CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

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Project Number

23363

Project Title

Starch Breakdown: The Power of Spit

Abstract

Objectives/Goals

The objective is to determine the optimum temperature and pH of salivary amylase for starch breakdown and to test the presence of salivary amylase in dogs/cats. We believe that optimum condition is pH-7 at 37°C. Humans and dogs have amylase in their saliva; cats don't.

Methods/Materials

Initially we performed pilot experiments to observe effect of amylase on rice starch; amounts of vinegar, buffer, bicarbonate needed to achieve different pH's; amount of saliva needed; and incubation period. For the actual experiments, we made rice starch solution by mixing 60g of rice flour into 940mL water and boiling it. Then we quantified the power of amylase action under different conditions by measuring viscosity of the rice starch solution after incubation with saliva. We adjusted the pH by adding vinegar and sodium bi-carbonate. We designed our own method for measuring viscosity. We made holes at the bottom of the plastic test tubes and used plastic screws as stoppers. To test viscosity, we unscrewed it after incubation with saliva, and timed the flow of solution. Experimented at temperatures: 4°C, 25°C (room temperature); 37°C (body temperature); 65°C as extreme. Experiments were conducted by keeping the temperature constant and changing one variable (pH) at a time. Viscosity was tested for each combination of temperature and pH. For each condition, we used a minimum of 2 samples including control. We tested the existence of saliva amylase in animals using iodine method. We prepared starch plates by boiling 2.5g of agar and 10g rice flour in 500mL water. After the agar solidified, we striped dog and cat saliva onto agar plates using a q-tip, and incubated for 30 minutes. We flooded the plate with diluted iodine solution to check for starch degradation.

Results

We observed the best starch degradation at 37°C followed by 25°C at pH-5 and pH-7. pH-10 solutions showed highest viscosity, almost same as the controls. Starch plate for human saliva after addition of iodine solution shows clarity. Cat, dog and control show no reaction.

Conclusions/Discussion

Our results show that 37°C is optimum for amylase action. The pH-5 and pH-7 show relatively close results. Human saliva showed clear amylase existence, but dog and cat saliva showed none. Further research in studying optimum incubation time, varying enzyme/substrate concentration, more saliva samples, and the use of more assay sensitive methods would be beneficial.

Summary Statement

The purpose of this project is to examine the optimum conditions of the salivary alpha amylase enzyme interaction with the substrate starch.

Help Received

Used lab equipment at Genencor International, Inc. under the supervision of Ms. Mee-Young Yoon; Dr. Jay Shetty of Genencor International, Inc. helped in data analysis.

Preliminary