

Determine the
macromolecules
present in an
unknown solution
essay sample



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Every living thing is dependent on large complex molecules, known as macromolecules. The objective of this lab was to correctly identify which macromolecules the unknown solution was comprised of using various substances as experimental controls. There are four major types of biological macromolecules - carbohydrates, lipids, proteins, and nucleic acids - made up of elements such as carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus in various combinations. Macromolecules are essential for survival; they provide structural support, a source of stored fuel, the ability to store and recover genetic information, as well as the ability to speed up biochemical reactions; hence their importance in biological systems is notable. (Prakash, 2008).

The control samples have a known outcome; in this lab both positive and negative controls were used to determine the identity of the unknown solution. The macromolecules being tested in this lab were carbohydrates (monosaccharides and polysaccharides) and proteins. To identify the presence of these macromolecules in a substance, three different tests were performed. Lugol's iodine solution was used for identification of starch and glycogen - polysaccharides - in the twelve solutions. A positive outcome of the test results in a colour change; blue-black in the presence of starch and a red-brown in the presence of glycogen. A negative outcome results in no colour change and all solutions remain a very pale yellow (Pavia, 2005).

Benedict's solution was used to identify the presence of reducing sugars; the aldehyde functional group is the part that reacts in the test. A positive indicator of the test is the formation of a coloured precipitate of the blue solution, ranging from yellow-green to red-brown (Hequet and Abidi, 2006).

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Lastly, the Biuret solution was used to test for the presence of protein. It is a mixture of copper sulfate and sodium hydroxide, or any strong alkaline solution. A positive test indicates a colour change from pale blue to violet, confirming the presence of proteins in the solutions.

The purpose of this lab was to successfully identify which macromolecules were contained in the unknown solution using the positive and negative results as indicators of each macromolecule.

DISCUSSION

The experiment consisted of three tests to identify the various macromolecules; iodine test for starch and glycogen, Benedict's test for reducing sugars, and Biuret test for proteins. Each test had positive and negative controls which helped identify the unknown substance. Before carrying out the experiment, all of the controls were observed to be clear, colourless liquids with the exception of honey, which was a pale yellow, and beer, which was a bright yellow-brownish solution.

The iodine test resulted in two positive controls, 1% glycogen solution and 1% starch solution, as seen in Table 1. The glycogen solution turned a red-brown colour while the starch solution turned blue-black as expected. Starch is made up of two polymers, amylose and amylopectin. The colour change was a result of the absorption of iodine in the open spaces of amylose molecule - helices - present in starch. Glycogen is structurally very similar to amylopectin; however, it is more branched which results in the red-brown colour (Pavia, 2005). All other solutions, including the unknown solution,

were negative controls and pale yellow in colour, meaning they did not react with iodine as there was no starch or glycogen present in the solutions.

The Benedict's test for reducing sugars resulted in six positive controls including: 1% glucose solution, 1% maltose solution, honey solution, 1% lactose solution, beer, and unknown #146 as can be seen in Table 2. All these solutions formed a red-orange or red precipitate which indicates high sugar content in the solutions. However, beer was an orange-yellow precipitate, which indicates a moderate to high sugar content. The Benedict's test is used to test for the presence of the aldehyde functional group, $-CHO$, which is what causes the formation of the precipitate. The results of glucose, maltose, and lactose solutions were expected as they are monosaccharides and disaccharides which contain the aldehyde or ketone functional groups. It reduced the cupric ions to cuprous ions that combined with oxygen to form a precipitate known as cuprous oxide (Hequet and Abidi, 2006). Honey is made up of the monosaccharides glucose and fructose, which is why it resulted in a precipitate (Grolier, 2011). The negative controls remained blue and did not form a precipitate. The unknown solution formed a red precipitate which indicates that it is in fact a reducing sugar.

The Biuret test resulted in one positive control, protein, as can be seen in Table 3. The protein turned violet; the colour change depends on the presence of two or more peptide linkages thus free amino acids do not partake in the reaction. The colour change is a result of the treatment of cupric ions with the unshared electron pairs of peptide nitrogen and the oxygen of water (Chatterjea, 2004). The rest of the solutions were negative controls; they remained a pale blue except honey which was a pale yellow.

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The unknown solution did not test positive and therefore contains no proteins.

In conclusion, the unknown solution #146 is a reducing sugar as shown in Table 2. Hence, it only tested positive for Benedict's test and resulted in negative controls for the iodine test and the Biuret test.

REFERENCES

Cameron, A. T. (2007). *Course in practical biochemistry - for students of medicine*. (pp 17-18). S. I.: Read Books.

Chatterjea (2004). *Textbook of Biochemistry for Dental/Nursing/Pharmacy Students*. (pp. 50-52). Jaypee Brothers Publishers. Bottom of Form

Department of Biology 2001 Introductory Cell Biology Lab Manual. University of Waterloo, Waterloo. pp. 15-19

Hequet, E. F., & Abidi, N. (2006). *Sticky cotton: Measurements and fiber processing*. (pp. 17-18). Lubbock, Tex: Texas Tech University Press.

Honey (2011). *Grolier Multimedia Encyclopedia*. Retrieved September 23, 2011, from Grolier Online <http://gme.grolier.com/article?assetid=0140720-0> Bottom of Form

Pavia, D. L. (2005). *Introduction to organic laboratory techniques: A small scale approach*. (pp. 451-452). Belmont, CA: Thomson Brooks/Cole. Top of Form

Prakash, M. (2008). Macromolecules: Giant Polymers. *Molecular Biology of Life* (pp. 252-254). New Delhi: Discovery Publishing House. Top of Form