

Benzoic Acid Blizzard in a Bottle

A Winter Lab



Introduction

Create a “snowflake crystal” scene in a jar while learning about solubility principles. This lab had a serendipitous beginning when a solution of benzoic acid was forgotten on a lab bench and allowed to cool! Voila! “Snow”!

Concepts

- Solubility
- Saturation

Materials

Benzoic acid, 1 g	Hot glue gun
Water, tap	Hot plate
Beaker, 250-mL	Ointment jar or baby food jar
Electrical tape	Plastic figurine, 1" tall
Forceps	Stirring rod
Graduated cylinder, 100-mL	

Safety Precautions

Benzoic acid is moderately toxic by ingestion. Avoid contact with skin, eyes, clothing, and respiratory tract as it is a severe irritant. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Use exhaust ventilation to keep airborne concentrations low. Keep the bottle capped to avoid breathing the vapors. Be sure to warn the students not to allow younger family members to take the jar apart or to ingest the solution. Please review current Safety Data Sheets for additional safety, handling, and disposal information. Wash hands thoroughly with soap and water before leaving the laboratory.

Procedure

1. Slowly heat 75 mL of tap water in a 250-mL beaker using a hot plate. Do not allow the water to boil.
2. As the water is heating, add about 1 gram of benzoic acid. Continue to heat and stir the mixture until the benzoic acid completely dissolves. The solution does not have to come to a boil.
3. Remove the beaker from the hot plate and allow the solution to begin cooling.
4. Thoroughly clean and dry a baby food jar or a 4-oz ointment jar.
5. Hot glue a plastic figurine inside the baby food jar bottom. Use a pair of forceps to hold the figurine by its top. Put some hot glue on the bottom of the figurine and immediately place the figurine on the bottom of the baby food jar. Hold it in place for a few seconds. Allow the glue to cool for several minutes.
6. Watch the benzoic acid solution as it begins to cool. Snowy-looking crystals will appear.
7. After the solution has completely cooled to room temperature and the figurine is secure at the bottom of the jar, stir the snow mixture, and then quickly pour it into the baby food jar.
8. Use a graduated cylinder to slowly fill the jar to the brim with tap water. Try to leave as little air as possible in the jar.
9. Cap the jar tightly. Turn the snow scene upside down and watch your figurine get buried in the blizzard of benzoic acid “snow.”
10. If desired, use some electrical tape around the jar lid to seal it completely. If the figurine comes loose, it can be repaired by opening the jar, pouring the solution into a disposable cup, regluing the figurine, and then replacing the solution. If any solution is lost, add a little more tap water.

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 benzoic acid solution may be neutralized according to Flinn Suggested Disposal Method #24a.

Tips

- Either a 4- or 6-oz baby food jar will work. Another option is the 4-oz ointment jar style bottles from Flinn (AP8445).
- Stress to the students the need to fill the jar to the brim with water. Air pockets tend to cause the benzoic acid to clump at the top.
- Encourage students to bring in their own figurines (whatever they find interesting). Solid plastic figurines work the best. Inexpensive figurines can be purchased at a local discount or craft store.
- Do not try to speed up the cooling process of the solution by using ice; beautiful crystals form when the solution cools slowly.
- If the solution is still hot when added to the jar, the figurine will have a good chance of falling off. Be patient.
- This activity is available from Flinn as a fun holiday demonstration, Santa in a Snowstorm (Catalog No. AP6186).

Discussion

A solution is formed by dissolving a *solute* such as benzoic acid in a *solvent* such as water. A *saturated* solution contains as much solute as possible at a given temperature and pressure. A solution is said to be *unsaturated* when it contains a lower concentration of solute than a saturated solution. When the temperature is increased, the solubility increases and more solute will dissolve. If a hot, saturated solution is then cooled, the “extra” solute that dissolved with heat will once again precipitate. This is the chemical phenomenon occurring when the benzoic acid precipitates out as “snow” in this lab.

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

Disciplinary Core Ideas: High School

HS-PS1 Matter and Its Interactions

PS1.A: Structure and Properties of Matter

Science and Engineering Practices

Asking questions and defining problems

Planning and carrying out investigations

Constructing explanations and designing solutions

Crosscutting Concepts

Patterns

Cause and effect

Structure and function

Acknowledgment

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Materials for *Benzoic Acid Blizzard* in a Bottle are available from Flinn Scientific, Inc.

Catalog No.	Description
AP6186	Santa in a Snowstorm—A Winter Holiday Demonstration
B0197	Benzoic acid, 100 g
AP8445	Bottle, 4 oz, ointment jar-style
AP9011	Glue gun
AP9012	Glue Sticks, Pkg/24

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