

Measuring the Content of Vitamin C

Background Research

Ascorbic acid is a reducing agent, meaning that oxygen molecules are removed from other chemical substances it comes into contact with.

It is essential to maintain the required amount of vitamin C on ones diet since it is needed for the synthesis of collagen and tissue proteins, formation of neurotransmitters in the brain, drug detoxification and preventing the accumulation of “free radicals” formed by the spontaneous oxidation of fatty acids and more! In addition it acts as a preservative in the food industry.

A dark blue coloured substance DiCPIP (Dichlorophenolindophenol), is reduced when combined with ascorbic acid, resulting in the liquid decolourising from a dark blue to a transparent solution. It indicates the presence and concentration of ascorbic acid present in a given volume of solution.

This is useful for when one would like to determine the amount of ascorbic acid in ones diet, possibly due to wanting to find out which type of foods/ drinks would be best to consume in order to take in the most amount of ascorbic acid.

It is found in green vegetables, potatoes and especially in citrus fruits.

Hypothesis

I predict that a highly concentrated solution of ascorbic acid will contain a higher amount of ascorbic acid than freshly orange juice, which in turn will contain a higher amount than a supermarkets cartoned orange juice drink. This is because the solution of concentrated ascorbic acid would not be as diluted as the supermarket orange juice and the orange juice.

Procedure

- Using a small syringe, I put 1 cubic centimetre of DiCPIP into a test tube.
- Filling a large syringe, I took 5 cubic centimetres of ascorbic acid.
- Carefully, one drop at a time, I added the ascorbic to the DiCPIP in the test tube.
- I was careful not to shake the test tube contents vigorously as this would increase the concentration of oxygen within the solution, decolouring the solution, producing un valid results.
- Soon as the DiCPIP decolourises, I recorded the amount of ascorbic acid added to the solution.
- After recording the value onto the results table (as shown below), I repeated the same experiment two additional times, so that I could workout an average in order to ensure that the reliability of the results obtained were accurate.
- I repeated the procedures listed above, using freshly squeezed orange juice, supermarket cartooned orange juice, and a cheap, economy supermarkets orange juice.

Measuring the content of ascorbic acid quantitatively

The higher the volume of solution added to the DiCPIP, the more amount needed to decolourise the DiCPIP, meaning that there is a lower amount of ascorbic acid in the solution.

In order to make the results easier to analyse and explain I used the calculation below to work out the concentration of ascorbic acid in each solution, therefore making comparisons much easier to make.

All volumes are measured in cubic centimetres.

The concentration of the ascorbic acid= A
(y cubic centimetres of this = y)

The Concentration of one orange drink= B
(x cubic centimetres of this = z)

In order to work out the amount of ascorbic acid in each solution, the following formulae is needed:

$$B = \frac{y \times A}{z}$$

Results/ Calculations

Tube	Name of the Solution	Volume of solution Added			Average	Concentration Of Vitamin C
1	Ascorbic Acid	0.5	1.0	1.0	0.8	
2	Freshly Squeezed Orange Juice	0.8	0.4	1.1	0.76	
3	ASDAs Own Brand	1.5	1.4	1.4	1.43	
4	Standard Orange Juice	1.6	1.8	1.6	1.67	

Conclusions

From my results I can conclude that my hypothesis was correct. The concentrated ascorbic acid solution contained the most amount, followed by the freshly squeezed orange juice then the supermarket orange juice drink, due to the dilution.

However, I am still wary of the way in which the procedure was conducted which may have produced some invalid results, but were insignificant to consider.

These include:

- Having used several test tubes, and needing to use them again, the rinsing and drying of the tubes were not conducted with care. This could have led to inaccurate results being obtained since the water left in the tube could have diluted the amount of ascorbic acid, therefore requiring a smaller amount, therefore meaning that the volume of solution added contained a smaller amount of ascorbic acid than what is actually does.
- The speed at which the volume of solution was added to the DiCPIP might have produced inaccurate results too since trying to add it one drop at a time carefully so that the exact volume, which decolourises the DiCPIP, can be known. Another method that can be used in the place of this one, enabling a more valid set of results is to use a titration method.