

Lab: How Enzymes Can Break Down Polymers Into Monomers

Purpose: To demonstrate how enzymes can break polymers into monomers.

Preliminary concepts/definitions:

Enzyme: _____

Polymer: _____

Monomer: _____

Starch: _____

Indicator: _____

PROCEDURE

1. **(TUBE 4, step 1)** Take a test tube. Add a finger's width of starch solution. Then add another nice healthy quantity of saliva (yours or your partner's) to the test tube. Gently shake the test tube, which now contains starch and saliva, for one minute (the goal is to thoroughly expose the starch to the enzymes in your saliva). Then let the test tube with the starch/saliva mixture sit for at least 5 minutes, shaking occasionally.
2. **(TUBE 1)** Take a test tube. Add a finger's width of simple sugar (glucose) solution. Add a few drops of Benedict's indicator solution. Using a test tube holder, put the test tube in one of the beakers of boiling water for about two minutes. Observe, and fill out the data table below.
3. **(TUBE 2)** Take a test tube. Add a finger's width of starch solution. Add a few drops of Benedict's solution. Using a test tube holder, put the test tube in one of the beakers of boiling water for two minutes. Observe, and fill out the data table below.
4. **(TUBE 3)** Take a test tube. Add a nice healthy quantity of saliva. Add a few drops of Benedict's solution. Using a test tube holder, put the test tube in one of the beakers of boiling water for two minutes. Observe, and fill out the data table below.
5. **(TUBE 4, step 2)** Take the test tube from step 1, with starch and saliva. Add Benedict's solution. Using a test tube holder put the test tube in one of the beakers of boiling water for two minutes. Observe what happens, and fill out the data table below.

DATA TABLE

substance	original color of the solution	color with Benedicts before heating	color with Benedicts after heating for 2 min.
1. simple sugar (glucose)			
2. starch solution ONLY			
3. saliva ONLY			
4. starch with saliva (let sit for 5 min.)			

CLEAN UP: SCRUB OUT YOUR TEST TUBE WITH A BOTTLE BRUSH, AND PLACE THE TEST TUBE IN THE BLEACH BATH.

Analysis:

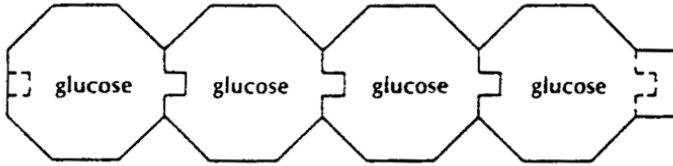
1. According to test 1, if a simple sugar is present, what color will Benedict's solution turn upon heating? _____
2. According to test 2, If starch is present, what color will Benedict's solution turn upon heating? _____
3. According to test 4, after you added saliva to the starch, what color did it turn with Benedict's and heating? _____
4. According to test 3, will saliva on its own cause the change you observed in question 3? _____
5. What substance must have appeared in the test tube to cause the change you observed in test 4? _____
6. How did the substance you listed in question 5 get there? _____

7. Thinking of this as an experiment, what was the purpose of testing the starch by itself and the saliva by itself? _____

8. Thinking of this as an experiment, what was our independent variable? _____
9. Thinking of this as an experiment, what was our dependent variable? _____
10. Why are indicators useful in scientific investigations? _____

Reading and Analysis:

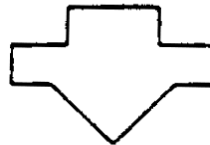
The image below represents a starch molecule. Starch is a polymer consisting of multiple glucose molecules that are covalently bonded together, forming a chain.



Starch molecule

An enzyme in your saliva-salivary amylase-can change starch into glucose by removing glucose molecules from the end of the chain (note: the actual reaction is somewhat more complicated, but thinking of it this way is useful for learning about how enzymes work). One way to envision this is to

imagine this enzyme closely fitting together with starch at the point where the glucose monomers connect. The enzyme stresses the bonds between the monomers, causing them to break, releasing the monomer (glucose) into the solution. As a result, a starch solution which initially has no glucose can be changed into a solution of that contains glucose. The enzyme, in other words, frees the glucose monomers from the starch polymer.



Using the shape shown at left to represent the enzyme in saliva, draw a series of diagrams to accompany the text in the table below.

1. Starch Molecule		2. Enzyme in saliva	
3. Enzyme fitting together with the starch molecule and stressing the bonds between the glucose monomers.		4. Glucose molecules freely floating the in the solution	

Conclusion. Write a few sentences explaining what happened in this lab. In your explanation, use some of the sequencing words provided immediately below.

<p>Sequencing words:</p> <ul style="list-style-type: none"> · first, second · next, later, then · before/after · while 	<ul style="list-style-type: none"> · finally · earlier · eventually · initially 	<ul style="list-style-type: none"> · meanwhile · immediately · during · subsequently