Experiment: Quantative analysis of glucose using a colorimeter

Apparatus

6 concentrations of glucose
Test tubes
Test tube racks
Couvettes
Water bath
Colorimeter
Syringe

Risk assessment

Lab coat because using Benedicts solution = corrosive
Safety glasses because using Benedicts = corrosive
Hair tyed back out of the way
Bags under the desk out of the way

Method

There are six concentrations of glucose solution: 0.01%, 0.05%, 0.1%, 0.25%, 0.3% and x. The aim is to find the concentration of x. A control is also to be completed. A control is a sample used to compare the results collected. To do the control, the same volumes are used as in the other samples: 2cm ^{3}; 1cm^3 of Benedicts solution and 1cm^3 of distilled water.

The other 6 concentrations were then mixed with Benedicts solution, each to the ratio 1cm^3:1cm^3 of Benedicts:glucose solution. Label each test tube with the concentration of glucose and then place them in the test tube rack. Once all 7 samples are complete, place them in a water bath for 5 m inutes (temperature = 84^0 C). After 5 minutes the test tubes need to be removed from the water bath and left to cool for approximately 5 -10 minutes.

Then use the colorimeter to test the concentration. Pour some of the solutions into the couvettes. The cou vettes have two plain sides and two grooved sides. The couvettes must not be held by the plain sides as these are the sides the light shines through and finger prints would make the experiment an unfair test. A colorimeter uses the light to measure the onc entrations of solutions. It can measure it in 2 ways, transmission and absorbtion. Thransmission measures the amount of light shining through the solution whereas absorbtion measures the amount of light absorbed by the solution. Different colour filters are also used according to the solution.

In this experiment, measure the transmission using filter number 3 or the blue/green filter. The transmission is measured as a percentage. Everytime a new sample is measured, reset the colorimeter using the "reset to 0" button. Pressing this button will make each experiment a fair test.

Pour the solutions from the test tubes into the couvettes. Then reset the colorimeter and and slide the couvette into the colorimeter according to the direction the light was shining. Then read off the results and record it in the table.

Results

Concentration %	Transmission %	Colour of solution
Control, 0	85	Blue
0.01	66	Blue
0.05	41	Greeny/blue
0.1	25	Brown
0.25	12	Orange
0.3	9	Red
x	31	Greeny/blue

Conclusion

There was approximately 5 sources of error in my experiment.

Firstly I found the syringes and measuring cylinder to be innaccurate. It was difficult to measure out $1cm^3$ everytime. I think the amount of drops of Benedicts solution should have been counted. The measuring gauge was difficult to read and an extra drop in one sample may cause the results to be unreliable. Also some syringes had air bubbles in. It was difficult to get rid of and the measuring gauge was not specific enough. It was shown at increasing by $0.5cm^3$ each time.

The next error I found was there was not enough space in the water bath for my test tube rack as I was the last person to put my samples in. Therefore all of the test tubes were put in at different times and then had to be removed while other people removed their test tubes. This could have effected my results.

The lid of the water bath was the next error. I found everybody put their test tubes in at different times which would mean the water bath my have been

lower than 84 oC again effecting the results. If each student placed her results in at the same time there would be no reason to remove the lid or take the test tubes out at any wrong time.

The precipitate, formed while beeing heated, settled to the bottom of the test tube. This meant that when the solution was poured into the couvettes, the precipitate was still in the bottom of the test tube and this precipitate was vital and needed to be tested. The solution needed stirring before being transferred to the couvette to prevent all of the pecipitate from being left in the bottom of the test tube.

The last source of error I noticed was the “0” on the colorimeter may have fluctuated meaning the dial did not reset to “0” everytime.

I think the colour of the solution, CuO, changed because the aldehyde group of the aldose sugars reduced Cu II to Cu I. The aldehyde group oxidised to form a carboxyl group causing the colour to change as the structure of the molecule changed.

This practical is used in the food industry and for medical reasons. The food industry use it widely to improve their products, for example they know how concentrate to make chocolate to make it how the public enjoy it. It is used in medicine to test urine for diabetes or sugar defects.

I think that concentration x = 0.075%