

Trash Troop: tackling trash together!

Casein Plastic

Bio-Plastic Activity

Goal

Teach students about alternatives to fossil fuel-based plastics by using milk protein to make a “bio-plastic” magnet.

Introduction

Today, over 99% of plastics in the world are made from fossil fuels (Center for International Environmental Law) and the majority of them end up in landfills or the ocean where they cause issues as they slowly degrade and leach toxic substances into the environment and pose as threats to wildlife. “Bio-plastics” are a bio-degradable alternative to fossil fuel-based plastics and some, including this milk-based plastic also called casein “plastic,” have been commonly used in the past. Use the following supplies and instructions to make a “bio-plastic” magnet with your students!

Next Generation Science Standards

Practices

- Planning and Carrying Out Investigations

Core Ideas

- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions

Crosscutting Concepts

- Influence of Science, Engineering and Technology on Society and the Natural World
- Structure and Function

Supplies

- Cooking pot/pan
- Spatula
- Small cookie cutters
- Measuring cup/spoons or beakers
- Hot plate or stove
- Sharpies/paint
- Hot glue gun
- Cheesecloth
- Container
- Magnetic tape
- Rolling pin
- Paper towels
- Milk*
- White vinegar

Instructions

1. Heat up one cup of milk, ~240 mL, in a pot or pan over medium heat until it is hot but not quite boiling.
2. Add six tablespoons of white vinegar, ~90 mL, to the heated milk, you will see it start to curdle slowly.

3. Stir mixture on low until you see more separation of the clumps from the liquid, remove after about two minutes.
4. Let the mixture cool slightly and then separate the liquid from the solids by using a cheese cloth draped over the container to collect the excess liquid. Keep straining and squeezing the cheesecloth to get the clump to dry up as much as possible, making it easier to work with.
5. Dump the remaining clumps from the strainer onto a paper towel and squeeze as much liquid out of the clumps, this will ensure a better product. Or use the cheesecloth to squeeze as much liquid out of the clumps if using cheesecloth to strain.
6. Lay out a paper towel on a hard surface, dump out the clumps and form into a ball.
7. Use a rolling pin to smooth out a layer of the “dough,” to about 1/8” thickness.
8. Use the small cookie cutters to cut-out shapes from this rolled out solid or hand-form unique shapes.
9. Let the shapes dry for 48 hours (may require extra time depending on ambient conditions).
10. Decorate the shapes by using art materials like sharpies and paint.
11. Attach a piece of the magnetic tape to the back of the decorated, cut-out to complete your magnet.

Discussion

- How does this “bio-plastic” compare to fossil fuel-based plastic?
- What happened when the vinegar was added to the milk?
- Why do you think this reaction happened?
- What sort of everyday materials could be made using “bio-plastic” instead of fossil fuel-based plastics?

References

Fossil Fuels and Plastic

<https://www.ciel.org/issue/fossil-fuels-plastic/>

Sculpted Science: Turn Milk into Plastic!

<https://www.scientificamerican.com/article/bring-science-home-milk-plastic/>