

Experiment 5**EDTA Titration: Calcium in Calcium Supplements****Student Handout****Purpose**

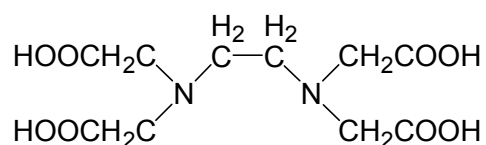
To determine the amount of calcium in a calcium supplement tablet by EDTA titration.

Background

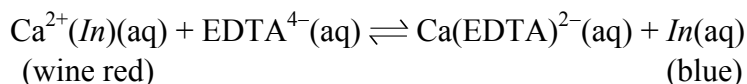
Calcium is an important element for our body. It is vital for the development of bones and teeth. More than 95% of calcium in our body can be found in bones and teeth. The long-term calcium deficiency leads to the decrease in bone density and strength. In fact, osteoporosis has affected many elderly people. To avoid this problem, calcium tablets may be taken to supplement the daily intake from diet.

The calcium supplements consist mainly of calcium salts. Other ingredients are binders, colouring agents, flavouring agents, etc. In the present experiment, the amount of calcium in a supplement tablet will be determined by titration with a standard solution of ethylenediaminetetraacetic acid (H₄EDTA).

EDTA is commonly used as a chelating agent. It forms very strong 1:1 complex with most metal ions. The structure of H₄EDTA is shown below.



As both the calcium ions and the calcium-EDTA complex are colourless, a suitable indicator that will change colour at the equivalence point has to be employed. Calmagite is used in the present experiment. It binds less strongly to the calcium ions than EDTA and exhibits different colours in free and bind forms at certain pH value.



where *In* stands for indicator.

Safety

Handle all chemicals with great care. Avoid direct contact of chemicals with skin. Dispose of chemical waste, broken glassware and excess materials according to your teacher's instruction.

Safety information on the chemicals used in the investigation can be found in the Material Safety Data Sheet (MSDS). Consult your teacher for details.



EYE PROTECTION
MUST BE WORN

Materials and Apparatus Available

Calmagite indicator solution



TOXIC

Standard 0.05 M EDTA solution



HARMFUL/
IRRITANT

3 M HCl solution



CORROSIVE



HARMFUL/
IRRITANT

3 M NH₃ solution



CORROSIVE



HARMFUL/
IRRITANT

NH₄Cl/NH₃ buffer solution with Mg(EDTA)²⁻



CORROSIVE



HARMFUL/
IRRITANT

Burette

Conical flasks

Analytical balance

Mortar and pestle


Beakers

Volumetric flasks

Pipette

Measuring cylinders

Experimental Procedure

 Photos of the experiment are available at <http://www.chem.cuhk.edu.hk/ssc.htm>.

Make sure you have recorded all the observations and data.

1. *Preparation of sample solution*

Write down the information for the calcium supplement, especially the amount of calcium present in each tablet. Estimate the portion of tablet used for titration with $\sim 25 \text{ cm}^3$ of 0.05 M EDTA solution. Grind the tablet into powder. Weigh accurately the amount of powder needed and put it into a 250-cm^3 conical flask. Add $\sim 5 \text{ cm}^3$ of 3 M HCl solution in small portions slowly to dissolve the powder.



2. *Titration with standard EDTA solution*

Add 50 cm^3 of distilled water and 5 cm^3 of 3 M aqueous NH_3 solution to neutralise the final solution in Part (1). Add $\sim 1 \text{ cm}^3$ of buffer solution to obtain a pH value of ~ 10 . Add a few drops of Calmagite indicator solution. The solution should be in wine red colour. Titrate with standard EDTA solution with continuous swirling until the wine red colour turns into blue. Repeat the titration twice.



Questions for Further Thought

1. EDTA is not a primary standard. Suggest a method to standardise the EDTA solution.
2. The present technique is employed to determine the hardness of water. Briefly describe what the hardness of water is and why we need to determine it.
3. EDTA is used in chelation therapy. Describe briefly this treatment and the principle behind.

References

1. A. D. Eaton, L. S. Clesceri and A. E. Greenberg, *Standard Methods for the Examination of Water and Wastewater*, 19th Ed., American Public Health Association, Washington, 1995, pp. 2-35 - 2-38.
 2. http://web.centre.edu/che/che131_lab/calcium.html
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Laboratory Report Form

Date: _____

Title: _____

Purpose:

Data and Calculation:

Sample Information:

Brand name: _____

Amount of calcium per tablet (labeled): _____ mg

Weight of tablet: _____ g

Estimated weight of powder used: _____ g

Concentration of EDTA solution: _____ M

	Trial 1	Trial 2	Trial 3
Weight of powder (g)			
Final reading of burette (cm ³)			
Initial reading of burette (cm ³)			
Volume of EDTA solution used (cm ³)			
Calcium per gram of powder			
Average (g)			
% deviation			

Amount of calcium per tablet: _____ mg

Conclusions:

Questions for Further Thought

1. EDTA is not a primary standard. Suggest a method to standardise the EDTA solution.

Answer:

2. The present technique is employed to determine the hardness of water. Briefly describe what the hardness of water is and why we need to determine it.

Answer:

3. EDTA is used in chelation therapy. Describe briefly this treatment and the principle behind.

Answer:
