Vitamin c analysis

Psychology, Psychotherapy

An experiment to investigate the enzyme concentration and rate of reaction Background To carry out our experiment we used 3 different types of orange juices, and we also used 0. 1% of vitamin C solution. The aim of our experiment was to see how much DCPIP was needed to be added to make the orange juices turn back to the orange colour and the DCPIP to decolourise once the 0. 1% of vitamin C was added. DCPIP is a blue dye in its non-reduced form; it becomes colourless when it gains electrons.

Vitamin C is an anti – oxidant, this is found mainly in fresh fruit and vegetables. The main use of Vitamin C is that it neutralises free radicals, which can cause damage to cells, including cells in the cardiovascular system Planning My aim in this experiment is to investigate how much juice is required to decolourise 1cm3 of 0. 1%of DCPIP solution. Prediction Before I started the investigation I made sure I did a hypothesis so that I would be able to refer back to it in the conclusion at the end.

Below is my hypothesis: My hypothesis is that: ‘ there will be less’ Don Simon’ juice needed to decolourise the DCPIP, the other juices will require more juice to decolourise the DCPIP’ Fair Test I will have to make sure that I will be carrying out a fair test. This is to ensure that anything affecting the amount needed to decolourise the DCPIP is due to what I have changed (independent variable) and nothing else. Below I have listed the independent variables as well as those factors which should be kept the same. Independent Variable: * The Juices * Amount of Juice added to the DCPIP

Dependent Variable:

- The amount of DCPIP put in the test tube

- 1% of DCPIP
- 0. 1% of vitamin C solution

Fixed Variables:

- The volume of DCPIP poured into the test tube
- Keeping a fixed volume of the DCPIP ensures that the decolourisation of the DCPIP is only because of the amount of juice added and not the different amount of DCPIP that is present
- Concentration of DCPIP solution
- Different concentrations can affect how long it takes to decolourise, therefore it is important that there is nothing else making it less concentrated.
- Concentration of Vitamin C solution The concentration of this can affect how much DCPIP is needed to make it colourless

The experiment should also be repeated a number of time from which an average will be calculated. This is to ensure that the results are accurate and reliable. The method The method we used to carry out this experiment and the equipment we used is shown below; I also included any faults with the method when we carried out the experiment this is all shown below:

Equipment and chemicals needed:

- 1% of DCPIP solution
- 0. 1% vitamin C solution
- A range of fruit juices
- Test tubes
- Test tube rack

- Pipette 1cm3 of 1% DCPIP solution into the test tubes
- Provide a clear sight into the experiment at hand.

Therefore it makes it easier to establish the decolourisation of the DCPIP. Using a pipette or burette, add 0. 1% vitamin C solution drop by drop to the DCPIP solution. After adding the drops shake the tube gently. Allows the solution to react with the vitamin C. And therefore resulting in more accurate results| Using a burette would have been more accurate. Also doing the experiment on a bigger cale would also allow any room for accuracy for the results collected. Continue to add drops of the vitamin C solution until the blue colour of the DCPIP has disappeared. Measure how much vitamin C solution was needed to decolourise the DCPIP. At this point we made sure that the solution was absolutely colourless which was correct, however later we did not do the same thing for the orange juices and therefore we were not able to collect accurate results. Record the exact amount of the vitamin C solution that was added to decolourise the DCPIP solution.

Repeat the procedure and average result. To calculate how near our value is to the actual value of vitamin C in the other orange juices. We did not decolourise the DCPIP, when adding the orange juices. As we had done for the vitamin C solution. Repeat this procedure with the fruit juices provided. If only one or two drops of the fruit juices decolourises the DCPIP, dilute the juice and repeat the test. To obtain an average to measure whether our results match the fact that there is meant to be 100mg of vitamin C in the juices. At this point we would get the result of the vitamin C and one of the juice means and divide them two and times it by a 100 to see how are results are, if it is close to the actual number it will mean it is reliable and

accurate, however if it is not near the number it means that it is not very accurate. Limitation of the apparatus and method Throughout the experiment I felt that there were many things that could have been improved on, so if I were to do the investigation with the modifications, I would get the correct and accurate results.

Firstly the syringes that we were using to measure the liquids were not very accurate because, it did not have the lines between the whole numbers, therefore forcing us to guess the amount that was needed. A more precise piece of equipment would be needed instead such as a burette, if this experiment was done on a larger scale this would be more efficient, and accurate. Another limitation with the experiment was that there was not enough DCPIP, thus limiting the amount of repeats being done. If more repeats were done, we would be able to take out the anomalies and be able to acquire a more accurate result.

Therefore, decreasing the range of the range bars. From the graph we can see that the range bars are fairly big, therefore to decrease this we would have to do more repeats which would decrease the range of the range bars The most difficult part of the experiment was detecting the change in colour of the DCPIP solution while performing the titration. Two of the juices showed clear disappearance of the colour, while the others had the tint of yellow due to some other compounds of colours present. The date of manufacture may be different which may change the nutrient content or concentration in different juices.

There were many limitations to the method as well, the main limitation was the fact that the method was not well explained; we added too much vitamin

C to the DCPIP, making the DCPIP absolutely colourless. However we should have stopped adding the DCPI when the DCPIP had stopped turning blue. This would have given us a result of around 0. 8 but from the results we can see that the results went up till 2. 4. A modification that could be made to this method, is to include more detail of how to do it, and what it should look like, this would increase the likelihood of the results to be more accurate. Results

Below is the results collected by are class. Trends & Patterns From the results table we can see that the values of the 0. 1% vitamin C solution had a large range of results. Therefore this emphasises that the results were not very accurate. For this part of the experiment we had to decolourise the DCPIP in the test tube by adding the vitamin C to it. This in itself was not very accurate, because people's perception of colourless was different to others. Therefore, it is evident that, from the first step many people's results were different for the other orange juices, the range of the results were within 0. cm3. The overall mean show us that there was a lot of Asda concentrated orange juice needed to decolourise the DCPIP. This shows that the amount of vitamin C in that volume of the juice was the same amount of what was in the 1. 35mg of the Don Simon orange juice. After collecting all the results and finding the means of all juices, I was able to construct a bar graph. A bar graph was drawn as the variable along the x axis could not expressed in the term of numbers, therefore a line graph was not suitable for this which left us with either drawing a histogram or a bar graph.

Personally I chose the bar graph as it was easier to construct and also easier to understand. I also included range bars to show the highest and the lowest

values that we had got from the repeats that were done, this also shows that the value that was plotted using the bar, is the average of the range of values for the one liquid. From the graph we can evaluate that the mean concentration of vitamin C/mg cm-3 was ‘ Asda from concentrated’ juice, the next juice that was after that was the ‘ Asda pure’ juice, lastly leaving the ‘ Don Simon’ juice at the end.

This means that the Vitamin C present in the 1. 35mg is the same in the other juices for example, it has the same amount of Vitamin C in the Asda Pure juice which has 1. 48mg required to decolourise the DCPIP My hypothesis, ‘ there will be less ‘ Don Simon’ juice needed to decolourise the DCPIP, and that the other juices will require more juice to decolourise the DCPIP’ was correct. I predicted this as ‘ Don Simon’ juices was seen as a better quality juice than the others, therefore I thought that a better quality juice would have more vitamin C in a small volume.

Other juices will have the same amount of vitamin C in a larger volume of juice. Systematic/Random errors In our experiment there were a number of errors caused, for example in the methodology, we had made the colours of juices different to the vitamin C. This was one of the biggest mistakes in the experiment as it affected the whole experiment. If we were to make the juices more clear, when it was being added to the DCPIP, then we may have got more accurate results. As this is what we did, when we were adding the Vitamin C solution to the DCPIP.

A systematic error is a problem that you can't overcome because it's a problem with the experiment itself. For instance, if you're measuring a colour change in a reaction, you have to rely on your eyes, there's a systematic

error there because your eyes are not as accurate as a machine. A systematic error that was made was the fact when we were trying to make the DCPIP colourless, people's perception of colourless was different, and therefore the results that had been acquired by the rest of the class were different. This is one of the reasons there was a big range of results for the decolourisation of the DCPIP.

Another possible error in this experiment that could be made is the fact that the person may have read the volume at the wrong place each time. Random errors in experimental measurements are caused by unknown and unpredictable changes in the experiment. These changes may occur in the measuring instruments or in the environmental conditions. A random error made was the fact that the syringes were not the same. In the way that they were measured differently, sometimes they were not big enough to carry the amount of orange juice we needed to decolourise.

An effective and more accurate equipment we could have used is a burette, as it can hold up to 40cm3 of liquid, and therefore we would have more than enough space to read the reading and to use the juice at once. Another random error that could have been made is that the vitamin C may have not been added by less than a drop a time, so sometimes the next drop may be too little or too big, which may change the colour of the solution more quicker therefore the volume will not be very accurate.

Lastly the end point may be misjudged, as it is quite tricky to say exactly when the DCPIP has become colourless. In conclusion, there were many small mistakes made during the experiment, if I was to do this experiment again, I would make sure that I was to do all the repeats myself, so the

mistake about people’s perception of what was decolourised would not affect the results. Also the fact that there would be enough equipment would mean that I would also get the results I need, and that there can be a different piece of equipment used for each of the different experiments. Interpretation of results

Overall the quality of my data is shown to be fairly accurate as most of the results I got were fairly close, in our class for the juices, however for the vitamin C; the results were not so accurate. This emphasises that there were a number of mistakes which could have caused this problem. There are many factors which affect the result such as, the temperature, pressure, and the equipment used etc. in the investigation I think the main mistake that was made was that we did not stop adding the Vitamin C solution to the DCPIP when it stopped going blue, therefore the value should have been at around 0. instead of the class average which was about

We overestimated the amount of Vitamin C that should have been added into the solution of DCPIP. However if we had decided to do this we should have added more orange juice to the DCPIP. Therefore to see whether we had accurate results we did a calculation to see the ratio of vitamin C in the actual Juices on the carton to the results of our experiment. The calculation was found by doing the following: Volume of 0. % vitamin C solution required to decolourise 1cm3 of DCPIP cm3Mean volume of juice required to decolourise 1cm3 of DCPIP cm3X 100. Therefore as we know the volume of standard vitamin C solution needed to decolourise a fixed volume of DCPIP, by using simple proportion, we can calculate the amount of vitamin C in the

three different types of orange squash. 0. 1% vitamin C solution: In 1. 70cm3 should be 1. 70mg of 0. 1% vitamin C solution

- 1cm3 1mg
- 1. 70cm3 1. 70mg

Don Simon:

- In 1. 36cm3 should be 1. 70mg of 0. 1% vitamin C solution
- 1. 70mg 1. 36cm3
- 100ml 125. 0mg

Asda from Concentrated:

- In 1. 85cm3 should be 1. 0mg of 0. 1%vitamin C solution
- 1. 70mg 1. 85cm3
- 100ml91. 9mg

Asda Pure:

- In 1. 48cm3 should be 1. 70mg of 0. 1% vitamin C solution
- 70mg1. 48cm3
- 100ml 114. 9mg

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To find whether our results were accurate, I found out how much vitamin C was present in each of the solutions, this is shown in the box below: From the calculations above, we can see that the results collected from the class were not very accurate. This is shown through the fact that it says that in the Asda Pure juices of 100ml there should be 114. 9mg of vitamin C when there should be 100mg of vitamin C in a 100ml of the juice. Conclusion & Evaluation My prediction, ‘ there will be less’ Don Simon’ juice needed to decolourise the DCPIP, the other juices will require more juice to decolourise the DCPIP’ was correct.

This is because; the smaller volume of fruit juice needed to decolourise the blue DCPIP solution, the higher is the Vitamin C content in the fruit. It is also shown on the graph, as there is less volume of Don Simon Orange juice needed to decolourise the DCPIP. This means that in 1. 35cm3 of Don Simon, there is the same amount of Vitamin C in 1. 48cm3 of the Asda Pure orange juice, and in 1. 85cm3 of the Asda from concentrated orange juice. The smaller volume of orange juice needed to decolourise the DCPIP solution means that the DCPIP solution is reduced at a faster rate.

Within my results, I did find quite a number of anomalies. However there were other numbers within the range of the anomaly such as in the 0. 1% vitamin C solution had the highest value of being 2. 4 cm3, which at first I had thought to be an anomaly, however 2. 1 cm3 was also another result that had been collected. However if we took out the 2 repeats, there was also another repeat of 2cm3. Therefore in the end I left the results in the results table. 0. 8cm3 was also another repeat I had though was an anomaly; however there were also other results that were near 0. 8 cm3 such as 1. cm3. Therefore I did not record these results as anomalies. The main reason for the high range was because of the fact that people had different perceptions of when the solution was to go colourless. In the rest of the results there were not any anomalies recorded as they were in the range of each other. If I was to do this investigation again I would make sure that the instructions were read clearly and also do the experiment on a larger scale, so instead of adding 5 cm3 of the DCPIP I would add 20 cm3 and therefore use a burette to add in the different types of orange juices.

This would make it more accurate, as the reading would be able to be made more precisely. Another thing I would do better next time is to do more repeats, even though there were a lot of repeats for my results, the results were not done by the same person and therefore the perception of the colour would be different to each person, and therefore if I was to do all the repeats myself I would be able not to take the risk of getting a wide range of results. Also I would make sure that there was enough DCPIP for my experiments as I know in my experiment there was not enough DCPIP for some people to do another repeat.

The most repeats a group was able to do were 2. Another factor I would change if I were to do the investigation again is that I would use other brands of orange juices as well to widen the results I was going to get. In conclusion, the investigation has stated that there will be less' Don Simon' juice needed to decolourise the DCPIP, the other juices will require more juice to decolourise the DCPIP. This is shown on the bar graph with the mean volume of the different types of juices needed to decolourise the DCPIP against the different types of juices. There is also range bars included to inform the highest and lowest values obtained from the repeats.

References

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