

Candidate 5 evidence

Measuring the mass of Vitamin C in different juices

Aim:

To find the mass of vitamin C in different juices through the use of titrations and calculations.

Underlying chemistry

Vitamin C is an antioxidant, antioxidants are added to many foods and drinks to prevent them from spoiling (oxidising). The way that antioxidants work is by oxidising themselves instead of the food or drink that they are in. When Vitamin C oxidises, the reaction is:



When Vitamin C reacts with iodine it is known as a redox reaction. A redox reaction contains both reductions and oxidisations. In that reaction Vitamin C is oxidised and Iodine is reduced, therefore Vitamin C is the oxidising agent because it loses electrons giving them to iodine which is the reducing agent because it "accepts" electrons.

The reaction for that is: $\text{C}_6\text{H}_8\text{O}_6 + \text{I}_2 \rightarrow \text{C}_6\text{H}_6\text{O}_6 + 2\text{H}^+ + 2\text{I}^-$

Vitamin C is also a free radical scavenger, this means that it prevents free radical chains from occurring by absorbing any free radicals it comes into contact with. This helps prevent whatever the Vitamin C is in from spoiling or being damaged.

Titrations can be used to find the unknown concentration of a solution. It can be done by placing a conical flask containing a set volume of a chemical with a known concentration below a burette. Using the burette, add small amounts of the unknown concentration chemical to the one in the conical flask below. By stopping that once the reaction is completed you can see precisely what volume of the unknown concentration chemical was used and using the reaction equation, you can calculate the unknown concentration.

Method

We used a burette to add diluted iodine to a set amount of each of the juices and recorded the volume of the diluted iodine used to complete the reaction. We did that three times for each juice. The first one was a rough one, but the second and third were accurate and within 0.2ml of each other. We used safety goggles to protect our eyes during the experiment and wore gloves to protect our hands since iodine stains.

Data collected and calculated

<u>Sample</u>	<u>Starting volume (cm³)</u>	<u>End volume 1 (cm³)</u>	<u>End volume 2 (cm³)</u>	<u>Average volume used (cm³)</u>
Blueberry	0.0	30.4	30.3	30.35
Orange	0.0	32	31.9	31.95
Cherry	0.0	24.5	24.5	24.5

(calculations on written sheet of paper)

(External sources and references on written sheet of paper)

Analysis

When comparing my experimental data and calculations to my external source that I used, I realised that for all three juices that I used I had calculated a much higher mass of Vitamin C per 100ml than the source shown.

Conclusion

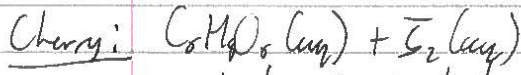
I set out to find the mass of vitamin C in different juices through the use of titrations and calculations and have successfully done so. I have managed to use the data from my experiment to calculate the number of moles in each juice and then calculate the mass. Although my numbers are all higher than my sources I feel as though they are close enough for my experiment and calculations to be considered successful.

Evaluation

Whilst doing the experiment it was challenging at some points to see when the reaction had been completed because the lighting in the room was not the best it made it harder to see the colour change.

Whilst putting the juice into the conical flask from the pipette, it is plausible that some drops of the juice may not have left the pipette therefore slightly changing the volume which may have affected results.

The external source which I had found was for a different brand than the juice used in the experiment, these different brands may have slightly different values in their juices for the Vitamin C mass, however it should not vary greatly between brands.



$$n = 6.125 \times 10^{-5} \text{ mol} \quad n = 6.125 \times 10^{-5} \text{ mol} \quad n = v \times c$$

$$v = 0.02625 \text{ mol} \quad = 0.02625 \times 0.0025$$

$$c = 0.0025 \text{ mol l}^{-1} \quad = 6.125 \times 10^{-5} \text{ mol}$$

$$m = n \times \text{GEM}$$

$$= 6.125 \times 10^{-5} \times 176$$

$$= 0.0108 \text{ g per 25 ml}$$

$$= 10.8 \text{ mg per 25 ml}$$

$$= \underline{43.2 \text{ mg per 100 ml}}$$

Insects Since Flies

Blueberry:

