



MILK PLASTIC

Grade Level

4-6

Length of Lesson

30 minutes

Objective

By the end of this lesson, students will have a better understanding of how sensitive the fats and proteins of milk are to new substances.

Materials Needed

- Milk (1 cup per student)
- White vinegar (4 tbs per student)
- Small bowls
- Spoons
- Strainer(s)
- Paper Towels
- Measuring cups
- Food coloring and cookie cutter shapes (optional)

Standards

Common Core

CCSS.ELA-Literacy.RI.4.3; RI.5.3

NGSS

5-PS1; MS-PS1

Lesson Summary

This lesson is a fun, hands-on activity designed to help students understand how proteins are sensitive to acids.

Suggested Sequence of Events:

1. Set Up: Complete this as a demonstration, group activity, or individual activity depending on time and materials. If you're using this as a student activity, make sure students use caution as the milk can be hot and burn skin in the first few steps.
2. Read through the IAITC Dairy Ag Mag to learn more about milk and other dairy products! Interactive online versions can be found on our website.
3. Complete the activity following the procedures:
 - Observe the milk and vinegar solutions, noting their color, texture, scent, etc.
 - Measure 1 cup of milk into a microwaveable bowl and microwave for 1.5 minutes. The milk should be hot but not boiling.
 - Stir in 4 tablespoons of white vinegar into the milk and stir for 1 minute. The milk will start to form clumps!
 - Carefully pour this substance into the strainer. Use your spoon to push the liquid out. This may take a little elbow grease!
 - Transfer the remaining "plastic" to a paper towel and continue to press, making sure all the liquid is out.
 - Have fun and mold the plastic into a shape either by hand or using a cookie cutter. Use food coloring to add some flare!
 - Set the formed plastic aside and let it dry for 2 days.
 - Compare and contrast the original ingredients to the final product.
4. Whole class discussion and reflection of activity. Here are some prompting questions:
 - Describe how the milk reacted when you first added the vinegar (step number 2).
 - What happened when you began pressing the liquid out of the clumped milk?
 - Why do you think the milk turned into a "plastic"? Read the background information on the teacher resources page and share with your students.

TEACHER RESOURCES

Background Information:

This activity doesn't produce an actual plastic, but instead a substance called casein. Casein comes from the Latin word meaning "cheese" and is one of the several proteins that are found in milk. The acid from the vinegar does not mix with the casein in the milk, causing clumps to form. Basically your end product, the milk "plastic", is the casein proteins from the milk all clumped together.

True plastics are polymers, which are a little different than the casein substance. A polymer is a chemical compound that is made up of long chains of repeating, identical molecular units. Keep in mind that not all polymers are plastics but all plastics are polymers.

Extension Ideas:

- Have students turn their milk plastic into ornaments, toys, or gifts for their family or friends.
- Have students mold their milk plastic into a shape related to agriculture.
- Have students write the steps of this activity out, in order, including descriptive language.
- Have students demonstrate their understanding by explaining what happened in the activity using a variety of ways: draw a comic strip, create a fictional narrative, film a short video, write a lab report, etc.
- Take a closer look at polymers (plastics). What are other types of polymers? How does this milk "plastic" compare to other plastics? (Making slime is also another fun activity that focuses on polymers.)
- Scientific Inquiry: Take the experiment to the next level and have students make predictions and test different variables. (Use our Scientific Inquiry worksheet to help guide them through their experiment.)
 - Does the amount of vinegar make more casein?
 - What would happen if you used skim milk or soy milk?
 - What if you used other types of vinegars?
 - If the acid from the vinegar caused the reaction, will acids from citrus and fruits cause the same reaction?
- Read "[Clarabelle: Making Milk and So Much More](#)" by Cris Peterson. Look at the pictures and have students analyze the images.
 - Have students write a short story or create a comic strip from Clarabelle's perspective.
- Take a field trip to a dairy farm and learn about dairy farming.
- Invite a dairy farmer into the classroom.
- Go to agintheclassroom.org to contact your County Literacy Coordinator for free classroom sets of our Ag Mags!