CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
S1005

Project Title
A Pair of Biosticks

Abstract

Objectives/Goals
The objective of this experiment is to produce a pair of eco-friendly and effective disposable chopsticks from a food waste-based bioplastic.

Methods/Materials
(9) individual conventional, disposable wooden chopsticks; (9) individual leftover bread-bioplastic chopsticks; (5) individual butternut squash skin-bioplastic chopsticks; (5) individual parsnip peel-bioplastic chopsticks; (1) spring scale; weights (200 g to 1 kg, increments of 100 g); (1) stopwatch; (2) 20 L buckets; (20) Chopstick Consumer Test questionnaires; (20) volunteers; (40) rubber bands;(20) mini-sized, wrapped chocolates; (40) wrapped, Starbursts; (4) small bowl plates

I gathered 4 food materials that were high in starch content, and made starches from 3 of their respective food waste materials. Using silicone putty, I constructed a chopstick mold. I tested different ratios of ingredients commonly used in starch-based bioplastic recipes. After 11 different trials, I found my master recipe for my bioplastic chopsticks. I was looking for a recipe that produced a bioplastic that was malleable, uniform, and hard but not brittle. Using this master recipe, I then tested the 3 different food waste starches by making 3 different varieties of food-waste based bioplastic chopsticks.

Results
The strength test consisted of testing my food waste-based bioplastic chopsticks (biosticks) against wooden chopsticks in five different 30-second trials, ranging from 2N to 10N of force. I then chose the biostick with the highest breaking point in the strength test to compete against the conventional, wooden disposable chopstick in a timed usage efficiency test, where 20 chopstick users transferred rubber bands (noodles) and mini-sized candy (meat pieces) from one plate to another. After, these chopstick users completed a quick consumer questionnaire.

Conclusions/Discussion
I produced my own pair of biosticks that met the performance of conventional, wooden disposable chopsticks, in strength (breaking point), usage efficiency, and consumer input tests. The results of my experiment show that with some improvements, specifically a factory made chopstick molds and a production plan, we can successfully replace wooden disposable chopsticks with biosticks made from safe, biodegradable ingredients.

Summary Statement
I produced and tested a pair of food-waste based bioplastic, disposable chopsticks as a culturally-sensitive solution to help reduce deforestation, petroleum-based plastic pollution, and food waste.

Help Received
I sought the advice of my chemistry teacher and my regional science fair's mentorship program for planning my procedure. I completed my research, and produced and tested my biosticks by myself.