



Student Guide: Turn Milk into Plastic!

How can milk be turned into plastic? With the help of a mug, a spoon, and paper towels, see how vinegar can turn hot milk into plastic!

Useful Vocabulary

- **Plastic:** A group of materials that can be molded into shapes. All plastics are made out of polymers.
- **Polymers:** Chains of one type of molecule, or chains of different types of molecules, linked together in a pattern.
- **Monomer:** A single repeat of the pattern of molecules used to make up a polymer. If the polymer uses only one type of molecule, the monomer is just one molecule.
- **Casein:** A protein in milk. Milk contains many molecules of the casein protein.
- **Casein plastic:** A polymer made out of casein molecules.

Materials

To do this activity you will need:

- Hot milk (1 cup)
- Mug or other heat-resistant cup with 4 teaspoons of vinegar (1)
- Paper towels (6)
- Spoon (1)

Directions

1. Measure out 1 cup of hot milk.
2. Add the hot milk to the mug with vinegar. What happens when you add the milk to the vinegar?
3. Use the spoon to slowly mix the milk and vinegar for a few seconds. What happens as you stir the milk and vinegar together?
4. The small white clumps that form are called curds. What do you think they are made of?
5. Stack four layers of paper towels on a surface that is safe to get damp.
6. After the mug has cooled a little, use the spoon to scoop out the curds. Tilt the spoon against the inside of the mug to let liquid drain but keep the curds inside of the spoon.
7. Put the curds on the stack of paper towels.
8. Scoop out as many curds as you can. Put all of them on the stack of paper towels.



Figure 1. Use the spoon to collect (and drain the liquid from) the curds from the mug. Put all of the curds on a stack of four paper towels, as shown here.

9. Fold the edges of the paper towels over the curds. Press the paper towels down on the curds to absorb any extra liquid from them.
10. If the curds are still very wet, put two new paper towels on top of the curds and press down.
11. Remove any paper towels covering the curds.
12. Push the curds together to make a small ball. It does not need to be completely round. This is the casein plastic.



Figure 2. Press down on the curds with the paper towels to soak up all of the extra liquid. Push the curds together to make a small ball, as shown here. This is the casein plastic.

13. You can transform the casein plastic by coloring, shaping, or molding it. You must knead the casein plastic well before shaping it. You have about one hour to mold the casein plastic after making it.
14. Leave it to dry on paper towels for at least 48 hours. You can also paint or color dried casein with markers.



Figure 3. You can mold and decorate the casein plastic into shapes such as these for about an hour after making it. It will take at least 48 hours to completely dry.

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