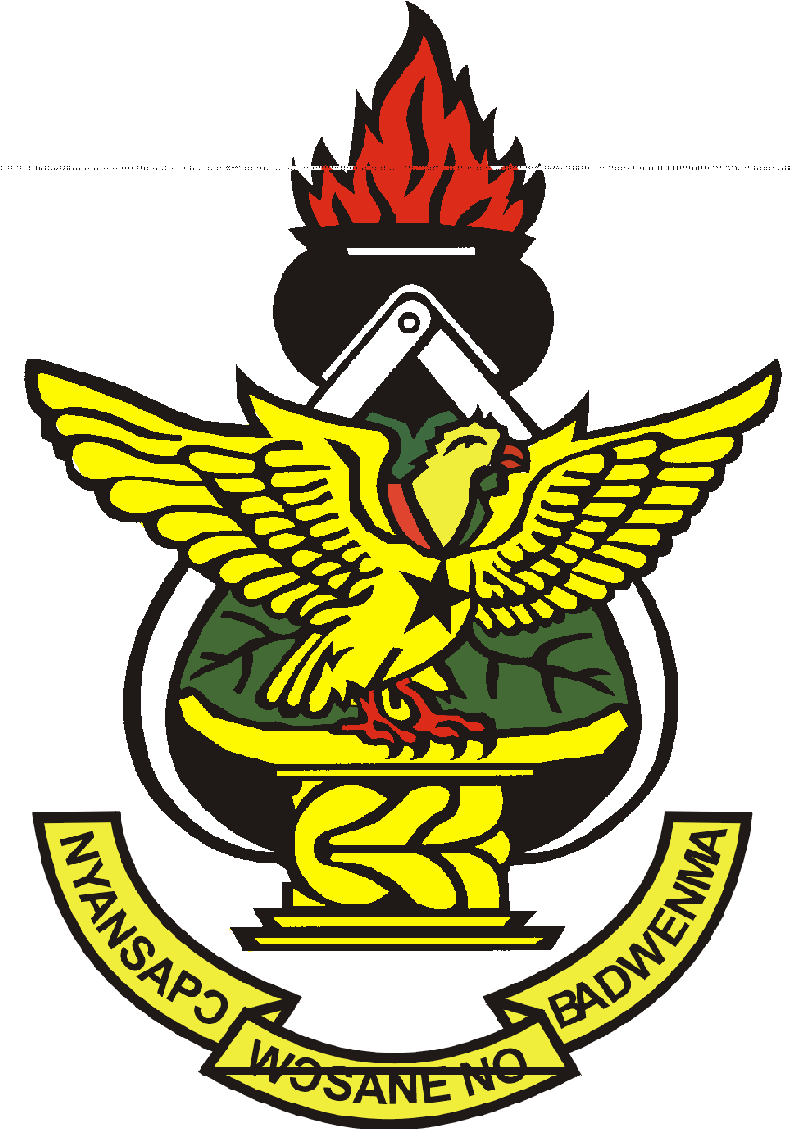
**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**COLLEGE OF ENGINEERING**

**DEPARTMENT OF CHEMICAL ENGINEERING**

**TITLE: IODIMETRIC TITRATION VITAMIN C**

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**NAME: AMPAW-ASIEDU,MERCY O**

