Candidate 9 evidence

Vitamin C content in fruit Juice.

Aim: to calculate the mass of Vitamin C in different flavours of ocean spray cranberry juice per 100ml

Underlying Chemistry

Vitamin C, also known as ascorbic acid, facilitates lots of repair processes and metabolic reations within the body. It isn't stored very well in the body and is destroyed by heat. It occurs in fresh fruit in a great abundance and also in most fresh vegetables. Ascorbic acid is also a very good reducing agent.

In a REDOX titration, there is a transfer of electrons between the reactants. A reducing agent is titrated with an oxidising agent, (In this case it is Vitamin C and Iodine) or vice versa.

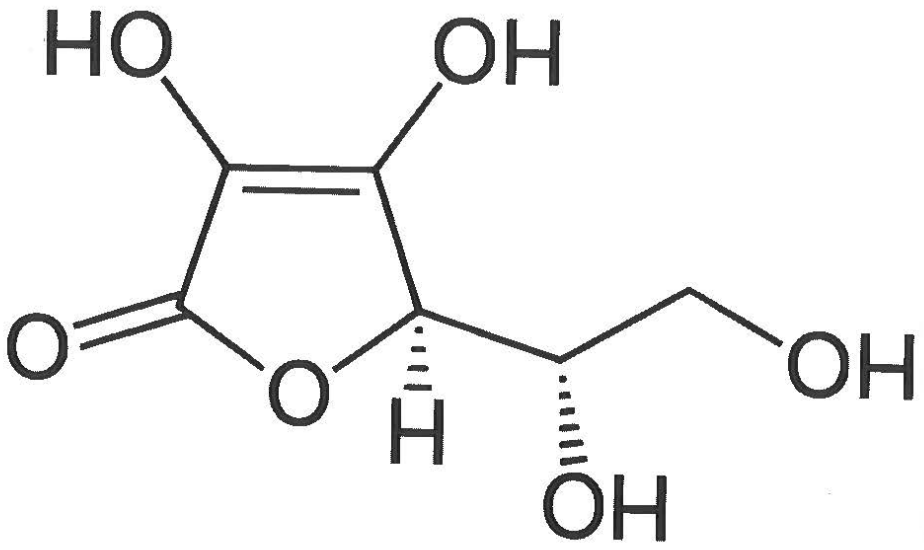
~~When the transfer of the electrons of the~~
When the reducing agent loses its electrons and donates them to the oxidising agent that then accepts them, One of the reactants is oxidised and the other one is reduced.

Vitamin C (ascorbic acid) is a reducing agent due to the loss of the hydrogen atoms from the OH's, which makes Vitamin C a hydrogen donor, and thus, a reducing agent.

1.

Full chemical Structure of Vitamin C:

(5) →

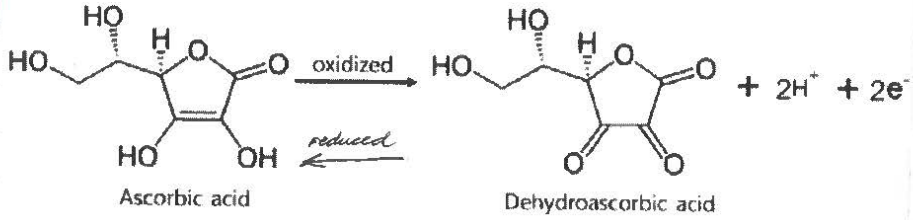


Reduction: $I_2 + 2e \rightarrow 2I^-$

Oxidation: $C_6H_8O_6 \rightarrow C_6H_6O_6 + 2H^+ + 2e^-$

REDOX: $C_6H_8O_6 + I_2 \rightarrow C_6H_6O_6 + 2H^+ + 2I^-$

(4) →



2.

Data Collection + Handling

The experiment that we did consisted of titrating 0·0025 mol l^{-1} Iodine solution into different juice flavours until a colour change appeared due to the starch indicator that we added

The apparatus we used consisted of:

- a burrette
- a pippette
- a conical flask
- a dropper
- a white tile
- a burrette clamp stand
- a filter funnel
- beakers containing our reactants
- a Pipette filler

