

Supersaturated Sodium Acetate Solution

Saturated, Unsaturated, and Supersaturated Solutions



Introduction

Snap your fingers over a clear solution and, presto, the solution instantaneously crystallizes. The flask can immediately be turned upside down without spilling a drop. Is it magic? Not exactly! It's science at work.

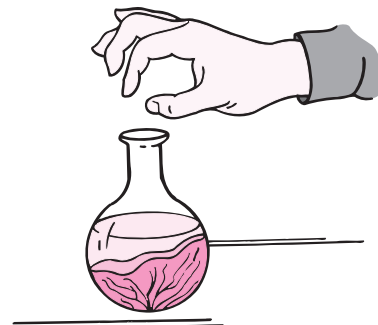
Concepts

- Supersaturated solutions
- Crystallization

Materials

Sodium acetate, trihydrate, $\text{CH}_3\text{CO}_2\text{Na}\cdot 3\text{H}_2\text{O}$, 160 g
Water, distilled or deionized, 30 mL
Balance
Erlenmeyer flask, 500-mL, Pyrex®
Graduated cylinder, 100-mL or 50-mL
Heat-resistant gloves or tongs

Hot plate or Bunsen burner
Parafilm M® or 100-mL beaker, to cover the flask
Ring stand set-up, if using a Bunsen burner
Stirring rod, glass
Washing bottle filled with distilled water



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 the hot flask. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Weigh out 160 g of sodium acetate trihydrate in a 500-mL Erlenmeyer flask.
2. Using a graduated cylinder, measure out 30 mL of distilled water, and add it to the flask of sodium acetate trihydrate.
3. Heat the mixture on a hot plate or over a Bunsen burner, stirring occasionally until all of the solid is dissolved. (This may take 15 minutes or so.) Make sure the sides of the flask are free of solid sodium acetate. To remove crystals from the sides of the flask, rinse them down with small squirts of water from the washing bottle.
4. Cover the flask with Parafilm or with a 100-mL beaker. Allow the solution to cool to room temperature undisturbed or, to speed up the cooling process, run cool water over the sides of the flask making sure no tap water gets into and contaminates the solution. The flask can now sit undisturbed until you are ready for the presentation. Take care not to disturb the solution as even slight movement may cause crystallization to occur before you're ready.

Procedure

1. While holding a single sodium acetate trihydrate crystal over the open mouth of the flask, snap your fingers and allow the crystal to drop into the flask. You might want to say some magic words like “abracadabra presto” as you snap your fingers. The single crystal should start a chain reaction of crystallization.
2. Immediately turn the flask upside down as crystallization occurs. The crystallized sodium acetate will not fall out.
3. Feel the sides of the flask. The flask will be warm since this is an exothermic process.
4. The solution may be used over again by reheating it to redissolve the sodium acetate.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The sodium acetate solution may be re-used or flushed down the drain with excess water.

Tips

- Use caution if substituting a non-Pryex[®] hydrometer cylinder for the flask in this demo. The temperature differential may crack the cylinder. Use a Pyrex cylinder instead or allow the supersaturated solution to cool slightly before pouring it into the cylinder.
- The addition of too much water will result in leftover liquid after recrystallization.
- This demonstration can be performed for a larger audience by using 640 g sodium acetate trihydrate and 120 mL water.
- Topics of discussion may include saturated solutions, supersaturated solutions, crystallization, and exothermic processes.
- Uses for supersaturated sodium acetate solutions include hot packs and hand warmers.
- Variations of this demonstration include performing the crystallization in a 500-mL graduated cylinder or placing a single crystal in a shallow container and pouring the solution onto the crystal. A buret may also be used to release the solution onto the crystal. These two variations can produce fairly tall columns of the recrystallizing sodium acetate.
- Use a Flinn ChemCam[™] or other video microscopy unit to provide a close-up view of the crystallization process.

Discussion

A supersaturated solution of sodium acetate trihydrate (the clear solution) will recrystallize by the addition of a single crystal of the solid. A supersaturated solution is a solution which contains a greater amount of dissolved substance than is present in a saturated solution at the same temperature. A saturated solution is a solution that contains the maximum amount of a dissolved substance at a given temperature.

A supersaturated solution can be made by gradually cooling a saturated solution without agitation so that crystals do not form. Supersaturated solutions are extremely unstable and will precipitate, or crystallize, upon addition of just one crystal of the solute. Even slight shaking or agitation may be enough to cause crystallization to begin.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation
Constancy, change, and measurement

Content Standards: Grades 9–12

Content Standard B: Physical Science, structure and properties of matter, conservation of energy and increase in disorder, interactions of energy and matter

Flinn Scientific—Teaching Chemistry[™] eLearning Video Series

A video of the *Supersaturated Sodium Acetate Solution* activity, presented by Bob Lewis, is available in *Saturated, Unsaturated, and Supersaturated Solutions*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Supersaturated Sodium Acetate Solutions* are available from Flinn Scientific, Inc.

Catalog No.	Description
S0036	Sodium Acetate, 100 g
S0037	Sodium Acetate, 500 g
GP3050	Erlenmeyer Flask, 500-mL

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