



DIGESTIVE ENZYME: AMYLASE

Caution:

Lugol's solution is slightly hazardous:

- It should not be handled by small children.
- It is dangerous if swallowed.
- Participants should wear gloves.
- Adults should place the Lugol's solution into a small dropper bottle for youth to use.

Skills:

- Observation, teamwork.

Grade Levels: Grades 4 - 12

- **Time: 15 – 20 minutes**

Number of Youth:

Any

Supplies Needed:**Materials for each test group:**

- Lugol's Solution in small dropper
- 2 test tubes with lids: 25ml or 50 ml
- Small cup of water
- Crushed saltine cracker in zip lock bag
- 5-7 plastic cups: 3 oz. or 5 oz.

BACKGROUND

Most animals begin their digestion in their mouths. Chewing breaks up large pieces of food and chemicals in the saliva begin breaking apart molecules of starch. In this experiment we add saliva to crackers to observe the how quickly this process begins to happen.

Basic definitions:

Amylase: an enzyme that breaks down starch into sugars.

Enzyme: a protein that speeds up a chemical reaction.

Chemical Indicator: a chemical that allows you to observe that a reaction has taken place.

Starch: a complex arrangement of sugar molecules.

Starch is a long group of glucose (sugar) molecules bonded together. Amylose is the starch form that's found in crackers. In amylose, the sugar molecules form a structure that has small spaces in between the molecules of sugar. Lugol's solution contains iodine molecules that fit tightly inside these small spaces. When the iodine molecules are inside these small spaces between bonded sugar molecules, the iodine looks blue-black in color. If the sugar molecules begin to break apart and release the iodine molecules, the indicator solution looks light brown-brown in color.

Amylase is the protein that breaks apart starch into sugars. Amylase is a chemical found in the saliva of many animals.

Materials for each test group:

Lugol's Solution (2%) in small dropper bottle

2 test tubes with lids : 25ml or 50 ml

Small cup of water

Crushed saltine cracker in zip lock bag

5-7 plastic cups: 3 oz. or 5 oz.

Several markers

WHAT TO DO**Introduction:**

In this experiment youth will observe a control test tube and an experimental test tube to determine if a reaction has taken place. In the control test tube, the instructor or youth leader will place a small amount of crushed cracker (pea sized) into 10 mL of plain water. In the experimental test tube, the instructor or youth leader will place a small amount of crushed cracker (pea sized) into 10 mL of saliva. Into each of the test tubes one or two drops of Lugol's solution will be

Do Ahead:

- Crush saltine crackers
- Place Lugol's solution in dropper bottle.

Web Resource:

- http://www.exploratorium.edu/ti/conf/nsta2009/karen/bogus_biology.pdf

Sources:

Kalumuck, Karen.
Saltines, Saliva, and the Starch Reaction.
Exploratorium Teacher Institute. 2008.

added. Each test tube will be capped and shaken for 30 seconds. Youth will observe any color changes in the test tubes. A positive test for sugars will be shown as the indicator (Lugol's solution) changes color from black/blue to light brown.

Procedure:

Ask several students to join you at the front of the room. Depending on the size of the group, you might have a greater number of youth join. For each group of 20 students ask 5 youth to participate at the front of the room. Each group of 5 volunteers will perform the experiment. The test tubes can then be passed around the room for all participants to observe the results.

1. Each group will label their test tubes. One test tube is labeled water. One test tube is labeled saliva.
2. Each participant in the group will receive a plastic cup. Ask the participants to begin spitting saliva in their cup. At the end, each group will need to have at least 10 ml of saliva.
3. Each group will add a pea sized amount of cracker into each test tube.
4. Each group will collect 10 mL of their saliva into the test tube labeled "saliva".
5. Each group will add 10 mL of water to the test tube marked water.
6. Each group will cap the test tubes and mix the cracker solutions by swirling the test tubes.
7. Each group will add one or two drops of Lugol's solution to each test tube.
8. Each group will cap the test tube and mix well.
9. The reaction could take up to 2-3 minutes to complete.
10. Each group will observe the color in each test tube.

TALK IT OVER**Reflect:**

- Ask youth what they observe in each test tube.
- In this experiment, what does a solution that retains its blue-black color represent?
- In this experiment, what does a solution that turns brown represent?
- How does this process aid in digestion?
- What are some other reasons saliva is important?

Apply:

- Other than crackers, what other foods contain starch? Corn, potato, rice, soy beans, bananas, peanuts.