The Effect of Hydrogen Peroxide Concentration (substrate) on the Activity of the Enzyme Catalase

The Effect of Hydrogen Peroxide on the Reaction Rate of the Enzyme Catalase

Background Information
Enzymes are biological catalysts. They are generally large protein molecules made up of several hundred amino acids. Enzymes speed up thousands of chemical reactions that occur in living cells. Enzymes are highly specific. This means that one form of an enzyme generally works on only one type of reaction, thus, there must be many different types of enzymes in a cell to carry out many different reactions.
Although an enzyme may change slightly as it performs its job with a substrate, it returns to its original state and can then work on another substrate molecule. Because enzymes can be reused, there needs to be only a small amount of enzyme present in any cell. Several factors are known to affect the action of enzymes: salt concentration, pH, temperature, enzyme positions, radiation, the concentration of the enzymes, and the concentration of the substrate.
Catalase is an enzyme that accelerates the breakdown of hydrogen peroxide into water and oxygen. Catalase is found in both plant and animal tissues. It is especially abundant in plant storage organs such as potatoes and the fleshy parts of fruits. Hydrogen peroxide is strong oxidizing agent produced as a by-product of certain chemical reactions within the cell. If too much hydrogen peroxide accumulates, it will when kill the cell. It must, therefore, be decomposed of by using catalase.

Safety Notes
Keep hydrogen peroxide out of your eyes. Hydrogen peroxide can damage your clothes. Rinse any spills with water immediately. Wipe up any spills and wash your hands at the end of the lab.
Problem
What is the effect of the hydrogen peroxide concentration on the reaction rate of catalase?

Variables
• Manipulated (independent): __________________________________________________________
• Responding (dependent): __________________________________________________________
• Controlled: _______________________________________________________________________

Hypothesis
A solution with a higher concentration of hydrogen peroxide will cause faster rates with catalase. Hydrogen peroxide is acting as the substrate; therefore, a higher concentration of substrate will yield a higher reaction rate with the enzyme, catalase (Allot, 2007). A greater concentration of substrates means that more active sites are being occupied and there are a greater proportion of enzyme-substrate complexes being formed. (Allot, 2007).

Materials
• 100 mL graduated cylinder
• 10 mL graduated cylinder
• 60 mL of each of the 5 concentrations of hydrogen peroxide
• one hole punch
• stop watch
• glass stirring rod
• 250 mL beaker
• five 100 mL Beakers
• potato juice
• two forceps
• distilled water
• 15 paper circles
• paper towels
• masking tape
• blender
**Procedure**

1. Wash your hands before handling the filter paper. Oils may affect the ability of the paper to absorb the desired chemical.

2. Obtain 60 mL of each of the five concentrations of hydrogen peroxide (0.10%, 0.20%, 0.30%, 0.40%, 0.50%)

3. Pour a small amount of potato juice from the blender into a 250 mL beaker.

4. Add 10 mL of the 0.10% solution to a test tube. Label the test tube.

5. Set the stopwatch to zero.

6. Using forceps to pick up one paper circle and dip it into the potato juice. Allow the circle to soak in the juice for 5 seconds so that it is completely saturated.

7. Transfer the paper circle to a clean paper towel and allow it to drain for 10 seconds.

8. Dampen the end of the glass-stirring rod with a bit of the hydrogen peroxide from the respective test tube.

9. Touch the dampen end of the glass stirring rod to the paper circle and move the circle the test tube.

10. Quickly push the paper circle to the bottom of the test tube with the glass stirring rod and then start the stopwatch.

11. Remove the glass stirring rod and continue timing until the paper circle rises and reaches the surface of the solution

12. Record the time

13. Repeat steps 3 through 12 for a total of five trials. Be sure to use fresh hydrogen peroxide solution and a new paper circle for each trial.

14. Repeat steps 3 through 13 for the remaining four hydrogen peroxide concentrations.