We also wore gloves to prevent the iodine from staining our skin

Classic Cranberry 25cm^3

	Initial Volume cm^3	Final Volume cm^3	Volume added cm^3
Rough	9·2	22	12·8
1	22	32·4	10·4
2	32·4	42·4	10·0
3	0	10·5	10·5

concordant

10·45 = avg titre Volume

$C_6H_8O_6$ I_2

GFm of $C_6H_8O_6$ = 176

$m = n \times Fm$

$m = 0{\cdot}0001045 \times 176$

$= 0{\cdot}018392$ g

$\times 1000$

$= 18{\cdot}39$ mg/100ml

$n = 0{\cdot}0001045$ mol

$c = 0{\cdot}00418$ mol l^{-1}

$V = \frac{25}{1000} = 0{\cdot}025$ L

$c = \frac{n}{V}$

$= \frac{0{\cdot}0001045}{0{\cdot}025}$

$= 0{\cdot}00418$ mol l^{-1}

$= 418$ mg/100ml

$n = 0{\cdot}0001045$ mol

$c = 0{\cdot}0025$ mol l^{-1}

$V = \frac{10{\cdot}45}{1000} = 0{\cdot}01045$ L

$n = c \times v$

$= 0{\cdot}0025 \times 0{\cdot}01045$

$= 0{\cdot}000026125 \times 4 = 0{\cdot}0001045$ mol

mol Ratio

1 : 1

0·0001045 : 0·0001045

3.

Apple Cranberry 25 cm^3

	Initial Volume cm^3	Final Volume cm^3	Volume Added cm^3
Rough	0	19.6	19.6
1	19.6	39.4	19.8
2	0	19.8	19.8
3			

concordant

avg titre = 19.8

$C_6H_8O_6$ I_2

$n = 0.000198$ mol
$c = 0.00792$ mol L^{-1}
$v = \frac{25}{1000}$
$= 0.025$ L

$n = 0.000198$ mol
$c = 0.0025$ mol L^{-1}
$v = \frac{19.8}{1000}$
$= 0.0198$ L

mol Ratio
1 : 1
$0.000198 : 0.000198$

$n = c \times v$
$= 0.0025 \times 0.0198$
$= 0.0000495$ mol $\times 4$
$= 0.000198$ mol

GFm of $C_6H_8O_6 = 176$

GFm of $I_2H_8O_6$ = 176

$c = \frac{n}{v}$
$= \frac{0.000198}{0.025}$
$= 0.00792$ mol L^{-1}

$m = n \times Fm$
$m = 0.000198 \times 176$
$m = 0.034848$ g
$\times 1000$
$\therefore = 34.8$ mg/100 ml

4.

Raspberry Cranberry 50cm³

	Initial Volume cm³	Final Volume cm³	Volume Added cm³
Rough	0	10·5	10·5
1	10·5	20·8	10·3 concordant
2	20·8	31·0	10·2 avg titre = 10·25
3			

$C_6H_8O_6$ I_2

$n = 0.00000125$ mol
$c = 0.001025$ mol L⁻¹
$v = \frac{50}{1000}$
$= 0.05$ L

$c = \frac{n}{v}$
$= \frac{0.00000125}{0.05}$
$= 0.001025$ mol L⁻¹

$n = 0.00006125$ mol
$c = 0.0025$ mol l⁻¹
$V = \frac{10.25}{1000}$
$= 0.01025$ L

$n = c \times v$
$= 0.0025 \times 0.01025$
$= 0.00002625$ mol $\times 2$
$= 0.00005125$ mol

Gr Fm of $C_6H_8O_6 = 176$

mol Ratio
1 : 1
0·00005125 : 0·00005125

$m = n \times Fm$
$= 0.00006125 \times 176$
$= 0.00902$ g
$\times 1000$
$\therefore = 9.02$ mg / 100 ml

Internet Sources:

1 → CRANBERRY CLASSIC OCEAN SPRAY:

Nutritional Information

Typical Values	per 100ml (%RI**)
Energy	86kJ/20kcal
Carbohydrate	4.3g
Of which sugars	4.3g
Vitamin C	24mg (30%)
**Reference Intake of an average adult (8400kJ/2000kcal)	-
Contains negligible amounts of Fat, Saturates and Protein and Salt	-

2 → CRANBERRY AND RASPBERRY OCEAN SPRAY:

Nutritional Information

Typical Values	per 100 ml (%RI**)
Energy	89 kJ / 21 kcal
Carbohydrate	4.9 g
of which Sugars	4.5 g
Salt	0.03 g
Vitamin C	12 mg (15%)
**Reference Intake of an average adult (8400kJ/2000kcal)	-
Contains negligible amounts of Fat, Saturates and Protein	-

3 → CRANBERRY AND APPLE OCEAN SPRAY:

Nutritional Information

Typical Values	per 100ml	(%RI**)
Energy	87 kJ	
-	20 kcal	
Carbohydrate	4.8 g	
of which Sugars	4.1 g	
Vitamin C	20 mg	(25%)
Contains negligible amounts of Fat, Saturates, Protein and Salt	-	-
**Reference Intake of an average adult (8400kJ/2000kcal)	-	-

