

## Milk and Vinegar Plastic Experiment

### Supplies needed:

- 1 Cup of milk
- White vinegar
- Lots of paper towel
- Food colouring (optional)
- Strainer

### Instructions:

1. Heat up the milk in the microwave for 1-2 minutes.
2. Add vinegar into the milk. I started with 4 tablespoons of vinegar for 1 cup of milk. But you can also keep adding until you see mostly curd in the mixture. You will get more curd to play with that way.



3. Place a paper towel on the strainer before straining the mixture.
4. When you get most of the liquid out, transfer the curds onto a fresh piece of paper towel.
5. Press and squeeze the curds until you get most of the liquid out.
6. Put a dab of the mixture on your tongue to taste (Do you like it? Does it taste like buttermilk, yogurt or cheese?)
7. Add food coloring (optional).
8. Use a cookie cutter or your imagination, shape the curd puddle like you would with playdoh.
9. Let it dry for 2-3 days.



## **Why?**

After 2-3 days, when the shaped curd is completely dry, it becomes very hard and will not dissolve in water.

Milk is made of mostly water and protein.

Roughly 80% of the protein content is casein protein and 20% whey protein. In addition, milk also contains calcium, other minerals, vitamins, butterfat and lactose.

Normally, the protein molecules inside milk are folded up.

Adding an acid, in this case vinegar, causes the casein protein to unfold and rearrange into long chains of polymer, called acid casein.

Acid casein is insoluble in water and precipitates out of the milk.

Applying heat speeds up the process and makes the separation more complete. The resulting substance is organic plastic.

We do not usually associate milk with plastic because modern day plastic is synthetic made from petroleum.

But synthetic plastic is a polymer, just like organic plastic made from milk and vinegar.

Before the invention of synthetic plastic, acid casein was used to manufacture buttons because dried casein is hard, strong and insoluble in water.

So, mixing milk and vinegar creates plastic which feels almost as strong as a stone.

This is a discrepant event (occurrences which defy our understanding of the world by presenting unexpected outcomes) because mixing milk and vinegar can create a substance that is in the same category as a petroleum product is very unexpected.

Buttermilk, yogurt and cheese can be made in a similar process using milk and various types of acid.