CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31793

Project Title

The Effect of the Concentration Level of B-glucosidase on the Rate of the Amount of p-NItrophenol Produced

Abstract

Objectives/Goals

The objective of this experiment was to determine the effect of the concentration level of an enzyme called beta-glucosidase on the amount of p-Nitrophenol produced, which indicated the rate that the substrate broke down. Knowledge on the effect of concentration of enzyme on the substrate would be vital for scientists in biofuel industries, since it is desirable to balance the amount of reaction time and resources like enzymes.

Methods/Materials

The most important materials of this experiment were the enzyme called beta-glucosidase or cellobiase. In this experiment, instead of using the natural substrate, cellobiose, which forms transparent products, an artificial substrate called p-Nitrophenol glucopyranoside was used, since it could produce colored products. There were 2 types of enzymes, high and low concentration enzyme. When 1.5mM substrate was pipeted into high concentration enzyme, the timer was started. After the time points on the cuvettes as H1(after 1 min), H2(after 2 min) and H3(after 8 min), 500 microlitres from each was added to the cuvette at each time point. Same steps were applied to low concentration enzyme, and there were 10 trials in this experiment. After all the data was gathered, the colors of the products were compared to the colorimetric standards to obtain numerical values of the amount of p-Nitrophenol.

Results

High concentration enzyme broke down the substrate at a faster rate than low concentration, indicated by the amount of p-Nitrophenol formed. For high concentration enzymes, the average amount of p-Nitrophenol formed after 1 minute was 57.5 nmol, after2 minutes, 85 nmol, and after 8 minutes, 100 nmol was formed. For low concentration enzymes, the average amount of p-Nitrophenol formed after 1 minute was 18.75 nmol, after 2 minutes, 37.5 nmol, and after 8 minutes, 70 nmol of p-NItrophenol was formed.

Conclusions/Discussion

The products formed from high concentration enzyme had darker and deeper yellowness than those from low concentration enzyme, meaning that more p-Nitrophenol was released and more substrate was broken down. In conclusion, high concentration enzyme yields more amount of p-Nitrophenol than low concentration enzyme in a given time. Using high concentration enzyme would be useful when products are desired to be formed quickly. However, enzymes are costly, so in order to be economically efficient, using low concentration enzyme is an advantage as well.

Summary Statement

The experiment tests whether concentration of enzyme affects the rate that substrate breaks down.

Help Received

Parents helped with transportation, financial support; Mr. Antrim gave me helpful advises

Preliminary