CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31949

Project Title
Enzyme Catalyzed Reactions: How Does Temperature Affect Their Rates?

Abstract

Objectives/Goals
Catalase is a very common enzyme found in most animal and plant cells. It speeds up the breakdown of hydrogen peroxide into water and oxygen. I was curious if I could extract the enzyme from your average, run-of-the-mill tuber: a potato, and if temperature changes its rate of activity.

Methods/Materials
Catalase enzyme was extracted by pureeing whole potatoes and straining out the pulp. Filter disks were then saturated with the catalase enzyme and immersed in different temperatures of hydrogen peroxide (H(2)O(2)). The time it took the saturated disk to rise to the surface of the peroxide was measured at temperature intervals of 5 degrees, ranging from 5 to 60 degrees Celsius. Three tests were performed at each temperature and the average time was calculated. In my experiment, catalase speeds up the breakdown of hydrogen peroxide into water (H(2)O(2)) and oxygen, the latter of which gets trapped in the fibers of the filter disks, giving the disk buoyancy. The time it took for each disk to reach the surface of the solution was used to judge enzyme activity, with faster times showing a greater release of oxygen.

Results
Between 5 degrees and 45 degrees Celsius, the time it took for the disk to rise to the top of the solution consistently decreased as the temperature of the hydrogen peroxide was increased, but not at a constant rate. At the colder temperatures, the increase in the rate of return was greatest, but as the peroxide temperature increased, the time differences lessened. At 50 degrees, the reaction rate slowed down markedly until, at 55 degrees, the reaction halted completely. I believe this happened because the enzyme was placed in a temperature too hot and it was denatured (destroyed).

Conclusions/Discussion
My results clearly show that catalase activity increases with increases in temperature until the enzyme becomes denatured (destroyed) and it no longer functions as a catalyst.

Summary Statement
My project explores how temperature affects enzyme activity, using catalase and the hydrolysis of hydrogen peroxide.

Help Received
Father helped me take times during experiment