

# Testing for starch, sugar and protein in foods



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## **Introduction**

Food can provide energy and essential amino-acids for people to maintain homeostasis, this is vital in a person's life. Therefore, using a simple food test to identify a substance in food is also significantly important. According to hyperphysics. phy-astr. gsu. edu (2000), carbohydrates include starch which is made of glucose and reducing sugars are the compounds which provide energy to living cells. Reducing sugar is defined as " the sugar contains aldehyde groups that are oxidized to carboxylic acids."(Chem. ucalgary. ca, 2009).

Proteins are essential compositions of all living cells which are made of amino acids. For instance, enzymes, hormones, and antibodies those are necessary for the regular functioning of human beings (Answers Corporation, 2009).

The lipid is a huge and various groups of the organic compounds which has ionic water soluble heads and a chain of organic tails. Besides, their solubility depends on non-polar organic solvents (cem. msu. edu, 2009).

In addition, each kind of substances reacts with the different reagent. For instance, starch becomes blue-black color when iodine solution is added (Pickering, 2000).

The principle of it is that starch focus helices form around iodine anions  $I_3^-$ , which can form a dark blue or black colour (Biology-online. org, 2008).

Pickering (2000) also suggests that glucose becomes yellow or red when added to Fehling's Reagent at elevated temperatures. Fehling's Reagent is

classified as “ equal volumes of Fehling I and Fehling II are mixed to form a deep blue solution. Fehling I consists of 7 g of hydrated copper (II) sulfate dissolved in 100 cm<sup>3</sup> of distill water. Fehling II is made by dissolving 35 g of potassium sodium tartrate and 10 g of sodium hydroxide in 100 cm<sup>3</sup> of distill water”(Chemie. uni-regensburg. de, 2003). This reaction can be explained clearly due to the equation below.

Equation: Fehling’s Test for Reducing Sugars

Chemie. uni-regensburg. de (2009)

When Biuret reagent interacts with peptide bonds it produces a purple colour, which demonstrates positive Biuret test for protein, the more protein presents the darker the color (Skavarijal et al, 1993).

Lipids can be separated from water because ethanol can partition the lipid molecules because of the solubility behavior of a lipid in water and organic (Lane, 2009).

## **Method**

### **Equipment**

- 5 test tubes
- Water bath
- Pipette

At the beginning, starch, glucose solution, egg albumen, peanut oil were labeled A, B, C, and D.

The first test was for starch. 3-4 drops of iodine solution were added into 1 cm<sup>3</sup> of starch solution in a test tube. Distilled water was used instead of a solution to repeat this process as a control.

The second test uses glucose solution. Firstly, 2 cm<sup>3</sup> of Fehling's Reagent A were added into a test tube using a pipette, then 2 cm<sup>3</sup> Fehling's Reagent B was added into the same test tube. Shake very vigorously to make sure they are mixed thoroughly. After adding the solution into the B solution, warm to 60 °C in a water bath for 5 minutes. Distilled water was used instead of B solution to repeat this process as a control.

The third test was using egg albumen. Biuret Reagent A was added into 2 cm<sup>3</sup> of solution C until in excessive. Using a Pipette, 1 cm<sup>3</sup> of Biuret Reagent B was trickled in. Distilled water was used instead of C solution to repeat this process as a control.

The fourth test was testing using peanut oil. 2 cm<sup>3</sup> of ethanol was added to 2 cm<sup>3</sup> of solution D. Shake strongly using a cork bung. After that, 2 cm<sup>3</sup> cold water was added. Again distilled water was used instead of D solution to repeat this process as a control.

## Results

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Table 1. Colour of starch, sugar, protein and lipid in different solution with different reagent

### **Discussion**

The colour of the reactions on identifying common substance was largely as predicted by theory. The experiments mentioned above show clearly that after adding the iodine solution into solution A, the yellow-brown colour changed in a blue-black colour, which indicated the presence of starch due to I<sub>3</sub><sup>-</sup> complexes. A transparent colour change into yellow-red colour after adding Fehling Reagent A+B and being warmed under 60°C water bath, indicated the reducing sugar presented in solution B. After adding Biuret Reagent A +B into solution C, a transparent colour changed in purple suggesting protein was in the solution C, When ethanol and water were added into solution C, a cloudy white suspension presented, which indicated lipid was in solution D. However, the colour change did not occur in the control experiment, which can prove that the test reagent give a false positive by themselves without material.

However, some problems occurred in the tests. It would be expected that solution B would become red colour when adding Biuret Reagent A+B. The results are a little different from the given reaction. Errors may have arisen in the process of adding the Biuret Reagent A+B into solution B before it was

warmed to 60 °C in a water bath, which might have affected the results. Besides, the concentration of reducing sugar may be a factor affecting the results. So future experiments should separate solution B and the Biuret Reagent A+B in a water bath warmed for 5 minutes before they are mixed. Moreover, the concentration of reducing sugar should be measured when the tests do. In addition, these tests are just qualitative which only identify the appearance of each material. In the next experiment, we should measure the mass of substances and proportion of the reagents, making each test specific and do a quantifying experiment.

Furthermore, in order to identify whether other materials exist in egg albumen or not, we can add different reagents into the solution to observe if anything can give a positive to the test. The same procedures can be repeated using glucose solution and peanut oil.

### **Conclusion**

It can be concluded that the results of these experiments generally accorded with the theory. Results demonstrate that solution A contains starch, solution B contains reducing sugar, solution C contains protein, solution D contains lipid.

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