Nutritional Information	
Typical Values	Per 100ml
Energy	82kJ / 19kcal
Fat	0g
Saturates	0g
Carbohydrate	4.4g
Sugars	4.4g
Fibre	0g
Protein	0.1g
Salt	<0.01g
Vitamin C	30mg
* Reference intake of an average adult (8400 kJ / 2000 kcal)	
As sold	-

*①

Orange:

Nutritional Information	
Typical Values	Per 100ml
Energy	199kJ / 47kcal
Fat	<0.1g
Saturates	<0.1g
Carbohydrate	10.5g
Sugars	10.5g
Fibre	<0.1g
Protein	0.5g
Salt	<0.01g
Vitamin C	25mg
* Reference intake of an average adult (8400 kJ / 2000 kcal)	
As sold	-

*②

Cherry:

Nutritional Information	
Typical Values	per 100ml
Energy	83kJ
-	20kcal
Fat	0g
of which saturates	0g
Carbohydrate	4.2g
of which sugars	4.2g
Fibre	0g
Protein	0.1g
Salt	0g
Vitamin C	30mg
NRV**	(37.5%)

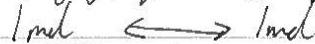
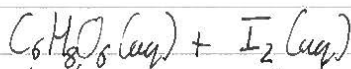
*③

Chemistry Assignments

Calculations

Iodine concentration used: $0.0025 \text{ mol l}^{-1}$

Blueberry:



$$n = 7.59 \times 10^{-5} \text{ mol}$$

$$n = 7.59 \times 10^{-5} \text{ mol}$$

$$n = v \times c$$

$$= 0.03035 \times 0.0025$$

$$= 7.59 \times 10^{-5} \text{ mol}$$

$$v = 0.03035 \text{ l}$$

$$c = 0.0025 \text{ mol l}^{-1}$$

~~$$m = n \times \text{RFM}$$

$$= 7.59 \times 10^{-5} \times 176$$

$$= 0.0134 \text{ g per } 25 \text{ ml}$$

$$= 134 \text{ mg per } 25 \text{ ml}$$

$$= 536 \text{ mg per } 100 \text{ ml}$$~~

$$m = n \times \text{RFM}$$

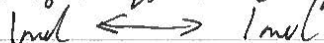
$$= 7.59 \times 10^{-5} \times 176$$

$$= 0.0134 \text{ g per } 25 \text{ ml}$$

$$= 134 \text{ mg per } 25 \text{ ml}$$

$$= 536 \text{ mg per } 100 \text{ ml}$$

Orange:



$$n = 7.99 \times 10^{-5} \text{ mol}$$

$$n = 7.99 \times 10^{-5} \text{ mol}$$

$$n = v \times c$$

$$= 0.03196 \times 0.0025$$

$$= 7.99 \times 10^{-5} \text{ mol}$$

$$v = 0.03196 \text{ l}$$

$$c = 0.0025 \text{ mol l}^{-1}$$

$$m = n \times \text{RFM}$$

$$= 7.99 \times 10^{-5} \times 176$$

$$= 0.0141 \text{ g per } 25 \text{ ml}$$

$$= 141 \text{ mg per } 25 \text{ ml}$$

$$= 564 \text{ mg per } 100 \text{ ml}$$

Chemistry Assignment

External Sources

Source	URL	Date Accessed
* ①	Blueberry https://www.tesco.com/groceries/en-GB/products/260027755	07/03/24
* ②	Orange https://www.tesco.com/groceries/en-GB/products/254859516	07/03/24
* ③	Cherry https://www.tesco.com/groceries/en-GB/products/264685493	07/03/24

