

# Science for Saturdays

## Hot Ice!

In this activity, you will be observing *crystallization* of sodium acetate. Before you begin, ask a parent for help with this activity as you will be using the stove.

### Materials:

- 1 liter of vinegar
- 4 Tbsp of baking soda
- Saucepan and lid
- Spoon

### Instructions:

1. Pour vinegar into the saucepan.
2. Very slowly add the baking soda to the vinegar (If the baking soda is added quickly, the solution will overflow your pan).
3. Boil the solution until a crystal film begins to form on the surface.
4. Remove solution from heat and immediately cover.
5. Place solution in fridge.
6. Once chilled, remove solution very carefully from the fridge so as not to start the crystallization process.
7. Dip spoon into the solution to begin crystallization process.
8. Make a note of your observations!

### The Science Behind It:

You just witnessed the *crystallization* of sodium acetate! When you combine vinegar (acetic acid,  $\text{CH}_3\text{COOH}$ ) and baking soda (sodium bicarbonate,  $\text{NaHCO}_3$ ), they react to form sodium acetate ( $\text{CH}_3\text{COONa}$ ). The reaction also produces water and carbon dioxide gas.



The mixture you created will not crystallize because of all the water that is left. When you boil the mixture, the water evaporates and only the sodium acetate is left. At hot temperatures, the sodium acetate is a liquid but when you place the solution in the fridge, it becomes *supercooled*, meaning the temperature drops below the normal freezing point of the solution. The crystallization process starts with *nucleation*, the clumping of molecules into small clusters throughout the solution. When the solution is disturbed with the spoon, the spoon creates a site for *rapid crystal growth*, the second and final stage of the crystallization process. The rapid crystal growth is an *exothermic* process, meaning it gives off heat, which is why the solid sodium acetate becomes warm to the touch even though it was just sitting in the cold fridge. Making rock candy is another crystallization project you can try at home.

### Turn It Into An Experiment:

- **Hypothesize!** Ask yourself the following questions and write down what you think will happen in each scenario.
  1. What would happen if you didn't boil off the water from the solution?
  2. What would happen if you use more baking soda?
  3. What happens when you add food coloring?
- **Design Your Experiment!** Do the activity a few more times changing one variable at a time. For extra accuracy in your experiment, do several trials!
- **Make Observations!** Make note of what you see during each of the trials.
- **Draw Conclusions!** What can you tell from the observations you noted? How did changing each variable affect what you saw? Was your hypothesis correct?
- **Think Critically!** Using what you learned about this chemical reaction, think about why you observed what you did? What may have caused the difference in observations?



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