Camphor Lice!

Properties of Solids

Introduction

Watch as particles seem to jump around the surface of water, then are calmed by the mere touch of the surface by a finger or a drop of detergent.

Concepts

- Polar vs. nonpolar
- Surface tension
- Intermolecular forces
- Sublimation

Materials

Camphor, $C_{10}H_{16}O$, several crystals
Soap or Detergent, household (optional)
Petri dish, disposable
Overhead projector
Wash bottle

Safety Precautions

Camphor produces flammable and explosive vapors when heated. Keep away from flames and heat sources. It is moderately toxic by ingestion. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please consult current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Place a Petri dish on the overhead projector.
2. Fill the Petri dish half full with water.
3. Tell the class that you have flea eggs that will begin to hatch and move when you place them in water.
4. Sprinkle camphor crystals around the water surface. Follow their movements on the overhead.
5. After about 1 minute, tell the class you will now put the fleas to sleep.
6. Rub your earlobe with your thumb and index finger. Place your fingers in the water and the “fleas” (camphor crystals) stop moving.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The camphor may be disposed of according to Flinn Suggested Disposal Method #18b.

Tips

- A rather unorthodox version of this demonstration of intermolecular forces can be performed with the addition of soap and a student with a good sense of humor! Prepare by placing the camphor in a small folded paper packet or envelope. At the beginning of class, turn the overhead projector on, as though you were about to give notes or something, and then look up and start staring at the student's hair. “Oh my... Joey, don’t move...I think you might be hosting a rather rare species of parasite there...” Hold the folded piece of paper with the Camphor in front of the student--do not open it! “Just lean your head forward and brush some of those guys onto this paper here...” Pretend to closely observe the invisible lice your student has brushed onto the paper.. “Yes, these do look like Camphoris hydroplaneous , a species of water gliding lice that I actually did some research on in graduate school."

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Obtain a Petri dish and beaker with water, and return to the overhead beaker. "This was the definitive test for members of the Camphoris genus..." Place the Petri dish on the overhead projector and fill it almost to the top with water. "If they skim around on the surface of this water, then they are the real thing..." Hold the folded paper over the Petri dish. Tap it a few times in an apparent attempt to shake the lice off the paper and into the water, but actually to shake loose the camphor crystals from inside the folded paper. The "lice" will scurry around across the surface of the water. "Joey, are you familiar with a product available now called "SHAMPOO!?" (any kind of soap or detergent will do the job) Here, let me show you how effectively it will help you with your little problem." Grab a dispenser of liquid hand soap or dish detergent and place a drop in the Petri dish. The "lice" stop dead in their tracks! Now you can crack a smile and let the students in on the secret, and let Joey off the hook...or wait until the next day to tell them!

Discussion

Molecules of water below the surface are symmetrically surrounded by other water molecules. The forces of attraction are the same on one side of the molecule as the other. At the surface, however, the molecules are more attracted to the molecules of water below the surface than to the air molecules above. The result is a domed shaped surface that minimizes the contact of water and air. Since the molecules on the surface are drawn into the liquid, the surface tends to be as small as possible and taut like the rubber of an inflated balloon. This is surface tension.

The phenomenon observed in this demonstration is called the "Marangoni effect." When there exists a local difference in surface tension on a liquid surface, a surface movement takes place from the lower surface tension region toward the higher surface tension region. The higher surface tension region literally pulls the liquid from the lower surface tension region.

In this demonstration, camphor is a surfactant and dissolves unevenly in water. Water on one side of the crystal contains more dissolved camphor than the opposite side. The side with less camphor dissolved will have a higher surface tension and will pull the camphor in that direction. When the oil from your ear lobe is placed in the water, it forms a thin layer on the surface of the water that prevents the water molecules from dissolving the camphor; thus, the crystals stop moving.

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
Form and function
Content Standards: Grades 5–8
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter, understanding of motions and forces, transfer of energy
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, motions and forces, conservation of energy and increase in disorder, interactions of energy and matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Camphor Lice!* activity, presented by Michael Heinz, is available in *Properties of Solids*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Camphor Lice!* are available from Flinn Scientific, Inc.

Catalog No.	Description
C0354	Camphor, 25g

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