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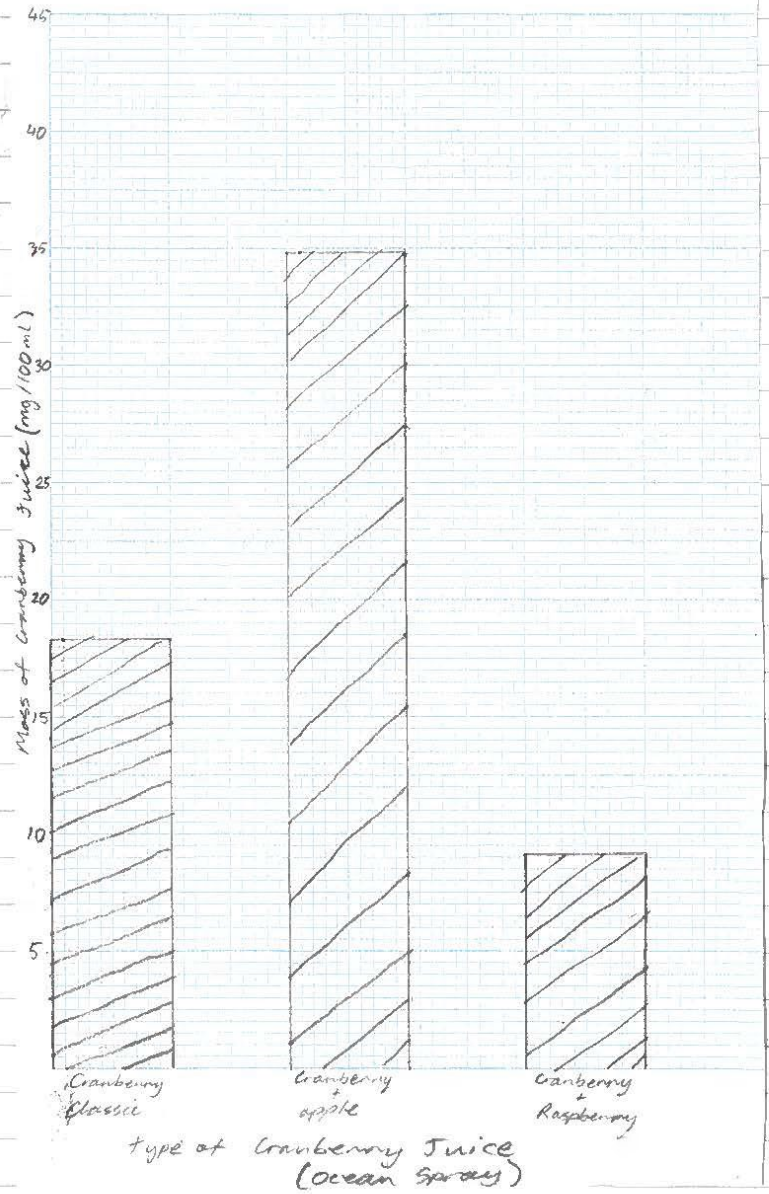
Graph of Results



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Analysis

Type of Juice	My Results mg	Internet Source mg
Cranberry Classic	18·39	24
Cranberry + Apple	34·8	20
Cranberry + Raspberry	9·02	12

On comparing my results to the internet source, it shows no general trend in results as my highest result, (Cranberry + Apple) is not the highest according to the internet, which shows classic cranberry as the highest.

Conclusion

The data in my experiment has been calculated to find the mass of Vitamin C in different flavours of ocean spray cranberry juice, we got a set of results but these do not match any trends according to the internet.

Evaluation

The data from the internet is from a website and follows U.K. food regulation law's so it has to be completely accurate.

In one of our experiments we had to increase the volume of juice, (Cranberry + Raspberry) to

8.

$50\ cm^3$ instead of $25\ cm^3$ as the colour change was happening too quickly so our results were ~~inaccurate~~. This change allowed us to get more accurate results that were closer to the ones from the internet source.

Information Links / References

1. https://www.tesco.com/groceries/en-GB/products/254859384

DATE ACCESSED 23/11/2023

2. https://www.tesco.com/groceries/en-GB/products/257630874

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3. https://www.tesco.com/groceries/en-GB/products/304384270

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4. https://www.researchgate.net/figure/Chemical-structure-of-ascorbic-acid-and-dehydroascorbic-acid-as-depicted-through-a-redox_fig1_312229647

DATE ACCESSED 23/11/2023

5. https://en.wikipedia.org/wiki/Vitamin_C

DATE ACCESSED: 22/11/2023

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