

Introduction

Digital S.T.E.A.M Plastic Project

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How Does the Amount of Water Change the Strength of Bioplastic?

The Big question!

How can I make the strongest bioplastic?

How I found my question

This is how I found my final question. To start this project, I first made the original recipe which was a bioplastic.

This is the recipe that I used:

- 1 tablespoon of cornstarch
- 4 tablespoons of water
- 1 teaspoon of glycerin
- 1 teaspoon of vinegar

The reason why I chose this bioplastic was because it wasn't that flexible, and it also wasn't sturdy.



I then added, replaced or took away ingredients from this recipe. The reason why I did this was because I wanted to find the best question to answer my bigger question.



I stretched the plastics until it broke, then I found out that the one with less water took the longest time to break. This led to my smaller question , “how does the amount of water change how strong the bio plastic is?”.

I would not been able to find my smaller question if I hadn't done all of these steps because I had to experiment to find the best investigation.

My hypothesis

I think that the less water there is in the recipe, the stronger the bio plastic will get.

Family tree of questions

This diagram show how I went from one question, to another question

How can I make the strongest bioplastic?

What materials are the strongest?

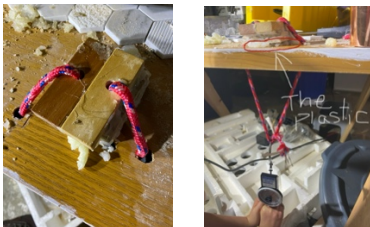
How does the amount of water change how hard and flexible it is?

How I measured the strength of bioplastic

This is how I measured the strength of the bioplastic, and also the problems that I ran into along the way. To measure the strength of the bio plastic, I found it was best to smush it, then find how much pressure it took to do that. So, to do that I made a mold where I can pour in different plastics with different amounts of water. A problem that I ran into was that I knew that the plastics where probably going to stick to the mold. (the paper cup). To fix this problem, I put oil onto the cups, so it doesn't stick. Here is a picture of all of the molds.



While the plastic was drying, I made something that would smush the plastic. First, with a hot glue gun, I glued two blocs to a piece of cement. Next, I drilled 2 holes through the whole thing, and also the table. the reason why I did this was because I wanted to put a string threw those holes. So, I put the string through the hole, and then made a knot. Then I put a fishing scale at the part that I made a knot. I then oiled it and tested it out, but there was a problem. The bottom of the cement was not level because I put the string in. to solve this problem, I drilled a long hole to put the string in, and then put another piece of cement on top of it. This is how it looked like.



I tested it out, and it worked! Because of the fishing scale, I could find how hard I pushed on it until it was completely smushed, or I couldn't smush it anymore.

Materials for water experiments

Here is the materials that I used for the experiments.

No water added	1 tablespoon water added	2 tablespoons water added	3 tablespoons water added
<ul style="list-style-type: none">One tablespoon of cornstarch	<ul style="list-style-type: none">One tablespoon of cornstarch	<ul style="list-style-type: none">One tablespoon of cornstarch	<ul style="list-style-type: none">One tablespoon of cornstarch

<ul style="list-style-type: none"> • One teaspoon of glycerin • One teaspoon of vinegar 	<ul style="list-style-type: none"> • One tablespoon of water • One teaspoon of glycerin • One teaspoon of vinegar 	<ul style="list-style-type: none"> • Two tablespoons of water • One teaspoon of glycerin • One teaspoon of vinegar 	<ul style="list-style-type: none"> • Three tablespoons of water • One teaspoon of glycerin • One teaspoon of vinegar
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- Cups
 - Oil
 - Tester (two play blocks, two pieces of cement, luggage scale)
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Procedure

How I test it

1. Oil the bottom of the tester
 2. Reset the luggage scale so it is on 75 (or 0)
 3. Place the plastic in the middle of the two holes in the table
 4. Put the string threw the two holes and top of the plastic
 5. Knot each part of the string that is coming out of the hole together at the end
 6. Hook up the luggage scale at the end of the knot
 7. Press down at the handle of the luggage scale until the tester is touching the table or you can't pull down anymore
 8. Repeat these two more times
 9. Find the averages for each recipe
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Description of each bio plastic water recipe before mushing

This is a diagram with some of the properties of the experiments.

	No water added	1 tablespoon water added	2 tablespoons water added	3 tablespoons water added
What happens when I smushed it	It is very strong, and when I smushed it, it didn't break	When I smushed it, it broke into parts, but those parts were big	When it smushed it, it wasn't smushed all the way, but is was broken into smaller pieces	When I smushed it, it was completely smushed.
color	The color was a light yellow	The color was whitish, but it still had a tint of yellow in it	The color was white	The color was pearl white
What happened when I stretched it	When I stretched it, it broke very easily	When I stretched it, it broke easily, but it was a little more flexible than the one	When I stretched it, it broke immanently	It was flexible but still easy to break.

		without any water		
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Results

This is a diagram showing how strong each sample

	No water added	1 tablespoon water added	2 tablespoons water added	3 tablespoons water added
Trial One	150+	122	88	40
Trial two	150+	117	114	61
Trial three	150+	120	114	48
Average	150+	279	240	108.333333

Conclusion

I found my hypothesis to be true. The less water you put in the recipe the stronger it gets. I know this because when I look at the average amounts of all of the tests I took, I can see, the no water added was the strongest of all of the 3 water tests that I made.

Further Thoughts....

Even though I know that the strongest of the 3 tests that I made was the one without water, there is still some recipe that may make a bio plastic stronger than this one. Also, my original question says: "what can make the most flexible and strongest plastic". I have not investigated flexibility. So, in the future, I am willing to figure that out.