

MAKE YOUR OWN BIODEGRADABLE PLASTIC

Learning Goal

Transform milk into casein plastic, a moldable substance that can harden into biodegradable plastic. Then, compare the biodegradability of casein plastic to regular plastic in different environments.

Whether its toys, packaging, or even furniture, plastic is something that we use a lot of! But have you ever wondered what happens when we're finished using these plastic items? A lot of commonly used plastics take up to 1000 years to decompose, polluting the Earth that entire time. That's definitely not a good thing, but -- before you go outlawing plastics altogether, consider that not all plastics are the same!

Casein plastic is a biodegradable plastic that decomposes in just 30 days. Let's make some casein plastic for ourselves! Then, we can track its decomposition.

CASEIN PLASTIC, PART 1: MAKING IT

Materials:

~1/2 Cup of Vinegar, ~2 Cups Dairy Milk, Strainer, Paper Towels, Spoon

Optional:

Food Dye, Cookie Cutters, Rolling Pin

Don't have these materials available? No problem! MOSH activities are designed to be versatile. Think of it as a challenge and change it up to suit yourself. Be sure to take a pic and show us your customization.

1. Heat two cups milk on the stovetop or in the microwave until steaming.
2. Pour in about 6 tablespoons vinegar. You may think that this is going to smell awful but it really doesn't, we promise!
3. Stir in your vinegar. You should see the acid in the vinegar work to separate the casein out of the milk almost immediately. This part is the chemical reaction!

4. Strain away the excess liquid using a strainer. Pat the pulpy, white casein down to squeeze out as much liquid as possible.



5. Scoop the casein goop out of the strainer and onto a paper towel. Use another paper towel and press down on your casein goop, absorbing as much excess liquid as possible.
6. Gently peel the paper towel away from your casein plastic. Knead it with your hands to remove even more liquid. The more liquid you remove at this stage, the better your final product will be!

You should have something that holds its shape when compressed.

7. If you are using food dye, knead it in. **Use only 1 or 2 drops**, because it will get much darker as the casein plastic hardens.

8. Mold the casein plastic into whichever shape you want! Flatter, more compressed shapes dry better, so bust out that rolling pin if you've got it.



9. Let your casein plastic harden in a dry place at room temperature for 48 - 72 hours.

Continue on to Part 2 to track the biodegradability of the plastic you just made!



CASEIN PLASTIC, PART 2: TRACKING ITS BIODEGRADABILITY

Tap water, salt water, and soil will act as basic examples of the different environments plastic is expected to decompose in. By mimicking these environments in our cups, we can observe how casein plastic decomposes compared to regular plastic.

Materials:

6 Cups/Containers, 3 Small Casein Plastic Samples, 3 Small Regular Plastic Samples (Ex: Bottle Lids, Small Toys, Cut Up Straw, etc.), 8 Cups Tap Water, 2 Tablespoons Salt, 2 Cups Soil (Recommended: fresh from outside), Tape and Markers (for labeling), Notebook, Pen/Pencil

1. Take 2 cups and fill each cup with 2 cups tap water.
2. Place a casein plastic sample in one cup, and a regular plastic sample in the other.
3. Label appropriately: “Casein Plastic, Tap Water” and “Regular Plastic, Tap Water”
4. Take 2 cups and fill each cup with 2 cups water, and 1 tablespoon salt. Heat in microwave or on stove top and stir until the salt is completely dissolved and the water is clear.
5. Place your casein plastic sample in one cup, and regular plastic sample in the other.
6. Label appropriately: “Casein Plastic, Salt Water” and “Regular Plastic, Salt Water”
7. Take your last 2 cups and place 1 cup of soil (preferably soil from outside) in each cup.
8. Bury your casein plastic sample in one cup and regular plastic sample in the other.
9. Label appropriately: “Casein Plastic, Soil” and “Regular Plastic, Soil”
10. Do not cover your cups! It is important that oxygen is able to get in and aid the decomposition process.
11. For at least **three weeks**, choose one day of the week to check on all of your plastic samples. If you wanted, you could do the experiment for even longer than 3 weeks! Only check on your plastic samples once a week, as decomposition takes time even in the best case scenario.
12. Be sure to **record your findings** every time you check on your plastic samples! Write down **the date** and whatever observations you may have, but be sure to answer these questions in particular:
 - Is my plastic sample a different shape? What shape is it now compared to my last check-in?

- Is my plastic sample a different size? Did it get bigger, or smaller, or have no change?
- Is my plastic sample a different texture? How is it different than last time?

Make sure to answer the questions for both your casein and regular plastic samples!

13. When your experiment is over, end your recordings with a conclusion. Write at least three sentences considering things like: Which plastic decomposed sooner? Assuming you saw any, when did the changes in your samples begin and end? Did the different environments affect the way the plastic samples decomposed?

Did you know?

Casein plastics have been around since the early 20th century! They were used to make things like buttons, ornate mirrors, and hairbrushes. Many experts in the field think that, with some chemical modifications, casein plastics could replace regular plastics for food packaging. Not only is casein-based plastic better for the planet, it also has smaller pores than other plastics making it up to 500 times better at locking out oxygen!

You made some awesome casein creations and discoveries about plastic so, don't be selfish, share your findings on social media! Make sure to use #MOSHConnect so that we can see the awesomeness too!