



EXPERIMENT: "PLASTIC MILK!"

What do you think will happen when you mix vinegar and milk and then microwave the mixture? You are mixing two liquids, will they remain liquids, or will you get a solid? Take your best guess.

HYPOTHESIS: _____

Materials Needed:

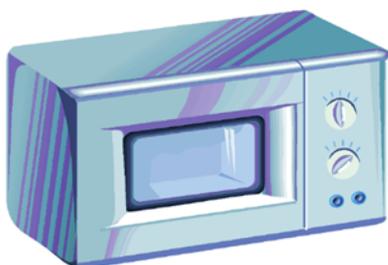
- 3/4 cup SKIM milk (important -- it must be skim milk)
- 2 teaspoons white vinegar

Step 1



Mix two teaspoons of white vinegar and 3/4 cup skim milk in a microwave safe bowl.

Step 2



Microwave the mixture for one minute.

Step 3

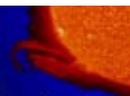


Take the bowl out of the microwave. **CAREFUL -- THE BOWL MIGHT BE HOT!**

Slowly stir the warm mixture with a spoon. You should find a clump begin to form on or next to the spoon. Keep stirring slowly and the solids will clump on the spoon.

For the accompanying video, additional experiments, and to see our curricula offerings, go to:

Experiment.EScience.com



Step 4

Once you have the clump, you can take it out and **LET IT COOL**. After it is cool enough to touch, go ahead and "play" with it. It will feel like soft rubber.

Conclusion

Why do you think the clumps formed in the solution?

So What Happened?



How does it work?

When vinegar is added to the milk, it results in separating the milk into a liquid and solid. Heating it in the microwave speeds this process. You may have heard of curds and whey (Little Miss Muffet)? That is exactly what you have here. The solid "blob" is the curd, and the liquid is the whey.

Digging Deeper

Milk contains a protein known as CASEIN. The addition of vinegar causes the casein to be separated out from the liquid. The casein protein is a polymer. Plastics are polymers. Polymers are long chained molecules. These long chains get tangled together giving plastic a moldable/malleable consistency. Plastics can be made from many sources, included animal horns, but most plastic today is made from oil.

Try this!



Take your "plastic milk" and try and sculpt an object. Once you are done you can leave it out to dry.

What does it feel like when it is dry?

Would it be possible to have your plastic milk be colored? What would happen if you colored the milk with food coloring before adding the vinegar? Did the plastic milk come out colored?

Vinegar is an acid. Would this experiment work with another acid like lemon juice?