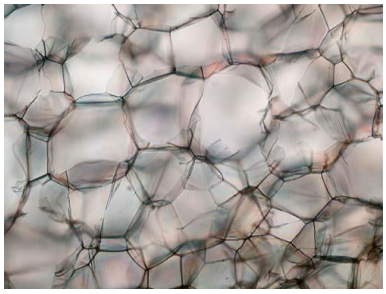
Puffed Up Polymers

Dissolving Lots of Styrofoam in a Little Bit of Liquid



Microscopic image of polystyrene packing peanut, from: http://www.microscopy-uk.org.uk

Topics: Matter, Solubility, Polymers

Materials List

- ✓ 50 – 100 packing peanuts (Styrofoam)
- ✓ 5 ml (1 teaspoon) of acetone
- ✓ Beaker or cup (NOT made of #6, polystyrene)

This amazing demonstration shows students just how much air there is in Styrofoam, and also reinforces the concept of a solvent in a memorable way.

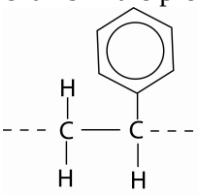
To Do and Notice (Directions for teacher/demonstrator)

RAFT recommends that teachers use this activity as a demonstration because of the fumes and volatility of acetone. However, if adequate ventilation is available and students are properly supervised, students can do this lab activity themselves. Review safety procedures before the lab.

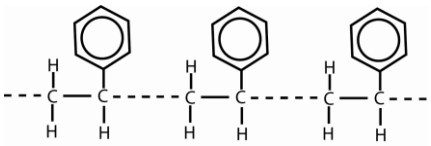
1. Measure out 5 ml of acetone into a beaker.
2. How many packing peanuts do you think that the acetone will dissolve? Try one! Now, how many do you think that the 5 ml will dissolve?
3. Keep adding peanuts until no more will dissolve. (Most demonstrators will be able to dissolve between 30 and 50 peanuts in the 5 ml of acetone!) Surprised?
4. Count out the number of peanuts that dissolved and place them in a pile next to the beaker of dissolved peanuts; compare them to the dissolved peanuts in the beaker. Styrofoam packing peanuts are really mostly made of air!

The Science Behind the Activity

Styrofoam packing peanuts are made of polystyrene, an organic polymer, and recycle plastic #6. Styrofoam, however, is really mostly air, containing very little of the plastic itself. Water does not readily dissolve polystyrene, but acetone (also called 2-propanone) is a highly effective solvent of the plastic. Acetone's molecular formula of C_3H_6O dissolves polystyrene, turning the solid packing peanuts into a liquid plastic sludge. After the acetone evaporates, the polystyrene solidifies, but with the air removed, it takes up significantly less volume. Dissolving polystyrene demonstrates more than a simple physical change: the long-chain polymers are broken into smaller chains in the process.



monomer



polymer

This activity can be used to teach:
Next Generation Science Standards:

- Structure of matter (Grade 5, Physical Science 1-1)
- Property of materials (Grade 5, Physical Science 1-3)
- Mixtures (Grade 5, Physical Science 1-4)
- Chemical reactions (Middle School, Physical Science 1-2; High School, Physical Science 1-2)

Web Resources (Visit www.raft.net/raft-idea?isid=337 for more resources!)
For background information on plastics and lesson plans for teaching about plastics, visit: http://www.handsonplastics.com/

Written by Coral Clark (RAFT)