**Experiment VI**

Oxidation Reduction Titration

Determination of Calcium in Milk

Determination of Vitamin C in Fruit Juice

**Name:** ym

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**Objectives:**

1. To learn how can one determine amount of calcium in milk.
2. Studying two experimental techniques: - precipitation of calcium by the oxalate.
   * Determination of Calcium by Redox titration.
3. To determine the amount of Vitamin C in Fruit juice.

**Theory:**

* + End point detection: 1- Potentiometric method (using electrodes and voltmeter)
  + 2- Visual indicators: - starch initially colorless, blue with I2
  + - Self indicators: MnO4- Mn2+



* + Determination of Ca in milk:
  + - Ca2+ + C2O42- CaC2O4



* + - CaC2O4 + H2SO4 Ca2+ + 2HSO4 + H2C2O4



* + - 2KMnO4 + 5H2C2O4 + 3H2SO4 K2SO4 + 2MnSO4 + 10 CO2 + 8H2O



* + - Ca2+ + C2O4-‑ CaC2O4



* + Determination of vitamin C in juice:
  + C6H8O6 + I2 C6H6O6 + 2 HI



* + C(mol/L) =



* + n(mol) =



* + The rest of the theory is on the lab manual

**Procedure:**

Please refer to the lab manual page 59🡪62

**Table of Data:**

|  |  |
| --- | --- |
| **DATA TABLE(milk sample)** | |
| Name of milk brand | Candia |
| Volume milk sample | 15 ml |
| Molarity of KMnO4 solution | 0.0200 M |
| Initial buret reading | 0 ml |
| Final buret reading | 9.40 ml |
| Volume of KMnO­4 used | 9.40 ml |

Theoretical: 120mg/100ml = 1.2 g/L

|  |  |
| --- | --- |
| **DATA TABLE** | |
| Volume of fruit juice sample | 25 ml |
| Molarity of I2 solution | 0.01 M |

|  |  |  |
| --- | --- | --- |
| **Name of fruit juice sample** | | **Libby's** |
| **First titration** | Reported amount of Vitamin C | 24 g/L |
| Initial buret reading | 100 ml |
| Final buret reading | 71.5 ml |
| Volume of I2­ solution | 18.5ml |
| **Second titration** | Initial buret reading | 100 ml |
| Final buret reading | 76.5 ml |
| Volume of I2­ solution | 23.5 ml |

Theoretical: 24 g/L

**Methods of Calculation:**

1. **Determination of Calcium by Oxalate:**
2. C(KMnO4) =



n(KMnO4) = C(KMnO4) V(KMnO4) = 0.02M 9.40 ml = 0.188



millimol

1. From the ratio of the reaction:

2KMnO4 + 5H2C2O4 + 3H2SO4 K2SO4 + 2MnSO4 + 10 CO2 + 8H2O



n(H2SO4) = 2.5 n(KMnO4) = 0.470 millimol

And from the ratio of this reaction:

CaC2O4 + H2SO4 Ca2+ + 2HSO4 + H2C2O4



n(H2C2O4) = n(CaC2O4) = 0.470 millimol

Also from the ratio of this reaction:

Ca2+ + C2O42- CaC2O4



n(CaC2O4) = n(Ca in milk) = 0.470 milimol

1. n(Ca) =



m(ca) = n(Ca) MM(Ca) = 18.8 mg



1. = 125.33mg/100ml



=4.44%

The % error is high since the experiment contained different chemical reactions and many steps were involved and chemicals were added, so the reaction was exposed to a variety of sources of error explained later in the report.

1. **Determination of Vitamin C in fruit juice:**
2. From the ratio of this reaction:

C6H8O6 + I2 C6H6O6 + 2 HI



n(vit C) = n(I2) = C(I2) V(I2) = 0.01 25 mol = 0.653 milimol



1. n(Vit C) =



m(vit C) = n(vit C) MM(vit C) = 115mg



1. C(g/l) = 0.46 g/100mL

**Sources of Error:**

* 1. Improper measuring the volumes.
  2. Leaving air bubbles in the burette.
  3. Using impure reagents.
  4. Eye sight bias when using the burette and the volumetric flask.
  5. Improper mixing of the solution.
  6. Adding excess of the titrant at the end point.
  7. Adding more than the required drops of indicator.
  8. Not keeping the solution in the water bath for enough time.
  9. Not cooling the solution properly.
  10. Improper centrifuging of the solution.
  11. Improper distillation after the centrifuging.
  12. Not extracting all the precipitate.