Titration of Iron (II) ammonium sulphate

Aim:

To find the concentration of Fe (II) in $(NH_4)_2SO_4$ Fe $SO_4.6H_2O$

Method:

1. A weighing bottle was accurately weighed and approximately 5g of Iron (II) ammonium sulphate was then added to the bottle, after which the total mass of bottle + Iron (II) ammonium sulphate was weighed and recorded. ALL of the crystals were then tipped into a 100cm^3 beaker. The bottle was carefully rinsed out 3 or so times with 1 mol dm^{-3} of sulphuric acid (whilst taking care not to let the acid come into contact with skin as it is irritant), transferring the rinsings to the beaker each time. Care was taken to ensure that all of the crystals were transferred to the beaker.

2. A further 25cm^3 of acid was then added to the beaker but the beaker was not filled to more than half its volume. The acid and solid were then stirred together in the beaker with a glass rod until it was clear that all of the solid was dissolved.

3. After that step the contents of the beaker were transferred through a small funnel into a 250cm^3 volumetric flask. The beaker and glass rod were then rinsed twice with small quantities of dilute sulphuric acid and the washings added to the solution already in the flask. After this the funnel was also rinsed into the flask with a small amount of acid. These two processes ensure that all of the iron compound is transferred to the flask.

4. Finally, dilute sulphuric acid was added to the flask until the solution was about 1cm below the graduation mark. Once this was the case, the acid was added slowly from a **clean** dropping pipette until the bottom of the meniscus of the liquid was just touching the graduation line. The flask was then stoppered and the flask was inverted several times to homogenate the solution.

5. A pipette and pipette filler were used to withdraw 25cm^3 of the solution from the volumetric flask and transferred to a conical flask. (Process 1)

6. Potassium Manganate (VII) was then added to a **clean** 100cm^3 beaker and transferred to a **clean** burette. A small amount of the solution was allowed to run through the jet to make sure it was full of solution. (Process 2)

7. The volume reading on the burette before titration was recorded in a table to the nearest 0.05cm^3. (Process 3)

8. Potassium Manganate was then added in small volumes to the solution in the conical flask, and after each addition the flask was swirled. The purple colour of the Manganate ions disappeared as they reacted with the iron ions. When a faint purple colour began to emerge in the solution this was the end point of the titration. (Process 4)

9. The final burette reading was recorded and the volume of solution run out into the flask was calculated. (Process 5)

10. Processes 1,2,3,4 and 5 were repeated until at least three titration volumes agreed to within 0.1cm^3

Raw Results:

Mass of weighing bottle and solid	6.85g
Mass of weighing bottle	1.93g
Mass of solid	4.92g

Results

Titration	rough	1	2	3	4	5
Final burette Reading	25.85	26.10	26.40	25.85	25.80	25.75
Initial burette Reading	0.55	0.90	0.80	0.85	0.85	0.75
Titre	25.30	25.20	25.60	25.00	24.95	25.00

11. Average titre = 24.98cm^3

12.

13. 250cm^3/titre = n
    70n = amount of Fe

    250/24.98 = 10.008

    70mg x 10.008 = 700.56mg

14. 70mg

15. 0.70/4.92 = 0.14227

    ans x 100 = practical percentage of iron in iron (II) ammonium sulphate crystals

    therefore the practical percentage = 14.23%

16a. $(NH_4)_2SO_4FeSO_4 \cdot 6H_2O$

16b. Mr

2 x N = 28
20 x H = 20
2 x S = 64
14 x O = 224
1 x Fe = 55.8

Mr = 391.8 Theoretical percentage = Ar of Fe/Mr of compound

= 55.80/391.80
= 0.1424
% = 0.1424 x 100
= 14.24%

Theoretical percentage = 14.24%
Practical Percentage = 14.23%

This means that this particular Iron (II) ammonium sulphate compound was quite pure (only a small amount of the Iron (II) in the compound has been oxidised).

Evaluation:

$$\text{Percentage error} = \frac{\text{error} \times 100}{\text{reading}}$$

Quantity measured	% error
Mass of iron compound weighed on balance	0.1
250cm^3 solution made up in volumetric flask	0.08
25cm^3 solution delivered by pipette	0.24
average titre	0.2

Percentage error of graph: 0.07% (5/70)

Error Identification-

The first stage in the procedure, which could have led to errors, is transferring the iron (II) ammonium sulphate to the clean beaker. This would have led to a lower titration result. The second stage in the procedure, which could have led to errors, is the transfer of the solution to the volumetric flask. This would also have led to a lower titration result. The third stage in the procedure, which could have led to errors, is the dropping of potassium manganate (VII) solution into the iron (II) solution. This error would have led to a higher titration result.

The final error, which was identified, would have the most impact on the overall titration result.

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