**COURSE: BSC. CHEMICAL ENGINEERING**

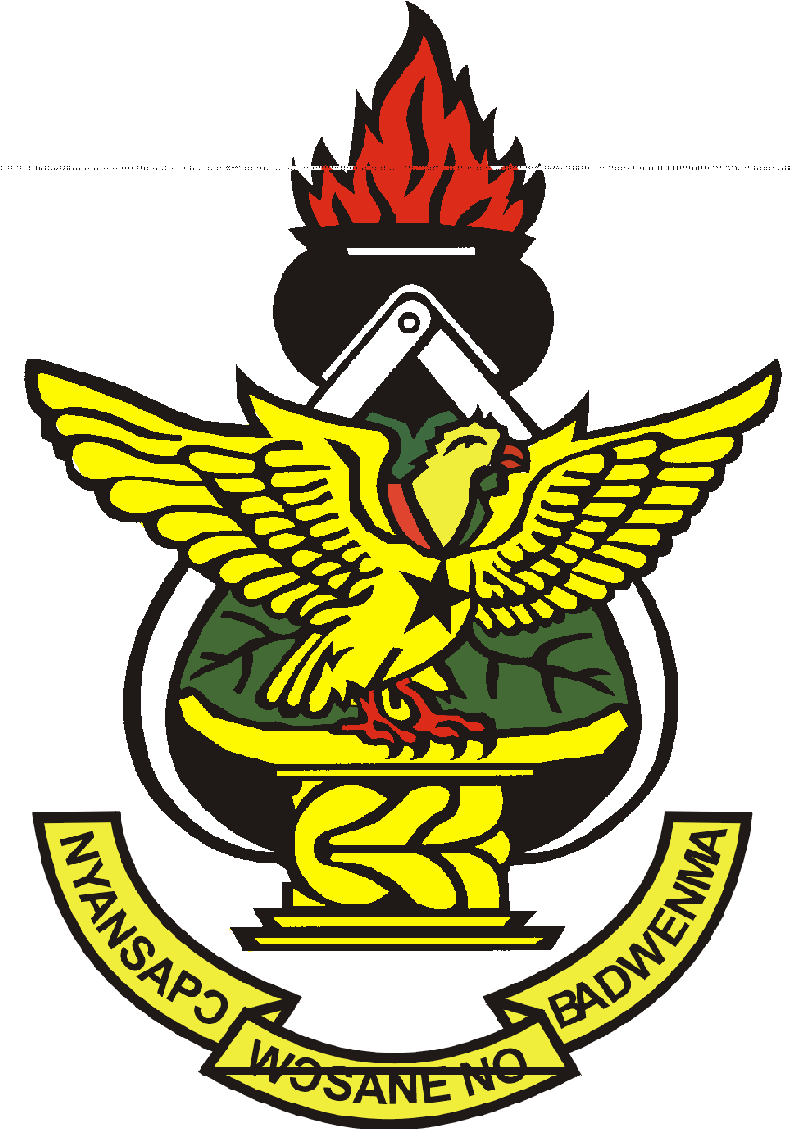
**YEAR: SECOND YEAR**

**EXPERIMENT NO. : A.1.2.3.**

**I.D. NO: 3643609**

**T.A.:**

**DATE: 9TH FEBRUARY, 2011.**

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**Aims and Objectives:**

1. To determine the percentage of chlorine in a sample with AgNO**3**.

**INTRODUCTION**

The direct iodimetric titration method (sometimes termed iodimetry) refers to titrations with a standard solution of iodine. The indirect titration method (sometimes termed iodimetry) deals with the titration of iodine liberated in chemical reactions. The normal reduction potential of the reversible system:

I2 (solid) + 2e <--=======--> 2I-

is 0.5345volts. The above equation refers to a saturated aqueous solution in the presence of solid iodine; this half cell reaction will occur, for example towards the end of a titration of iodine with an oxidizing agent such as potassium permanganate, when the iodide concentration becomes relatively low.

In this experiment, redox titration will be used to determine the weight percent of vitamin C (ascorbic acid) in a commercial tablet.

The titration of a reducing agent (such as ascorbic acid) with iodine (I2, generally present as I3- , triiodide ion) to produce iodide ion (I-) is referred to as an iodimetric titration.

A known amount of I2 (or I– 3) will be generated by adding an excess of solid potassium iodide to a known volume of acidified standard potassium iodate (KIO3) solution.

**IO3 - + 5I- + 6H+ 🡪 3I2 + 3H2O**

L.R excess

The generated I2 is reacted with limited amount of ascorbic acid.

**C6 H8 O6 + 2 H2O + I2 🡪 C6 H6 O6 + 2I - + 2H3O +**

Ascorbic acid excess

(Vitamin–C)

Finally, the excess iodine is back-titrated with sodium thiosulphate (Na2S2O3) solution that was already standardized.

**I2 + 2S2O32- 🡪 2I- + S4O6 2-**

Tetrathionate ion

The amount of ascorbic acid is determined by the stoichiometry of the reaction and the difference between the total amount of I2 present and the amount of I2 that was left over after reaction with ascorbic acid and hence reacted with thiosulphate.

**CHEMICALS AND EQUIPMENT**

* AgNO**3**.
* Potassium chromate as indicator
* 250ml volumetric flask.
* Pipette.
* Burette.
* Retort stand.
* Conical flask.
* Electronic balance.
* Unknown sample.
* Measuring cylinder.

**PROCEDURE**

1. A 0.1g of the unknown sample is weighed into a beaker. The weighed sample is dissolved with distilled water into a 250ml volumetric flask and topped to the mark.
2. 50ml of the solution was pipette into a conical flask and 2ml of a 5% potassium chromate is added which turned the solution to yellow.
3. This is titrated against the 0.1M AgNO**3** solution from the burette. A red precipitate signifies an end point.
4. Procedure 2 and 3 is repeated for concordant values of the endpoint.

**TABLE OF VALUES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Burette Reading/cm3** | **1** | **2** | **3** |
| **Final** | 10.0 | 10.0 | 10.0 |
| **Initial** | 0.00 | 0.00 | 0.00 |
| **Titre value** | 10.0 | 10.0 | 10.0 |

**CALCULATION**

Reactions:

Ag+ + Cl- AgCl (white ppt)

2Ag+ + CrO4-  Ag2 CrO4

n( IO3-) = 1

n(I2) 3

n(I2) = 3 x n(IO3-)

n(I2) = 3 x C(IO3-) x V(IO3-)

n(I2) = 3 x 0.01M x 0.25dm3

n (I2) = 7.5 x 10-3 mol

**I2 + 2S2O3-2** → **2I- + S4O6-2**

n( I2 ) = 1

n(S2O3-2) 2

n (S2O3-2) = 2 x n(I2)

n (S2O3-2) = 2 x 1.5 x10-3 = 3 x 10-3 mol.

