3) and 60 mL of water.
6. Add the standardized potassium permanganate solution from a 50-mL Class-A burette until the first appearance of a faint pink color that persists for 30 seconds. Record the volume delivered as V.

Calculation

$$\% \text{H}_2\text{O}_2 \text{ (w/w)} = \frac{(V)(N)(1.701)(25)}{W}$$

where: V = mL of potassium permanganate used in titration
N = normality of potassium permanganate
W = grams of sample weighed into 50 mL beaker
1.701 = weight per milliequivalent of $\text{H}_2\text{O}_2 \times 100$
25. = dilution factor

NOTE: If the proper equipment is available, this titration can be done potentiometrically.

Storage and Handling

- Store hydrogen peroxide in the original vented container, upright, in a cool, ventilated area where it is protected from damage, or in bulk storage tanks made from approved alloys of aluminum or stainless steel.
- Do not store other chemicals, fuels, or combustible materials near hydrogen peroxide.
- Never return unused hydrogen peroxide to the storage container.
- When empty, rinse all peroxide containers thoroughly with clean water before discarding.
- Use only approved material for pumps, piping, and hoses.

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Safety

- Persons working with hydrogen peroxide should be familiar with personal protective equipment, first aid measures and the proper safety and handling procedures. Consult the Material Safety Data Sheet (MSDS) for appropriate information.
- Prevent accidental decomposition by keeping the product free of contaminants.
- Prevent fires by avoiding accidental spills. Water is the preferred method for extinguishing fires in which hydrogen peroxide is present.
- Spills and leaks should be contained, diluted with copious amounts of water and disposed of in compliance with local regulations.
- Hydrogen peroxide storage or handling areas should be equipped with a safety shower, an eyewash station, and a water hose.

First Aid

In case of product splashing into the eyes and face, treat eyes first.

- **Eye contact:** Flush eyes immediately with water for at least 15 minutes. Call a physician.
- **Skin contact:** Immediately flush skin with water while removing contaminated clothing and shoes. Call a physician if irritation persists.
- **Inhalation:** Remove the victim from the contaminated area to fresh air. Call a physician in case of respiratory symptoms.
- **Ingestion:** Consult with a physician immediately in all cases. DO NOT induce vomiting. If victim is conscious, rinse mouth and give fresh water.

Danger: Hydrogen Peroxide solutions are strong oxidizers and corrosive to the eyes, mucous membranes and skin. Consult the MSDS for the appropriate Personal Protective Equipment to wear when handling hydrogen peroxide. In case of contact with the eyes, skin or clothing, flush with large amounts of water for 15 minutes. In case of ingestion, sit upright, drink large quantities of water to dilute the stomach contents and seek immediate medical attention. Product in contact with combustible materials may cause fires.

Before using, read Material Safety Data Sheet (MSDS) for this chemical.

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24 hour Emergency Phone Number - 1-800-424-9300 (CHEMTREC®)

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