CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
J0520

Project Title
Catalyst Reaction Rate

Abstract

Objectives/Goals
My project is to study the effect of two variables, temperature and substrate concentration on the decomposition of hydrogen peroxide into oxygen gas and water with two catalyst organic catalase and inorganic manganese dioxide (MnO2) and measure the rate of the reaction.

Methods/Materials
Oxygen production rate catalyzed by catalase was measured by measuring the time needed for a filter paper to float,(the filter paper was dipped into catalase enzyme solution extracted from a potato by micro-centrifugation, and dropped in a well filled with 5 ml hydrogen peroxide to a height of 1cm), different concentration of 1%, 1.5%, 2%, 2.5%, 3% H2O2 at 25°C was used for experiment A(3 trials), and different temperatures 15°C, 25°C, 35°C, 45°C, 55°C with a 3% H2O2 was used for experiment a (3 trials). Oxygen production by MnO2 was measured by a gas collecting apparatus,(a giant pencil and metal pencil holder and weight as a ring stand, shelf holder as a clamp to hold the inverted glass cylinder filled with water in a glass bowl, water bottle as a reaction vial, and tubes connected to the reaction bottle and fitted into the inverted graduated cylinder), for substrate concentration effect 20 ml H2O2 with 1%, 1.5%, 2%, 2.5%, 3% concentrations was poured in the reaction bottle and 100mg MnO2 powder was added at 25°C, and the displaced volume of water by produced oxygen gas was marked on the inverted graduated cylinder every 30 second for six minutes, experiment B(3 trials). The process was repeated for different temperatures 15°C, 25°C, 35°C, 45°C, 55°C with 3% H2O2, experiment b (3 trials).

Results
Increased substrate concentration increased the rate of the reaction with catalase, and the increase in temperature also increased the rate of reaction until a certain point 45°C where it start to decrease and stopped at 55°C. The rate of reaction catalyzed by MnO2 increased with increase substrate concentration, and increase temperature.

Conclusions/Discussion
My conclusion is that my experiment agreed with my hypothesis, increase substrate concentration and temperature, increases the reaction rate of decomposition of hydrogen peroxide catalyzed by two catalyst, organic catalase and inorganic manganese dioxide. However catalase being a protein, denatured after certain point of increased temperature and changed its structure, where the active site no longer functioned for the catalytic activity to take place.

Summary Statement
My Project is to study the effect of variables, substrate concentration and temperature on the rate of reaction of the decomposition of Hydrogen Peroxide by an organic catalyst Catalase and inorganic catalyst Manganese Dioxide.

Help Received
Father helped with explanation of key terms and equipment assembly.