

Lab: Titration of H₂O₂ with potassium permanganate

Purpose

To determine the concentration of H₂O₂(aq) in store-bought hydrogen peroxide solutions

Tasks

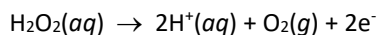
- Answer the pre-lab questions
- Read Safety, Background and Prior Knowledge, Equipment Available and Chemicals Available
- Design your experiment and write your procedure; submit for review
- Perform your experiment
- Summarize your findings (lab report)

Safety

- Follow all normal safety procedures in the laboratory
- Potassium permanganate solution and sulfuric acid are hazardous and must be handled with great care. You must wear goggles, aprons and gloves at all times. Potassium permanganate can stain skin and sulfuric acid is corrosive.

Background and Prior Knowledge

- When in acidic conditions, the permanganate ions are reduced to Mn²⁺ ions. A few mL of acid (usually less than 10) is sufficient to ensure acidic conditions.
- MnO₄⁻ is a dark purple color. Mn²⁺ is nearly colorless in solution.
- A solution of hydrogen peroxide can be oxidized according to the equation:



- Typical drugstore hydrogen peroxide solutions are labeled “3%” and stored in opaque bottles to prevent sunlight from decomposing the hydrogen peroxide. Even with this protection, the H₂O₂ will still break down over time into water and oxygen gas.
- In order to make the titration easier to perform, it may be a good idea to add distilled water to otherwise very small volumes of analyte.

Equipment Available

All the normal equipment associated with a titration: Erlenmeyer flasks, burets, graduated cylinders and regular pipets of various sizes (from 5 mL up to 25 mL), pipet bulbs, stands, clamps, funnels, wash bottles, etc.

Chemicals Available

- Store-bought hydrogen peroxide solution to be analyzed (the analyte)
- 3M sulfuric acid
- distilled water
- potassium permanganate solution of known concentration equal to _____ (the titrant)

Pre-Lab Questions

1. Write the half-reaction for the reduction of permanganate ion to manganese (II) ion in acidic solution.
2. Combine the half-reaction from #1 with the hydrogen peroxide half-reaction from the background in order to form the full REDOX equation for the reaction of permanganate with hydrogen peroxide.
3. If a solution of hydrogen peroxide is labeled as 3%, it means "3% hydrogen peroxide by mass," or 3 g H_2O_2 /100 g of dilute solution. Assuming the density of such a solution is 1.00 g mL^{-1} , what is the molarity of a solution that is labeled "3% hydrogen peroxide?"

Design an appropriate procedure for your experiment that addresses safety, precise data collection and equipment cleanup and return. ***Have your procedure (plan) reviewed before you start your experiment.*** Write your final procedure into your lab notebook.