Name(s)

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Project Number

J1316

Project Title

Which Type of Starch Makes a Stronger Bioplastic?

Abstract

Objectives

Strong bioplastics that are biodegradable might provide a solution to plastic pollution. My project investigated bioplastics made from different types of starch to compare how strong they were. I tested the hypothesis that starches with a finer texture will form stronger bioplastics because their molecules are more tightly packed.

Methods

Six bioplastics were prepared to the same size and shape with an identical method but using different starches: tapioca starch, cornstarch, arrowroot starch, rice flour, potato flour or potato starch. The bioplastics were then extended from the edge of a table and the distance until breaking or reaching a test limit of 5.5cm recorded. The average result from four replicate tests was calculated for each bioplastic as a measure of strength.

Results

The bioplastic made from arrowroot starch could be extended further than the other bioplastics before reaching the test limit. The six bioplastics ranked from strongest to weakest as follows: arrowroot starch, tapioca starch, cornstarch, potato starch, rice flour and potato flour. In addition, arrowroot starch was the only bioplastic which could be bent to the test limit without breaking.

Conclusions

My conclusion is that arrowroot starch made the strongest and most flexible bioplastic. In addition, I noticed the bioplastics that were starch-based, rather than flour-based, were stronger and they were all made from finer grained powder consistent with my hypothesis that finer textured starches can form stronger bioplastics because their molecules are more tightly packed.

I also observed that flexibility was an important component of strength for the arrowroot bioplastic. Further research is suggested to determine if a flexible bioplastic made from arrowroot could replace the plastics currently being used for some clothing, e.g. waterproof ponchos. To address this, it would be important to test how well the arrowroot bioplastic could withstand water. This could have important consequences for our environment because any bioplastic that was able to replace the plastic we use today in making clothing would help solve some of the plastic pollution issues that are harming our world.

Summary Statement

After making bioplastics from six different starches, I found that arrowroot was the strongest with a flexibility that may be suitable to replace some of the plastics currently used in today's clothing to help reduce plastic pollution.

Help Received

I made and tested the bioplastics myself with parental supervision for working on the hot stove and handling the hot bioplastic mixtures.