Digestion- KEY: Exercise 9, Experiments

Monday, July 07, 2014
3:28 PM

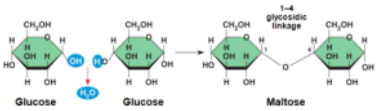
A. DIGESTION OF PROTEIN

HYPOTHESES:

1. Will a more or less acidic solution enhance PEPSIN activity? ***Pepsin is most active in very acidic conditions.***
2. Will a more or less acidic solution enhance TRYPSIN activity? ***Trypsin works best in neutral - mildly basic conditions (pH 7.5 - 8.5)***

B. TEST FOR STARCH

BACKGROUND:

- 

STARCH = REPEATING MALTOSE

Starch:

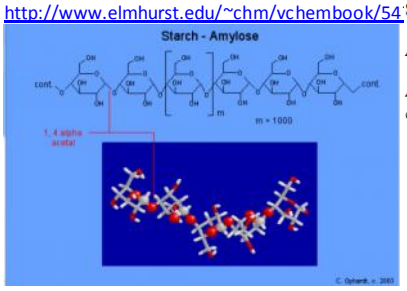
Plants store glucose as the polysaccharide starch. The cereal grains (wheat, rice, corn, oats, barley) as well as tubers such as potatoes are rich in starch.

Starch can be separated into two fractions--**amylose and amylopectin**. Natural starches are mixtures of amylose (10-20%) and amylopectin (80-90%).

Amylose forms a colloidal dispersion in hot water whereas amylopectin is completely insoluble. The structure of amylose consists of long polymer chains of glucose units connected by an **alpha acetal** linkage. The graphic on the left shows a very small portion of an amylose chain. All of the monomer units are alpha -D-glucose, and all the alpha acetal links connect C # 1 of one glucose to C # 4 of the next glucose.

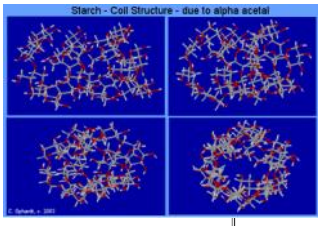
http://www.elmhurst.edu/~chm/vchembook/54

Starch Coil or Spiral Structure:



As a result of the bond angles in the alpha acetal linkage, amylose actually forms a spiral much like a coiled spring.

Amylose is responsible for the formation of a deep blue color in the presence of iodine. The iodine molecule slips inside of the amylose coil.



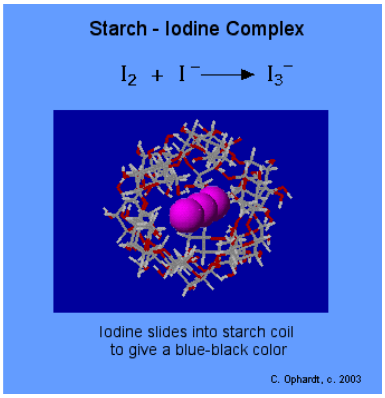
Chemical Test for Starch or Iodine:

Amylose in starch is responsible for the formation of a deep blue color in the presence of iodine. The iodine molecule slips inside of the amylose coil.

Iodine - KI Reagent: Iodine is not very soluble in water, therefore the iodine reagent is made by dissolving iodine in water in the presence of potassium iodide. This makes a linear triiodide ion complex with is soluble. The triiodide ion ion slips into the coil of the starch causing an intense blue-black color.

Starch Test: Add Iodine-KI reagent to a solution or directly on a potato or other materials such as bread, crackers, or flour. A blue-black color results if starch is present. If starch amylose is not present, then the color will stay orange or yellow. Starch amylopectin does not give the color, nor does cellulose, nor do disaccharides such as sucrose in sugar.

Iodine Test: When following the changes in some inorganic oxidation reduction reactions, iodine may be used as an indicator to follow the changes of iodide ion and iodine element. Soluble starch solution is added. Only iodine element in the presence of iodide ion will give the characteristic blue black color. Neither iodine element alone nor iodide ions alone will give the color result.



HYPOTHESES:

1. Will a drop of iodine solution (IKI) cause starch to change color? ***Yes. The iodine inserts itself into the coiled amylose component of starch.***
2. Will a drop of iodine solution (IKI) cause maltose to change color? ***No. Maltose does not contain a coiled structure (it's a glucose dimer).***

C. TEST FOR SUGAR

BACKGROUND:

1.

Benedict's reagent contains blue copper(II) ions (Cu^{2+}) which are reduced to copper(I) ions (Cu^{+}). These are precipitated as red copper(I) oxide which is insoluble in water. Benedict's Reagent provides a quantitative test for reducing sugars along with qualitative test. The color of the obtained precipitate gives an idea about the quantity of sugar present in the solution. A greenish precipitate indicates about 0.5% concentration; yellow precipitate indicates 1% concentration; orange indicates 1.5% and red indicates 2% or higher concentration.

To test for the presence of monosaccharides and reducing disaccharide sugars in food, the food sample is dissolved in water, and a small amount of Benedict's reagent is added. During a water bath, which is usually 4–10 minutes, the solution should progress in the colors of blue (with no glucose present), green, yellow, orange, red, and then brick red or brown (with high glucose present). A colour change would signify the presence of glucose. The common disaccharides lactose and maltose are directly detected by Benedict's reagent, because each contains a glucose with a free reducing aldehyde moiety, after isomerization.

Sucrose (table sugar) contains two sugars (fructose and glucose) joined by their glycosidic bond in such a way as to prevent the glucose isomerizing to aldehyde, or the fructose to alpha-hydroxy-ketone form. Sucrose is thus a non-reducing sugar which does not react with Benedict's reagent. Sucrose indirectly produces a positive result with Benedict's reagent if heated with dilute hydrochloric acid prior to the test, although after this treatment it is no longer sucrose. The acidic conditions and heat break the glycosidic bond in sucrose through hydrolysis. The products of sucrose decomposition are glucose and fructose, both of which can be detected by Benedict's reagent, as described above.

Starches do not react or react very poorly with Benedict's reagent, due to the relatively small number of reducing sugar moieties, which occur only at the ends of carbohydrate chains. Inositol (myo-inositol) is another carbohydrate which produces a negative test.

Benedict's reagent can be used to test for the presence of glucose in urine. Glucose found to be present in urine is an indication of diabetes mellitus. Once a reducing sugar is detected in urine, further tests have to be undergone in order to ascertain which sugar is present. Only glucose is indicative of diabetes.

http://en.wikipedia.org/wiki/Benedict's_reagent

HYPOTHESES:

1. Will maltose react with Benedict's solution? ***Yes. Maltose solution contains many molecules with free reducing ends.***
2. Will starch react with Benedict's solution? ***No. Starch solution contains very few free reducing ends (they are concealed by glycosidic bonds).***