CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35896

Project Title

The Effect of Acid and Enzymatic Hydrolysis of the Starch on the Decomposition Rate of Bioplastic

Abstract

Objectives/Goals

In this project, enzymatic and acid hydrolysis of the starch were performed to alter the structure of bioplastic. The alteration in the structure was then studied by comparing the decomposition rate of the two types of bioplastic that were made out of acid treated and enzyme treated starch.

Methods/Materials

The starch used to make the bioplastic was hydrolyzed in two different ways: with acid or with enzymes. All the bioplastic pieces were 2cm by 2cm and .5 cm thick. There were 10 bioplastic pieces hydrolyzed with enzymes and 10 hydrolyzed with acid. It was a total of 2 groups(Enzymatic or Acidic), each with 10 trials. The bioplastic pieces were then placed into film canisters with soil for decomposition. Then, each week(total of 6 weeks), it would taken out to have its mass measured with an electronic scale.

Results

The hypothesis was supported. The data showed that bioplastic that underwent acid hydrolysis had a decomposition rate of -0.052g/week and bio plastic that underwent enzymatic hydrolysis had a decomposition rate of -0.028g/week.

Conclusions/Discussion

Based on the data that was acquired from the experiment, the average rate of decomposition of bioplastic that was made out of starch that underwent enzymatic hydrolysis was found to be -0.027g/week and the rate of decomposition of bioplastic that was made out of starch that underwent acid hydrolysis was found to be -0.051g/week. The result of the experiment supported the hypothesis that was made. Bioplastic that underwent acid hydrolysis had the faster rate of decomposition.. During acid hydrolysis, amylopectin chains, the branches that diverge from the main amylose chain, are broken from the amylose chain. While the hydrogen ions in the acid along the water molecules break apart the bonds between glucose molecules by forming hydroxyl groups. During this process, amylose chains are also being broken since acid hydrolysis is not specific. The result that leads the weaker and less flexible bioplastic to a faster decomposition r ate. Enzymatic hydrolysis of the starch however, does not break apart the amylose chains into monomers of glucose because it is specific and targets only the alpha 1, 6 glycosidic bond. The result of a the bioplastic that was made out of enzyme hydrolyzed starch was a much stronger and orderly structured bioplastic that is less susceptible to decomposition.

Summary Statement

This project involved hydrolyzing the starch that was used to make the bioplastic with two different ways and the effect that these two methods of hydrolysis had on the structure was studied by decomposing the bioplastic.

Help Received

Ms Cooper helped improve experimental design, parents helped gather materials.