**LABORATORY REPORT**

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| ESTIMATION OF CALCIUM IN A SAMPLE SOLUTION WITH EDTA |
| |  |  | | --- | --- | | Name: | Victor Kwansa | | Index Number: | 2841708 | | Class: | A.1.2.2 | | Demonstrator: | Mrs. Nancy Oppong | | Date: | 17th March, 2009 | |
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| **AIMS/OBJECTIVES:**   1. To identify the effect of ethylenediaminetetraacetic acid on calcium (metal) and determine the product. 2. To estimate the amount of calcium in a sample using ethylenediaminetetraacetic acid. |
| **INTRODUCTION/THEORY:**  Calcium contributes massively in various important ways to living matter. For example, calcium forms a very essential part of the human teeth as well as the entire bone system.  Calcium plays a vital role in heart action, blood clotting, muscle contraction and nerve impulse.  The calcium ion is present in a complex phosphate salt, hydroxyapatite, **Ca5 (PO4)3OH. A c**haracteristics function of calcium ion in living system is the activation of a variety of metabolic process.  Many metals form complexes with reagent which contain appropriate ligands. EDTA is one such reagent which forms complexes with metals.  The amount of calcium in a sample can be estimated using EDTA.  In this experiment, the direct titration method will be employed. A solution containing the metal ion to be determined is buffered to the required pH and titrated directly with the standard EDTA solution. The ligand, ethylenediaminetetraacetic acid (EDTA) will react with a metal in a 1:1 ratio (the oxidation state of the metal does not change the ratio) to form a hexadentate (six bonds between the ligand and the metal) chelate. Chelates are very stable and most are stable. |
| **CHEMICALS & EQUIPMENT:**   1. Measuring balance 2. 250ml volumetric flasks 3. Three 250ml conical flask 4. Retort stand 5. Burette 6. Wash bottle 7. Spatula 8. Measuring cylinder 9. Pipette 10. Dilute HCl 11. Distilled water 12. Ca solution 13. Buffer solution 14. Indicator 15. Ethylenediaminetetraacetic acid (EDTA) solution |
| **PROCEEDURE:**   |  |  | | --- | --- | | TEST | OBSERVATION | | -2.5g of CaCO3 was weighed and transferred into a 250ml volumetric flask and was mixed with little amount of water. | A chalky solution was obtained when the solid CaCO3 was added to the distilled water. | |  |  | | -Dilute HCl was added drop by drop to the solution. | There was strong effervescence observed when the acid was added.  The effervescence ceased as more drops of the acid was added to the solution. | |  |  | | -The solution was diluted to the 250ml mark of the volumetric flask using distilled water. |  | |  |  | | -10ml of the prepared Ca solution was pipette into a 250ml conical flask |  | |  |  | | -The solution was diluted with 20ml of distilled water.  -2ml of the buffer solution was then added to the solution.  -5 to 6 drops of the indicator solution were added to the mixture/solution. | A purple red colour was observed when the indicator was added to the solution. | |  |  | | -The solution was titrated with EDTA solution, drop by drop | The solution changed from the reddish colour to a permanent blue colour. | |  |  | | -The titration was repeated to obtain two more additional values. |  | |  |  | |
| **CALCULATIONS:**   |  |  |  |  | | --- | --- | --- | --- | | Burette readings | 1 | 2 | 3 | | Initial volume/cm3 | 0.00 | 0.00 | 0.00 | | Final volume/cm3 | 11.20 | 11.10 | 11.00 | | Titre value/cm3 | 11.20 | 11.10 | 11.00 | |
| AVERAGE TITRE = 11.20+ 11.10 + 11.00 = 11.10 cm3  3  Titration reaction is:  H4Y2- + Ca2+  CaH2Y +2H+  mole ratio= n (Ca2+ ) = 1  n (H4Y2-) 1  Concentration of H4Y2-=0.1M  Volume of H4Y2-=11.10×10-3  Moles of H4Y2-=11.10×10-3×0.1= 11.10×10-4mols  From the mole ratio  n(H4Y2-)=n(Ca2+)  .:moles of Ca2+=11.10×10-4mols    This amount is present in the 10ml, therefore the amount that would be present in the 250ml that was pipette would be:  250×11.10×10-4 = 0.0278moles 10  Therefore, the amount/weight in grams of Ca in the solution  Mass =moles ×molar mass  Mass=0.0278mol×40gmol-1  =1.11g  **DISCUSSION:**  From the experiment, the dilute HCl reacted with the CaCO3 solution to produce an effervescence of CO2 and a salt:  **CaCO3(aq) + 2HCl(aq)  CaCl2(aq) + H2O(l) + CO2(g)**  The salt dissociated into ions in the solution so that:  **CaCl2(aq)  Ca2+ + Cl-**  The structure of EDTA is represented by  **HOOCH2C CH2COOH**  **N\_CH2\_CH2\_N**  **HOOCH2C CH2COOH**  During the reaction with the calcium ion, the two ends of EDTA were replaced with the calcium ion and hydrogen ion is released into solution, making the solution slightly acidic:  H4Y + Ca2+  CaH2Y +2H+  The buffer solution was added to balance the increase in acidity since the acid aids in dissolution. This gives a natural neutral medium suitable for the reaction.  The endpoints of EDTA titrations of Ca2+ can be located with the metallochromic indicator, Calmagite. This indicator forms a red complex with either Ca2+ or Mg2+.  Before the endpoint of the titration, the solution is red because of the presence of excess metal ion (Ca2+). As the EDTA forms more and more complexes with the metal, the above equilibrium shifts to the left. At the endpoint the solution turns blue. |
| **ERROR ANALYSIS:**   1. A drop more of the indicator was added in the second titration which could have slightly affected the results obtained. 2. The amount of distilled water which was added to the volumetric flask slightly exceeded the 250ml mark. |
| **PRECAUTIONS:**   1. All apparatus were washed with distilled water before and after use in order to prevent the effect of impurities in the reaction process. 2. The weighing balance was set to the zero mark before weighing the amount of solid CaCO3 to ensure that the weight of the solid CaCO3 sample was accurately measured. 3. All readings recorded were taken from the meniscus of the liquid to prevent wrong measurement of the burette readings. 4. It was also totally ensured that all the effervescence had ceased before the solution was diluted to the 250ml mark of the volumetric flask using distilled water. |
| **CONCLUSION:**  From the experiment, we can strongly deduce that the mass of Calcium in the solution was 1.11g.  Also it can be concluded that EDTA is used in the estimating the amount of Calcium in a sample. |
| **REFRENCES:**   1. http://www.answers.com/topic/ Ethylenediaminetetraacetic acid/ 2. ***The Columbia Electronic Encyclopedia***, Sixth Edition, Copyright © 2003, Columbia University Press. Licensed from Columbia University Press. 3. Medical Dictionary, the American Heritage® Stedman's Medical Dictionary, Copyright © 2002, 2001, 1995 by Houghton Mifflin Company. 4. J. P. Sevengor, Introductory Chemistry. |