

Supersaturation Tower

Introduction

Create a tower of sodium acetate trihydrate from a supersaturated solution. Your students' curiosity will grow as you demonstrate the concepts of supersaturation and crystallization!

Concepts

- Supersaturation
- Exothermic
- Crystallization

Materials

Sodium acetate, trihydrate, $\text{CH}_3\text{CO}_2\text{Na}\cdot 3\text{H}_2\text{O}$, 150 g

Water, distilled or deionized

Balance

Beaker, borosilicate glass, 600 mL

Graduated cylinder, 100-mL or 50-mL

Heat-resistant gloves or tongs

Hot plate

Parafilm® M or rubber stoppers to cover test tubes

Stirring rod, glass

Test tubes, 25 × 200 mm, borosilicate glass, 5

Washing bottle filled with distilled water

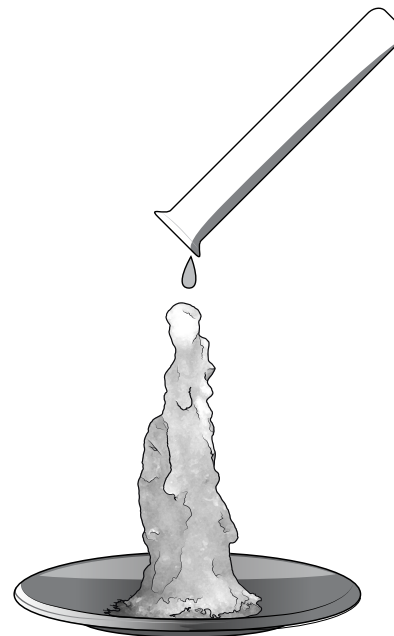
Watch glass

Safety Precautions

Sodium acetate is slightly toxic by ingestion, inhalation, and skin absorption. Wear chemical splash goggles, chemical resistant gloves, and a chemical-resistant apron. Wear heat-resistant gloves or use tongs when handling hot glassware. Please review current Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Fill a 600 mL beaker approximately half full with water and heat on a hot plate. This will be used as the warm water bath. *Note:* The water should not be boiling.
2. Measure out 30 grams of sodium acetate trihydrate and place it into a test tube. *Note:* It is best to prepare a couple test tubes for each demonstration, since some may crystallize prematurely if the solution is disturbed.
3. Add 9.0 mL of distilled water to the test tube.
4. Place the test tube in the warm water bath and allow the sodium acetate trihydrate to dissolve. After heating for a few minutes, stir the solution with a glass stirring rod.
5. Continue heating in the water bath until all of the sodium acetate trihydrate has dissolved and the solution is clear. If any sodium acetate trihydrate gets stuck on the side of the test tube, squirt a very small amount of distilled or deionized water to wash it into the solution.
6. Cover the test tube with Parafilm and allow the solution to cool to room temperature. Take care not to disturb the solution as even slight movement may cause crystallization.



Procedure

1. Place a seed crystal of sodium acetate onto the center of a watch glass.
2. Slowly pour the sodium acetate solution from the test tube onto the seed crystal. A tower will begin to form. *Note:* A slow and steady stream of the solution works best. This may take some practice! As with all demonstrations, try it out ahead of time before performing the demonstration for class.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. The sodium acetate solution may be re-used or Flinn suggested disposal method #26a is one option. Please review all federal, state and local regulations that may apply before proceeding.

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School

MS-PS1 Matter and Its Interactions
PS1.A: Structure and Properties of Matter
PS1.B: Chemical Reactions

Disciplinary Core Ideas: High School

HS-PS1 Matter and Its Interactions
PS1.A: Structure and Properties of Matter
PS1.B: Chemical Reactions

Science and Engineering Practices

Developing and using models
Constructing explanations and designing solutions

Crosscutting Concepts

Cause and effect
Structure and function
Stability and change

Teaching Tips

- The addition of too much water will result in leftover liquid after recrystallization.
- When first practicing and learning the demonstration, a demonstration tray may be beneficial to prevent spills.
- Use only borosilicate glassware for this demo. The temperature difference may crack glass that is not borosilicate.
- Variations of this demonstration include placing a single crystal into the test tube and allowing crystallization to occur in the tube. Also, a buret may be used to release the solution onto a seed crystal.
- Use a stereo microscope with a Celestron Digital Microscope Imager (Flinn Catalog No. MS1116) or other video projection device to provide a close-up view of the crystallization process.

Discussion

The sodium acetate solution is a supersaturated solution. The seed crystal is the start of a chain reaction, which causes all of the sodium acetate trihydrate molecules to crystallize. Crystallizing means that a liquid is becoming a solid, or “freezing.” The solution is supersaturated and supercooled—this means that it contains more dissolved sodium acetate than a saturated solution and has been cooled to below its freezing point without crystallization occurring.

Initially, when the solidified sodium acetate trihydrate crystals are heated to a temperature greater than 58 °C (136 °F), the crystals will melt.

In the supersaturated solution, when the crystallization is activated, the solution climbs to its freezing point temperature, which is 58 °C (136 °F). At this temperature, the sodium acetate solution changes from a liquid to a solid.

Catalog No.	Description
S0037	Sodium Acetate, 500 g
GP8009	Watch Glass, 100 mm, Borosilicate Glass
GP6077	Heavy-Walled Test Tubes, 20 x 200 mm

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.