

Canned Heat

The Preparation of Sterno®



Introduction

By mixing a concentrated calcium acetate solution with alcohol, a colloidal gel is formed. When this gel is burned, it can be used as a heat source similar to the commercial product Sterno. The gel is a safer source of heat since it is not as volatile and will not spill.

Concepts

- Gels
- Heat
- Precipitation

Materials

Calcium acetate, monohydrate, $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$, 3 g	Evaporating dish or small beaker, Pyrex®
Ethyl alcohol, 95%, $\text{CH}_3\text{CH}_2\text{OH}$, 75 mL	Fire extinguisher, ABC class
Sodium chloride, NaCl , pinch	Graduated cylinder, 100-mL
Balance	Matches (fireplace matches work best)
Beaker, 250-mL	Spatula
Ceramic plate or tile, nonflammable	Stirring rod or wood stick

Safety Precautions

Ethyl alcohol is a flammable liquid and a dangerous fire risk—an ABC class fire extinguisher should be close by while conducting the demonstration. Covering the burning gel with a large beaker or jar will also extinguish the fire. Avoid breathing the alcohol vapors. Any spills should be cleaned up immediately and students should wash their hands thoroughly after handling. Students should not touch hot evaporating dishes. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Weigh out 3 g of calcium acetate in a 250-mL beaker.
2. Measure out 10 mL of water (tap water is fine), and add it to the calcium acetate. Stir to dissolve most of the solid (not all of the solid will dissolve).
3. Add a pinch of sodium chloride to the calcium acetate solution and stir.
4. Measure 75 mL of ethyl alcohol using a graduated cylinder and transfer it to the beaker containing the calcium acetate solution. The gel will form as soon as the alcohol is added. Do not stir the mixture.
5. Using a spatula, transfer the gel into the evaporating dish.
6. Place the evaporating dish on a nonflammable ceramic fiber square or tile and away from all combustible materials.
7. Use a match to carefully light the gel. Turning off the lights will make the flame more noticeable. Notice the formation of calcium carbonate on the inside of the evaporating dish. The sodium chloride added to the solution makes the flame yellow and therefore more visible.
8. The evaporating dish will get extremely hot, so use caution and do not handle until it has cooled completely.
9. Wash hands, work area, and equipment thoroughly when finished.

Disposal

Please consult your current Flinn Scientific Catalog/Reference Manual for general guidelines and specific procedures governing the disposal of laboratory waste. All equipment (when cool) should be thoroughly washed. Leftover gel may be washed down the drain.

Tips

- For an enhanced effect, roast a marshmallow over the Sterno fire.
- Try coloring the gel by adding some base (e.g., sodium hydroxide) and an acid/base indicator (e.g., phenolphthalein). Commercial Sterno has dyes added to make it pink.
- Be sure to only use borosilicate glass (e.g., Pyrex®) glassware to prevent the glass from shattering or melting. A metal can will also work well.

Discussion

Sterno is a commercial product used in many cafeteria and banquet serving lines. It is a favorite with restaurants because it provides a reliable, odorless and safe heat source. Sterno, also called Canned Heat, produces a flame that is relatively small and long lasting. Since it is a solid, it does not spill. Another benefit is that it does not evaporate or easily vaporize. Canned Heat is produced by mixing a concentrated solution of calcium acetate with ethyl alcohol. As the ethyl alcohol and calcium acetate solution are mixed, the calcium acetate immediately precipitates out of solution and forms a gel with the ethyl alcohol. A gel is a solid dispersed in a liquid that develops a structure that resists flow. The exact structure of the gel is unknown but it is very stable and has an even consistency. The formation of the gel is a physical phenomenon and not a chemical reaction.

As the Canned Heat is ignited, the ethyl alcohol evaporates and begins to burn to produce carbon dioxide and water. The calcium acetate also burns to produce a mixture of calcium oxides, calcium carbonate, carbon dioxide and water.

References

Summerlin, Lee R. and James L. Ealy, Jr., *Chemical Demonstrations: A Sourcebook for Teachers*, American Chemical Society, 1985.

Materials for the *Canned Heat—The Preparation of Sterno* are available from Flinn Scientific, Inc.

Catalog No.	Description
C0262	Calcium Acetate, 100 g
E0009	Ethyl Alcohol (95%), 500 mL
S0063	Sodium Chloride, 500 g

Consult the [Flinn Scientific website](#) for current prices.