CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

J0619

Project Title

Rice Plasticity: The Effect of Amylose and Amylopectin in the Formation and Tensile Strength of Rice-based Bioplastic

Abstract

Objectives/Goals

The objective of this experiment was to determine the effect of amylose and amylopectin in different types of rice grain/starch in the formation and tensile strength of a rice-based bioplastic. My hypothesis was if amylose molecules can easily align and associate through hydrogen bonding, while amylopectin yields a much larger molecule than amylose, then different ratios of amylose and amylopectin in the rice grains will affect the plasticity in a rice-based bioplastic, because the linearity of amylose molecules have more extensive hydrogen bonding, while the branched structure of amylopectin molecules build higher viscosity in forming a bioplastic.

Methods/Materials

The procedures to develop different rice grain/starch bioplastic formulas were performed in Stages 1 and 2. The final bioplastic formulas of long grain, medium grain, short grain, glutinous rice and rice flour were developed and compared to cornstarch bioplastic (control). Magnetic hot plate with digital thermometer was used to create the bioplastic. All rice bioplastics and control had their maximum force tested using digital force gauge and had their tensile strength calculated.

Results

Data showed that each rice grain had different amylose and amylopectin contents that affected each formula's plasticity. Amylose contributed to gel strength. Amylopectin had the reverse effect. Some rice bioplastics had a higher tensile strength than the control despite having less amylose content. Unexpected results were found and possible sources of error were discussed.

Conclusions/Discussion

The results partially supported my hypothesis and I concluded that higher amylose rice grains produce a greater tensile strength as a bioplastic. Rice grains may be a viable alternative to bioplastic materials. Further development for application was conducted by combining rice bioplastic with paper fibers that successfully increased the tensile strength significantly.

Summary Statement

I developed my own rice bioplastic formulas from different rice grains, observed each rice bioplastic's formation and tested their respective maximum forces with the digital force gauge and calculated their tensile strengths.

Help Received

I performed this experiment by myself with adult supervision (Mrs. Aily Salikin). My parents for their assistance in creating graphs in excel and design format for the board. Mr. Lee (science teacher) for his support and feedback.