



# Science Behind: Milk Plastic

Making milk plastic is a chemistry experiment working with polymers. Polymers are molecules that have formed a regular chain structure. Milk contains molecules of a protein called Casein. During this reaction between warm milk and acid the casein molecules unfold and form long chains called a polymer. The polymer can be molded and shaped which makes it a plastic. In this case it's called casein plastic or milk plastic because of the type of molecules that created the plastic.

This process has been used for over 100 years and is the way they used to make plastics before 1945 when synthetic plastics were introduced. Even royalty wore jewelry made from milk plastic many years ago. How cool is that? With this simple process you can make toys, beads, jewelry, decorative pieces and more.



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# Milk Plastic Ingredients & Supplies

## What's included in your kit:

- 4 tsp of lemon juice
- strainer
- plastic mold

## What you need:

- 1 cup of milk (you can also use chocolate milk and the end result smells amazing!)
- Stove top and pot or microwave and a heat resistant bowl
- paper towels

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# Milk Plastic Instructions

Measure out 1 cup of milk (you can also use chocolate milk and the end result smells amazing!). Heat on the stove top in a pot or in the microwave in a heat resistant bowl. You want it to just start steaming. Remove from the heat. Add 4 tsp of lemon juice and stir gently.

The amount of lemon juice is not exact. You will notice that it immediately begins to curdle. You're making curds and whey!

Stir gently for approximately one minute for the full reaction to finish and all the curds to form. Don't stir aggressively. Be gentle. Strain off the whey using a strainer. Let drip for a few minutes until most of the liquid has drained off. Gently smoosh the curds around in the strainer if needed. Now remove the curds and place them on a few layers of paper towel. Carefully pat and squish to remove more liquid. You may need to replace the paper towel and repeat a few times. The goal is to remove as much liquid as possible. You will notice it is kind of crumbly and squishy, but you can smoosh and shape it.



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# Science Behind: Secret Messages

Most invisible ink messages can be revealed by heating either side of the paper on which they're written. The message discolours before the rest of the paper gets hot enough to do so. When you wrote your message using the lemon juice, carbon-based compounds in the juice were absorbed into the paper's fibers. Also, since lemon juice ink is a weak acid, it softened the fibers in the paper. The added heat caused some of the chemical bonds to break down in the dried juice and some carbon was cut loose. When the carbon came into contact with air, it burned or oxidized. One effect of oxidation is things turn a darker color. (Some oxidation doesn't need heat to occur; it just needs a little air. Think of a piece of apple, banana, or pear left out on a plate for a while.) Lemon juice – like most fruit juice – contains carbon compounds. These compounds are pretty much colorless at room temperature. Heat breaks down these compounds and releases the carbon. When carbon comes in contact with air (specifically oxygen), oxidation occurs and the substance turns light or dark brown. If it oxidizes long enough, it can go all the way to black.



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# Secret Messages Ingredients & Supplies

## What's included in your kit:

- Cardstock
- 2 plastic cups
- Q-tips
- lemon juice

## What you need:

- Measuring spoons
- small hand towel/dish towel
- Paper Towels
- Spoon
- Iron
- milk

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- Measuring spoons
- small hand towel/dish towel
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- Spoon
- Iron
- milk



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# Secret Messages Instructions

Squeeze some lemon juice into the bowl. Add a couple of drops of water into the lemon juice. Using the spoon, mix the lemon juice and the water together. Dip the cotton swab into the mixture and use it like a pen to write a secret message on the white paper. Let the message dry so that it becomes “invisible.” When you want to read the message, put the paper on a clean towel. Next use a hot iron with no steam to heat up your message . Your message will magically appear and turn brown!



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