



## Curiosity Guide #506

### Bioplastics

Accompanies Curious Crew, Season 5, Episode 6 (#506)

#### Design a Bioplastic Sculpture

STEM Challenge

#### Description

Form bioplastic material into a fun, fantastic, possibly futuristic shape!

#### Materials

- Cornstarch
- Vinegar
- Water
- Glycerin
- Spoon
- Spatula
- Stove
- Cooking pot
- Cookie sheet
- Aluminum foil
- Measuring cup
- Teaspoon
- Tablespoon
- Toothpick
- Safety goggles

#### Procedure

1. Cover the cookie sheet in aluminum foil. Set aside.
2. Put on safety goggles.

3. In the cooking pot, measure and combine a ratio of 1 tablespoon cornstarch, 4 tablespoons water, 1 teaspoon vinegar, and 1 teaspoon glycerin.
4. Stir the ingredients together and heat the mixture on the stove over low to medium heat.
5. Keep stirring the mixture until it thickens up and changes from white to translucent.
6. Test the plastic by letting some of it drip from a spoon back into the pot. Keep stirring the mixture until the plastic holds its shape when you spoon it up.
7. Remove the pot from the heat.
8. Use the spatula to spread the plastic mixture out on the cookie sheet covered in aluminum foil.
9. Pierce any air bubbles with a toothpick.
10. Let the plastic sit for an hour before shaping it.
11. Sculpt the bioplastic into an interesting design.
12. Allow the sculpture to cure overnight undisturbed.
13. What else might you shape your bioplastic into?

## My Results

## Explanation

Conventional plastics are made from oil. Oil-based plastics do not break down well in a landfill. Bioplastics are a natural solution as a kind of plastic that is safer for the environment. In this investigation, each ingredient helps improve the quality of the plastic. Cornstarch is a starch, which is a natural polymer that plants make out of extra glucose. The acetic acid in the vinegar helps the cornstarch to dissolve. The glycerin is the plasticizer that creates space between the starch polymer chains so that the plastic is more flexible and won't be so rigid or brittle. The water is the solvent for the mixture. Amazingly, this plastic will dissolve in hot water, is safe for the environment, and is also safe to eat. Be sure not to expose your sculpture to anything too hot because the sculpture will dissolve.

Chemical engineers test how well their bioplastic recipes work with a variety of tests. One way to test the recipe is by stretching the plastic material to see how far the plastic can go without breaking. Stretchiness would be a perfect quality for a bioplastic garbage bag! Engineers might also test how much the material will bend, how it holds up against heat, or how it endures being struck with different amounts of force. Testing to see how long bioplastics take to degrade outdoors is one of the most important tests to understand and protect our environment. Based upon the test results, chemical engineers can make recipe changes and improve their bioplastic designs.

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