Biology practical examination: planning exercise

This investigation is to find out what the concentration is of copper (II) sulphate that brings full denaturation of egg albumen. I can find this out by decreasing the concentration of CuSO4 using the serial dilution method to up the diluted state that no longer gets fully denatured.

Background Information

Egg albumen is a protein and can also be denatured by heat, pH and mechanical methods, so to make this experiment fair, I need to try and make sure that these factors don’t affect the experiment.

Denaturation of a protein is the breaking of bonds that hold the protein molecules together; in this case CuSO4 is being used to break the bonds. The bonds that are being broken and changed are disulphide and hydrogen bonds. The R groups on the amino acids in the proteins are responsible for the 3D shapes of the protein molecules and their functions, and they are what get changed when the protein is denatured, so when denatured, it ceases to function properly.

CuSO4 denatures the protein, because within it, it has Cu ions. These break the hydrogen and disulphide bonds, because they both have ?- and ?+ charges and the ?- charges are attracted to copper ions. The copper sulphate is therefore breaking the bonds, changing the structure of the protein and denaturing it.

To measure the opaqueness of the albumen in the different concentrations of copper sulphate, I could put a cross on a piece of paper and put it underneath a beaker with the egg albumen and solution in. If the albumen is

completely denatured, I shouldn’t be able to see the cross, as the solution would be opaque. Vice versa if the albumen wasn’t completely denatured. This method isn’t very accurate though. There would be no numerical readings that could be taken, so it would take a long time to find the correct minimum concentration, and also, because the experiment relies on eyesight alone, the results would vary, making the experiment inaccurate.

Another way I could carry out this experiment is by using a colorimeter. This piece of equipment measures the light absorbency of the solution being tested, or the transmission of the light through the solution to the metre on the other side. This is a good piece of equipment to use for this experiment, because it would give me accurate numerical readings, which, unlike the previous possible method, could enable me to plot a graph when analysing the results. For example, if I were testing water in the colorimeter, I would get readings of 0% absorption and 100% transmission.

Equipment

Graduated pipette and filler

10 test tubes

2 test tube holders

10 curvettes

Colorimeter

A supply of 0. 1 mol dmï¿½ï¿½ copper (II) sulphate solution

A supply of egg albumen

Distilled water

Precautions – Health and Safety

* Wear safety glasses

* Handle all chemicals with care

* Don’t run in laboratory

* Wash hands before and after handling albumen and chemicals

* Don’t put anything breakable, i. e. made out of glass, on the edge of the work surface.

Procedure

1. Rinse pipette using distilled water

2. Using pipette put 2. 0cmï¿½of egg albumen into each of the 10 curvettes.

3. To create a good range of concentrations to use to work out the lowest concentration of copper sulphate that fully denatures the albumen, use the serial dilution method shown in the diagram below:

> Concentrations of each test tube:

Test tube

1

2

3

4

5

6

Concentration (mol dmï¿½ï¿½)

0. 1

0. 05

0. 025

0. 0125

6. 25*10ï¿½ï¿½

3. 125*10ï¿½ï¿½

Test tube

7

8

9

10

Concentration (mol dmï¿½ï¿½)

1. 5625*10ï¿½ï¿½

7. 8125*10ï¿½

3. 90625*10ï¿½

1. 953125*10ï¿½

> Each test tube has half the concentration of the one before it, which I achieved by using this method.

4. Take each of the 10 solutions, and add to the ten curvettes and mix with the egg albumen.

5. Take a reading of the percentage transmission for each one in order of decreasing concentration, and tabulate the data.

6. Repeat this experiment three times

7. Plot a graph to find out what the lowest concentration is of CuSO4 to bring about full denaturation of the egg albumen. This will be at the first point where the percentage transmission reaches zero, because no light would be able to get through.

Precise and reliable results

In order to produce precise results, I am using the best equipment available to me. Rather than, for example, using a measuring cylinder to measure out the quantities of substances used, I am using a pipette. This piece of

equipment is a lot more accurate, because it is a lot easier to read, and the pipette filler is calibrated, so is very accurate.

I will also try to get my results to be as reliable as possible. To do this, I am repeating my experiment at least three times. I will also compare my final results against specimen data, and see if they match or are close.

Fair testing

To keep this experiment as fair as I can, I will:

* Keep the experiment at room temperature (around 21ï¿½C)

* Make sure that I measure out the same amount of albumen in each curvette, and at the end there is the same amount of solution in all curvettes.