C6H8O6 + 2H2O + I2  C6 H6O6 + 2I- + 2H3O+

**Ascorbic acid (vit –C)                  excess**

n (I2) = 1

n(C6 H8 O 6 )  1

n( I2) = C(C6 H8 O 6) x V(C6 H8 O 6)

Mass density of C6 H8 O 6 = mass/volume = 2g/0.15dm3 = 13.33g/dm3

Molar concentration = (mass concentration) / Molar mass

Molar mass of C6H8O6 = 6(12) + 8(1) + 6(16) = 176g/mol

Molar concentration = 13.33/ 176 = 0.0757M

**For first titration**

n (I2) = C(C6 H8 O 6) x V(C6H8O 6)  = 0.0757 x 0.0317 = 2.400 x 10-3 mol

moles of I3- that reacted with C6H8O6 = mol I3- added – mol S2O32- = (7.5 x10-3 ) - ( 2.400 x 10-3)

n (I2) = 5.1 x 10-3 moles

Mass of C6 H8 O 6 = n(C6 H8 O 6) x M(C6 H8 O 6)

m(C6H8O6 ) = (5.1 x 10-3 x 176) = **0.8976g**

**For second titration**

n (I2) = C(C6 H8 O 6) x V(C6H8O 6)  = 0.0757 x 0.0315 = 2.385 x 10-3 mol

moles of I3- that reacted with C6H8O6 = mol I3- added – mol S2O32- = (7.5 x10-3 ) - ( 2.385 x 10-3)

n (I2) = 5.115 x 10-3 moles

Mass of C6 H8 O 6 = n(C6 H8 O 6) x M(C6 H8 O 6)

m(C6H8O6 ) = (5.115 x 10-3 x 176) = **0.9002g**

**For thrid titration**

n (I2) = C(C6 H8 O 6) x V(C6H8O 6)  = 0.0757 x 0.0318 = 2.407 x 10-3 mol

moles of I3- that reacted with C6H8O6 = mol I3- added – mol S2O32- = (7.5 x10-3 ) - ( 2.407 x 10-3)

n (I2) = 5.093 x 10-3 moles

Mass of C6 H8 O 6 = n(C6 H8 O 6) x M(C6 H8 O 6)

m(C6H8O6 ) = (5.093 x 10-3 x 176) = **0.8964g**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mass(X)/g | Frequency(f) | fx | (X-X) | (X-X)2 |
| 0.8976 | 1 | 0.8976 | -5 x 10-4 | 2.5 x 10-7 |
| 0.9002 | 1 | 0.9002 | 2.1 x 10-3 | 4.41 x 10-6 |
| 0.8964 | 1 | 0.8964 | -1.7 x 10-3 | 2.89 x 10-6 |
|  | ∑ƒ = 3 | ∑ƒx = 2.6942 |  | ∑ƒ(X-X)=7.55 x 10-6 |

Mean (X) = ∑ƒx = 0.8976 + 0.9002 + 0.8964 = 0.8981

∑ƒ 3

Standard deviation (S) =  = = 1.586 x 10-5

Relative standard deviation = 

= 

= **1.76 x 10-3% or 0.00176%**

**DISCUSSION**

The experiment used a redox titration to determine the weight percentage of vitamin C (ascorbic acid) in a commercial tablet.

The standard deviation and the relative standard deviation of vitamin-c are 1.586 x 10-5 and 1.76 x 10-3 respectively. This is very negligible and as such it can be said that the vitamin-c constitutes the most of the tablet. The deviation may be accounted for in the slight inaccuracy in titre values due to the undissolved solid binding material.

**CONCLUSION**

In conclusion, our data was reproducible and very precise with a small standard deviation. Our results were reasonably close to the manufacturers claims. Undissolved solid was noticed when dissolving the vitamin C tablets and can be reasoned to be other, insoluble, ingredients from the tablet. No major sources of error were presented in this lab.

**PRECAUTIONS**

* All readings recorded were taken from the meniscus of the liquid.
* All apparatus was rinsed with distilled before use.
* **SOURCES OF ERRORS**
* The effervescence did not entirely dissolve in the HCl before proceeding the experiment
* Too much of the indicator can affect the result of the reading
* **REFERENCE**
* BENERAL CHEMISTRY by RAYMOND
* HEALTH CHEMISTRY(teachers annoted solution)
* INTRODUCTORY CHEMISTRY by JOHN P. SEVENGOR