



This activity will have you look at physical and chemical changes by creating plastic figures out of milk.

Physical Change = A usually reversible change in the physical properties of a substance. The substances chemical properties, however, remain the same. A new substance is also created.

Chemical Change = A usually non-reversible change in which the chemical structure of the substance changes to create an entirely new substance.

Plastic = A material mainly made by people that can be formed into almost any shape.

First you need to do research on plastic itself and how you use it in everyday life.

1. Make a list of some of the various things plastic can be made from.

2. Name at least 3 ways that you use plastic in your everyday life.

YOU WILL NEED:

- 1 cup of milk (2% is best)
- 4 teaspoons of white vinegar
- A bowl
- A strainer/colander
- Spoon
- Paper towels
- Stovetop or microwave

OPTIONAL:

- Food coloring
- Molds or cookie cutters to help shape your figures
- Paint/paint brushes/markers

How to Make Your Plastic Figures out of Milk (You need to be working with an Adult for safety!)

1. Measure out and heat 1 cup of milk on the stovetop burner or microwave with an adult's help. You want to heat the milk until it is hot, has just started steaming, and is **NOT boiling**.
2. Pour the heated milk into a bowl and add 4 teaspoons of vinegar (an acid) and stir gently for about a minute.
3. When you begin stirring the mixture, you will notice that the liquid begins to curdle, separating into curds (the chunks you notice) and whey (the leftover liquid). After about a minute of gentle stirring, the curds should be done forming.
 - Is this a physical or chemical change? How do you know? Look back at the definitions of physical/chemical changes and you can also do some research of your own if you like on any search engine (www.google.com) for more specific answers.



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4. Using the strainer/colander, strain off the whey (leftover liquid) from the curds. If you need to, squeeze the curds against the strainer/colander. The goal is to remove as much liquid from the curds as you can.
 5. Remove the curds from the strainer and place them on a few layers of paper towel. Carefully pat and squish them in the paper towel to remove even more liquid. (You may need to replace paper towel and repeat multiple times.)
 6. At this point, the curds will be all clumped together into a dough-like ball that is moldable. You may now, if you like, add a couple drops of food coloring to the dough and knead it with your hands to mix it together.
 - When you add the food coloring, is that a physical or chemical change? Why? Look back at the definitions of physical/chemical changes and you can also do some research of your own if you like on any search engine (www.google.com) for more specific answers.



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7. You may now place your dough, to make your plastic figures, into molds, cut it with different shaped cookie cutters, or use your hands to mold it yourself into whatever you want.
 8. Allow a couple of days for the dough to dry and become your plastic figure. To speed up the process, you can take it out of the mold after 24 hours.
 9. Once completely dry, you can paint or color with markers your new plastic figure if you would like.



Further Experimentation

1. Try changing the conditions of your experiment by attempting the following:
 - a. Increasing the amount of vinegar in the recipe.
 - What happens with 5 teaspoons? 6 teaspoons? Are your results any different?
 - b. Use different types of milk
 - Whole milk? Lower fat milk? Soy milk? Are your results any different?
 - c. Use a different type of vinegar.
 - Balsamic vinegar? Apple cider vinegar? Are your results any different?
 - d. Use a different acid, such as lemon juice or orange juice.
 - Are your results any different?

Lesson was inspired by:

<https://www.steampoweredfamily.com/activities/make-plastic-from-milk/ps://www.thoughtco.com/how-to-make-bouncing-polymer-ball-606316>

<http://sciencebob.com/make-plastic-milk/>