PROJECT L.A.B.S. (LEARNING ABOUT BASIC SCIENCE)

Title: Amylase Enzyme in Saliva

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Grade Level: Grades 5 to 8

Discipline: Biochemistry

Goals:

1. To have students measure by mls. and ozs., teaspoons, tablespoons, and drops.
2. To have students make solutions using cornstarch, tincture of iodine, saliva, vinegar, and baking soda (sodium bicarbonate) and sugar.
3. To have students use an indicator to test chemical reactions.
4. To have students use variables to change results.
5. To have students compare results with their lab partners.
6. To show students that chemical reactions occur in their bodies.

Specific Objectives:

1. Students will prepare solutions of their saliva and the variables assigned-- alcohol, baking soda and/or vinegar.
2. Students will use an indicator and their saliva solution to demonstrate how starch breaks down into smaller sugar molecules.
3. Students will time their results.
4. Students will compare the time for objective 3 to the time when a variable is added.
5. Students will compare their results with their lab partners' results.
6. Students will graph and chart their results with the rest of the class.
7. Students will see that starch is broken down to sugar in their mouths.

Materials:

hot plate, immersion heater, or teapot
droppers and bottles
beakers, jars, plastic cups, and/or glasses
quart jars for solutions
teaspoons, tablespoons
graduated cylinders or measuring jars
saliva
corn starch
tincture of iodine
unsalted saltine crackers
vinegar
baking soda (sodium bicarbonate)
sugar

Background:

Enzymes are proteins that catalyze the chemical reactions of living cells. They are composed of 200 to 1000 amino acid residues linked by a unique genetic code. The unique structure determines the function of the enzyme. The chemical that the enzyme attaches to is called the substrate. The enzyme transforms the substrate into products. In this case starch is broken down into sugar by the enzyme, Amylase, which is in saliva. Enzymes have been named by adding the suffix -ase to the substrates that the enzyme works on. Amylase is an enzyme (-ase) which works on starch (amylum). Starch turns purple when added to iodine, but the small sugar molecules do not. In this activity, saliva will be added to cause the break down of the starch and prevent it from reacting with iodine.

Procedures:

1. Make a Starch Solution (The teacher should do this ahead of time.) Make a watery paste of about 5g or level teaspoon of corn starch in 30mL or 2 tablespoons of hot water. Dissolve this in about 100mL or 4ozs of boiling water. Cool the solution and dilute it with 1L or a quart of water.
2. Make an Iodine solution (The teacher shoul do this ahead of time. Avoid having children handle because of staining.) 1 part tincture of iodine to 9 parts water. Pour into dropper bottles. Light sensitive if the solution is made ahead of time.
3. Make a variable solution Use 8 parts water to 1 part of either vinegar, sugar, or baking soda.
4. Make a saliva solution Add 100mL or 4ozs of water to a jar or beaker. Add about 2mL or a teaspoon of one's own saliva and stir until dissolved. Label the saliva solution with your name.
5. Test your saliva for amylase Place an unsalted saltine on your tongue, without chewing, and close your mouth until you have a sugary taste. The amylase in your saliva has changed the starch in the crackers to smaller sugar molecules.
6. Experiment with the Indicator and the indicator and variable. Add 20 drops of iodine solution to 40 drops of starch solution, twice, to produce 2 blue indicator solutions. Add 2 drops of variable solution to one of the bottles. Pour half of the saliva solution into each bottle. Record the time for the indicator to turn clear.

Sample Results:

Results of salivary amylase from various subjects.

1. The time it took for the starch sample to change to sugar molecules and the blue color to disappear when various saliva samples were added.

Subject's saliva	Time for change (purple to clear)
Ave	6:40
Kathy	5:15
Chuck	2:10
Lester	8:00
Andrea	16:00
Beth	5:10

2. The effect of a vinegar on the rate of reaction. Vinegar is acidic with a pH of 3 to 4 and the enzyme does not function as efficiently as at pH 7.

Subject's saliva	Drops of vinegar solution	Increase in time
Judy	1 drop	10%
Ave	2 drops	20%
Steve	2 drops	41%

Questions:
1. When the saltine was in your mouth how did the flavor change? What do uou think caused this to happen?
2. What reaction did you see when you added iodine to your starch solution, to make your indicator?
3. What reaction did the saliva solution have on the indicator solution?
4. How did your variable solution change the results?

Extensions:
Compare the students' results by use of a graph or charts.
Have the students suck on an orange first and repeat
Develop a general distribution curve with your students to show differences in amylase.
Use other variables to check for changes in reaction rate. (alcohol, soda, etc.)
Heat saliva to show amylase destroyed by heat and unable to react with indicator.

Please Note:
Some saliva has a very low or high concentration of amylase. Adjust saliva solution and try again if reaction time is too slow or too fast .
Stress the importance of controlling all variables.