DETERMINATION OF VITAMIN C CONTENT

AIM
To determine the percentage by mass of vitamin C in a vitamin tablet.

INTRODUCTION
Vitamin C is present in many fruits and vegetables. It is necessary part of the diet as it is required to form the protein, collagen. A lack of vitamin C can cause lesions in the skin – a condition known as scurvy. To ensure a sufficient intake of vitamin C some people take vitamin supplements.

Vitamin C has the formula C\textsubscript{6}H\textsubscript{8}O\textsubscript{6} and can be oxidised to form C\textsubscript{6}H\textsubscript{6}O\textsubscript{6}. The amount of vitamin C present in a vitamin tablet can therefore be determined by titrating a known amount of the tablet with an oxidising agent. In this experiment iodine, I\textsubscript{2}(aq) is used as the oxidising agent. The iodine provided is of unknown concentration so that the first step of the experiment is to standardise the iodine solution using standard sodium thiosulfate solution, Na\textsubscript{2}S\textsubscript{2}O\textsubscript{3}(aq).

ENVIRONMENTAL CARE: The small amounts used in this experiment do not contain any seriously harmful substances to the environment once diluted and can be disposed of safely down the sink.

SAFETY: Avoid skin contact with the iodine solution and be sure to wear safety glasses to avoid getting any iodine in your eyes.

PROCEDURE:
(a) To standardise the iodine solution.
Pipette 10.0 cm\textsuperscript{3} of the 0.100 mol dm\textsuperscript{-3} sodium thiosulfate solution provided into a conical flask and add a few drops of freshly prepared starch solution. Titrate with the iodine solution provided until one drop causes the blue-black colour to remain permanently. Repeat the procedure to obtain two accurate results.

(b) To determine the percentage of vitamin C.
Record the mass of a vitamin C tablet and then dissolve it in approximately 50 cm\textsuperscript{3} of distilled water. Transfer the solution and all the washings into a 100 cm\textsuperscript{3} volumetric flask and make up to the mark with distilled water. Pipette a 10.0 cm\textsuperscript{3} aliquot of this solution into a conical flask and add a few drops of freshly prepared starch solution. Titrate with the solution of iodine until one drop causes the blue-black colour to remain permanently. Repeat the procedure to obtain two accurate results.

Record your results in a suitable format. From your results determine the concentration of the iodine solution used and hence the percentage of vitamin C present in the tablet.
CALCULATION

The equation for the reaction of sodium thiosulfate with iodine is:

\[ \text{I}_2(\text{aq}) + 2\text{Na}_2\text{S}_2\text{O}_3(\text{aq}) \rightarrow 2\text{NaI(}aq\text{)} + \text{Na}_2\text{S}_4\text{O}_6 \]

1. Determine the amount (in mol) of sodium thiosulfate in 10.0 cm\(^3\) of 0.100 mol dm\(^{-3}\) \text{Na}_2\text{S}_2\text{O}_3(\text{aq}).

2. Determine the amount of iodine (in mol) in the average volume of \text{I}_2(\text{aq}) used in the titration with \text{Na}_2\text{S}_2\text{O}_3(\text{aq}).

3. Determine the concentration (in mol dm\(^{-3}\)) of the iodine solution.

The half-equation for the reduction of iodine is:

\[ \text{I}_2(\text{aq}) + 2\text{e}^- \rightarrow 2\text{I}^-(\text{aq}) \]

and the half-equation for the oxidation of vitamin C is:

\[ \text{C}_6\text{H}_8\text{O}_6(\text{aq}) \rightarrow \text{C}_6\text{H}_6\text{O}_6(\text{aq}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \]

4. Give the overall equation for the reaction of vitamin C with iodine.

5. Calculate the amount of iodine (in mol) in the average volume used to react with the vitamin C solution.

6. Calculate the amount of vitamin C in the 10.0 cm\(^3\) aliquot of vitamin C solution

7. Calculate the amount of vitamin C present in the vitamin C tablet.

8. Calculate the percentage by mass of vitamin C in the vitamin C tablet.