Latex Rubber Balls

Fun with Polymers

Introduction

Form a bouncy rubber ball from a latex polymer solution.

Concepts

- Polymers
- Organic chemistry

Materials

Latex, 15 mL
Vinegar, 15 mL
Water, tap, 15 mL
Beaker, 1-L or bucket, ½ full of tap water
Graduated cylinder, 50-mL
Paper cup, 5 oz
Paper towels
Wooden or plastic stick
Food coloring (optional)

Safety Precautions

Although latex is not considered hazardous, not all health aspects of this substance have been thoroughly investigated. The ammonia preservative in the latex and the vinegar both have irritating fumes, and precautions should be taken. Latex, and the ammonia in the latex, may be allergens. Students with known allergies to these substances should not participate in this activity. As is always good practice, students should be warned not to ingest any of the materials and to use them only in the manner for which they are intended. Wash hands thoroughly after handling any of these materials and clean up any spills as soon as possible. Consult Material Safety Data Sheets for further safety and handling techniques. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron.

Procedure

1. Use a 50-mL graduated cylinder to measure out 15 mL of latex. Pour it into a paper cup. Stick your finger into the latex to feel its texture. Wash your hands immediately.
2. Use a clean, 50-mL graduated cylinder to measure out 15 mL of water (tap water is fine). Pour it into the paper cup containing the latex. Stir the mixture with a wooden stick. Add a couple of drops of food coloring, if desired.
3. Use a clean, 50-mL graduated cylinder to measure out 15 mL of vinegar. Add it to the paper cup containing the water/latex mixture while stirring.
4. Remove the stick from the paper cup with the polymer lump attached, and place it in the large beaker ½ full of water.
5. Under the water, gently pull the lump of rubber off the stick. Keeping the rubber under water, squeeze the lump into a ball and then squeeze several more times to remove any unused chemicals.
6. Remove the ball from the water and squeeze it dry in paper towels. Drop it on the floor and observe its properties.

Disposal

Dispose of the paper cup and stick in the solid waste disposal. The used water may be rinsed down the drain. If necessary, dispose of the latex rubber ball in the solid waste disposal.

Discussion

Polymers are long, chain-like molecules composed of multiple repeating units of smaller molecules, called monomers, that have been joined together by a chemical reaction. Natural polymers are the main "ingredients" in our bodies (DNA and RNA, proteins), as well as in plant and animal products (wood, starch, cellulose, cotton, wool, latex, etc.). Synthetic or man-made polymers are versatile "modern materials" that are widely used in building and construction, transportation, packaging, and electronics. More than 100 *billion* pounds of synthetic polymers (also called plastics) are produced annually in the United States and Canada!

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Latex is a natural polymer found in certain trees that originally grew in Brazil. The purpose of latex in nature is to protect the tree from damage. If the bark is damaged, the latex will ooze out and act as a "bandage" for the tree. Native Americans discovered the useful properties of latex rubber more than 3,000 years ago and made simple products out of the rubbery material.

Liquid latex is made up of very small globules of polymer hydrocarbons suspended in an aqueous solution. Proteins and other chemicals are present in the solution to keep the polymer globules from coming together to form one solid mass. Ammonia is added to stabilize this solution. The pH of the solution changes when the ammonia is neutralized by the addition of vinegar (4–8% acetic acid) and the globules of suspended latex begin to "join together" to form one large mass of rubber.

Elastic polymers, such as natural and synthetic rubber, have interesting properties. Elasticity is the ability of a material to return to its original shape after a force is removed. Natural rubber can be stretched to at least twice its original length and will return rapidly to that original length when released. The elastic properties of polymers can be explained in terms of the size and flexibility of polymer molecules. Polymer chains are very long and, like pieces of string or yarn, become easily entangled. When a force is applied, rubber molecules "stretch" out to their full length. Rubber stretches, but does not break, because cross-linking between the polymer chains keep the molecules attached to one another. When the force is removed, the rubber molecules return back to their lower-energy, smaller "entangled mess."

Connecting to the National Standards

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

Unifying Concepts and Process: Grades K–12
Evidence, models, and exploration
Form and function
Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter, chemical reactions

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Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Latex Rubber Balls* activity, presented by Bob Lewis, is available in *Fun with Polymers*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Latex Rubber Balls* are available from Flinn Scientific, Inc.

Catalog No.	Description
L0004	Latex, 500 mL
L0110	Latex, 1 L
L0111	Latex, 4 L
V0005	Vinegar (white), 4 L
V0003	Vegetable Dyes (Food Coloring), Set

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