



Oxford Cambridge and RSA

Wednesday 19 June 2019 – Morning

A Level Chemistry B (Salters)

H433/03 Practical skills in chemistry

Practical Insert

Time allowed: 1 hour 30 minutes



INSTRUCTIONS

- Do not send this insert for marking; it should be retained in the centre or destroyed.

INFORMATION

- This document consists of **4** pages. Any blank pages are indicated.

Iron in spinach

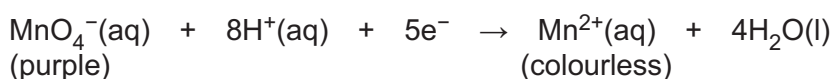
Spinach has often been regarded as an excellent source of dietary iron.

Below a student describes an investigation to determine the mass of iron contained in a typical portion of spinach used in a meal.

Introduction

The amount of iron, as Fe^{2+} , in spinach can be found by titration with potassium manganate(VII) solution.

Manganate(VII), MnO_4^- , is a strong oxidising agent. It accepts electrons easily, and is reduced to colourless manganese(II) ions according to the half-equation below:



The electrons are provided by reducing agents such as iron(II) salts:



As a result, manganate(VII) can be used in acidic solution to determine the number of moles of reducing agent, e.g. Fe^{2+} , present.

Manganate(VII) is added from a burette to a solution of Fe^{2+} ions and is decolourised immediately. As soon as the Fe^{2+} ions are used up, the next drop of manganate(VII) is not decolourised, and so the solution in the conical flask goes pale pink. The end-point of the titration is the first permanent appearance of this pale pink colour. Manganate(VII) is therefore self-indicating and no other indicator is needed.

The acid used to provide $\text{H}^+(\text{aq})$ is dilute sulfuric acid; this should always be in excess or else insoluble brown MnO_2 will form.

Getting the Fe^{2+} ions into solution

Approximately 5g portions of spinach were immersed in dilute sulfuric acid for various amounts of time. The solutions were filtered and 25cm³ portions were titrated with the standard potassium manganate(VII) solution.

Method

- Four samples of approximately 5g of the spinach leaves provided were weighed by difference, accurately, using a 2 decimal place balance. All the weighings were recorded.
- Each weighed sample of spinach was added to about 100 cm³ of sulfuric acid in a beaker and allowed to stand for various amounts of time.
After standing each sample was filtered into a 250 cm³ volumetric flask. The original beakers were washed several times with de-ionised water and the washings transferred to the flask. The solution was made up to the mark with de-ionised water.
- 25 cm³ of one of the solutions was pipetted into a conical flask.
- The above solution was titrated against a $5.0 \times 10^{-6} \text{ mol dm}^{-3}$ solution of KMnO_4 from a burette until at least two concordant results were obtained.
- Steps 3, 4 and 5 were repeated with each of the sample solutions.

Results and Analysis**Weighings**

	Mass of weighing boat/g	Mass of spinach + weighing boat/g	Mass of spinach/g
Sample 1	1.43	6.75	5.32
Sample 2	1.43	6.98	5.55
Sample 3	1.43	6.40	4.97
Sample 4	1.43	6.53	5.10

Table 1**Titration**

		Sample 1	Sample 2	Sample 3	Sample 4
	Time/mins	30	60	90	120
Rough titre	Initial vol/cm³	0.00	0.00	0.00	0.00
	Final vol/cm³	6.80	7.25	7.70	8.20
	Titre/cm³	6.80	7.25	7.70	8.20
Titre 1	Initial vol/cm³	7.00	8.00	8.00	10.00
	Final vol/cm³	13.80	15.10	15.55	18.05
	Titre/cm³	6.80	7.10	7.55	8.05
Titre 2	Initial vol/cm³	15.00	16.00	16.00	20.00
	Final vol/cm³	21.75	23.15	23.50	27.95
	Titre/cm³	6.75	7.15	7.50	7.95

Table 2

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