



POLYMERS: MAKING PLASTIC FROM MILK

Most kids have made slime with glue and borax.

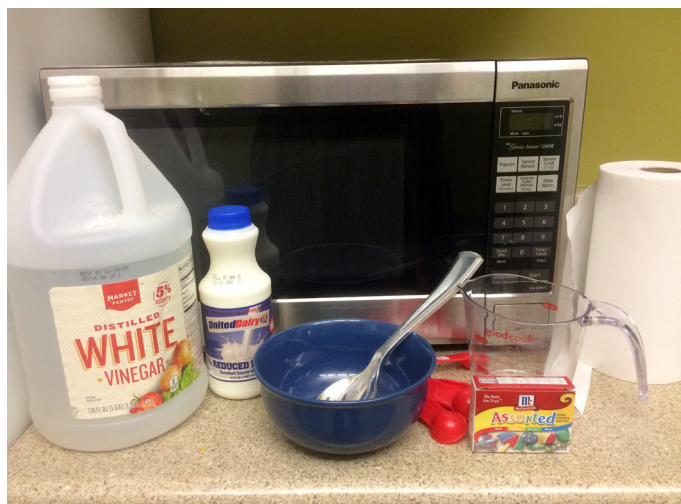
Here's how to use the science behind it to make plastic from milk!

Fun Facts:

- Polymers are long strings of molecules. Imagine a chain. Each link is the same, and connected to a long line of other links. In a polymer, each link is the same kind of molecule or several molecules linked in a pattern.
- How a polymer behaves depends on the kind of molecules it has. Balloons and glue are both made of polymers, but are very different.
- Polymers can be natural or man-made. Wood, wool, silk, and even your hair and fingernails are natural polymers. Plastic, rubber and Teflon (non-stick coating on pans) are man-made.
- Milk contains a protein called casein, which is a natural polymer. It can be made into plastic that can be colored and shaped.
- Queen Mary of England had jewelry that was made of casein plastic!

Materials:

- 1 cup milk
- 4 teaspoons white vinegar
- Stove and pan or microwave and micro-wave-safe container
- Heat resistant bowl or mug
- Slotted spoon
- Paper towels
- Hard surface that is ok to get wet
- Cookie cutters, food coloring, glitter, markers (optional)
- Adult help for handling hot liquids



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Directions:

1. Heat the milk in a pan on the stove to steaming hot. If you prefer, you can heat the milk in the microwave at 50 percent for about 5 minutes. It should be about the same temperature as for hot chocolate. Heat a little longer, if necessary.
2. Put the 4 teaspoons of vinegar in the heat resistant bowl or mug. Add the hot milk and observe what happens. Do you see clumps (called curds) starting to form?
3. Stir the milk and vinegar solution. What happens? Do more curds form? White vinegar is an acid. It made the casein in the milk unfold and reorganize into long chains.
4. Put a stack of 4 paper towels on the hard surface.
5. Use the slotted spoon to scoop the curds out of the bowl, letting the liquid drain. Put them on the paper towels.
6. Fold the paper towels over and press more liquid out of the curds.
7. Pick them up and knead them in your hands, like dough. This is casein plastic.
8. Knead the casein plastic well. Add food coloring and glitter, if you like. Once the casein plastic is kneaded, you can shape it. Press it into a cookie cutter, or mold it into the shape you want (this takes more patience).
9. Shaping needs to be done within about an hour of making the dough. After that, it will harden. If you want to hang it later (like Queen Mary's jewelry), use a toothpick or other small, pointed object, to make a hole while the plastic is still pliable.

Extension:

- If you haven't already, try making slime with white glue and borax. If you don't have borax, try using liquid laundry soap or contact solution.
- Go on a polymer hunt! Look around your house. How many things can you find that are made of:
 - Wood
 - Plastic
 - Rubber
 - Paper
 - Nylon, polyester, acrylic or rayon (hint: look at clothing tags)