

Practical work N°4. Quantitative analysis of the Fe^{2+} ion in FeSO_4 by manganometry
(KMnO_4 titration)

1. Introduction

Redox titration, also known as oxidation–reduction titration, is an analytical method used to determine the concentration of an unknown solution by identifying the equivalence point of a redox reaction. In this type of titration, the chemical reaction involves the transfer of electrons, leading to changes in oxidation states in aqueous medium.

Redox titrations are typically classified according to the oxidizing or reducing agent employed. Common types include:

- Permanganate titrations.
- Dichromate titrations.
- Iodometric titrations.

2. Permanganate titrations

- In this type of titration, potassium permanganate (KMnO_4) acts as a strong oxidizing agent.
- Permanganate titrations must be performed out in a strongly acidic medium, typically provided by sulfuric acid (H_2SO_4), to ensure the complete reduction of MnO_4^- to Mn^{2+} .
- A solution MnO_4^- ions is intensely purple, while Mn^{2+} ions produce a nearly colorless solution. Therefore, when KMnO_4 is added to a solution containing a reducing agent, the purple color disappears until all the reducing agent is consumed.

3. Objective

In this practical work, the concentration of Fe^{2+} ions in a FeSO_4 solution is determined using the potassium permanganate (KMnO_4), a strong oxidizing agent in acidic medium.

4. Materials and Chemicals

Materials	Chemicals
- Burette with stand and clamp - Graduated cylinder - Erlenmeyer flask - Funnel	- 0.1 M Potassium permanganate (KMnO_4) solution - Iron sulfate (FeSO_4) solution of unknown concentration - 0.1 M sulfuric acid (H_2SO_4) solution - Distilled water

5. Experimental procedure

1. Fill the burette with the KMnO_4 solution and adjust it to a zero.
2. Using a graduated cylinder, measure 10 ml of the 0.1 M of FeSO_4 solution.
3. Transfer it into a 250mL Erlenmeyer flask.
4. Add 20 ml of 0.1 M H_2SO_4 solution to acidify the medium..
5. Incorporate 10 ml of distilled water.
6. Perform the titration by adding the KMnO_4 solution one drop at a time until the endpoint is reached, indicated by the appearance of light pink color.
7. Note the volume of V_{KMnO_4} used.
8. Repeat the titration twice.

Given data: Molar mass (FeSO_4) = $151.92 \text{ g}\cdot\text{mol}^{-1}$