CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
J0422

Project Title
A Very Juicy Experiment: The Effect of Pectinase, Cellulase, Amylase, and Their Immobilization on Apple Juice Production

Abstract

Objectives/Goals
My project was divided into 3 different experiments. Experiment 1- the effects of pectinase, cellulase, and amylase on apple juice production. Experiment 2- the effects of enzyme combinations on apple juice production (pectinase and cellulase, pectinase and amylase, cellulase and amylase). Experiment 3 part 1- the effects of immobilized enzymes on apple juice production, Experiment 3, part 2: the effects of reused immobilized enzymes on apple juice production.

Methods/Materials
Method:
For each experiment, cut one apple, divide it equally into 4 parts, and place each quarter into a beaker. Experiment 1- apply enzymes (one to the contents of each beaker) and distilled water to the forth one (control). Filter the juice into the test tubes, and recorded the results. Experiment 2- combine the enzymes (pectinase and cellulase, pectinase and amylase, cellulase and amylase) and apply the combinations to the contents of each beaker,distilled water to the last one. Filter the juice, and record the results. Experiment 3- immobilize the enzymes using calcium chloride and sodium alginate, and apply the immobilized beads to each beaker. Filter the juice, and record the results. Separate the beads from the apple waste, and reuse them.
Materials:
pectinase, cellulase, amylase, distilled water, apples, beakers, testing tubes, a balance, sodium alginate, calcium chloride, a syringe, a tea strainer, timer, stirring rod

Results
Experiment 1- pectinase: 4.2 mL, cellulase: 2.4 mL, amylase: 1.9 mL, distilled water: 0 mL; Experiment 2, trial 1- pectinase and amylase: 4.3 mL, pectinase and cellulase 4 mL, cellulase and amylase: 2.2 mL, distilled water: 0 mL; Experiment 2, trial 2: pectinase and cellulase: 5.7 mL, pectinase and amylase 5.5 mL, cellulase and amylase 1.5 mL, distilled water: 0.1 mL; Experiment 3, part 1- immobilized pectinase: 2.5 mL, immobilized cellulase: 1.4 mL, immobilized amylase: 0.6 , distilled water: 0 mL; Experiment 3, part 2- pectinase: 0.3 mL, others didnt produce any juice.

Conclusions/Discussion
The outcome of my first experiment supported my hypothesis (pectinase was the most effective); my second hypothesis was not fully proven correct (trial 1: pectinase and amylase was most effective, trial 2: pectinase and cellulase was most effective); and my third hypothesis was also proven correct (I was able to immobilize and reuse the enzymes. The immobilized enzymes weren't as effective as the enzymes

Summary Statement
The effects of pectinase, cellulase, amylase, and their immobilization on apple juice production.

Help Received
My mother guided me throughout my project; Mrs. Shela Jawaid helped find and order the enzymes needed to conduct my experiment