

Ups and Downs of Grapes



Introduction

Unpeeled grapes float while peeled grapes sink—why?

Concepts

- Lipids
- Fatty acids
- Waxes
- Hydrophobic
- Hydrophilic
- Cell membranes

Background

Lipids, an important part of cell structure, is a class of fatty compounds that includes fatty acids, triglycerides, waxes and steroids. Lipids consist of a large number of carbon and hydrogen atoms that are symmetrically arranged making the molecule predominantly nonpolar. Nonpolar substances are not attracted to water. Cell membranes are made of fatty acids that are composed of molecules of long nonpolar hydrophobic chains of carbon and hydrogen with a carboxyl (COOH) end which is polar hydrophilic. In cell membranes the hydrophobic, or water-fearing ends face towards the center of the membrane whereas the hydrophilic ends face towards the aqueous side of the membrane. A wax is similar to a fatty acid, but with a long alcohol chain in place of the carboxyl end. This composition makes the wax molecule highly waterproof. In plants, wax forms a protective barrier on leaves, stems and fruit.

In this demonstration, the hydrophobic (nonpolar) nature of the skin of a grape is illustrated when nonpolar carbon dioxide molecules from a carbonated beverage cling onto its surface and water molecules are repelled. The peeled grape lacks the hydrophobic skin, attracting polar water molecules to its surface and repelling the carbon dioxide gas. The low density of the carbon dioxide gas causes the unpeeled grapes to float to the surface, where the gas is detached causing the grape to sink and repeat the process.

Materials

- Grapes, 10
- Colorless carbonated beverage, (ex: Seltzer®, 1-L bottle)
- Sharp knife

Safety Precautions

Never consume food products that have been brought into a laboratory. Always follow laboratory safety rules while performing experiment.

Preparation

Use a sharp knife to carefully peel five grapes.

Procedure

1. Pour approximately 200 mL of colorless soda pop from a newly-opened bottle.
2. Add five peeled and five unpeeled grapes to the soda bottle. Do not replace the bottle cap.
3. Observe that bubbles will adhere to the unpeeled grapes and cause them to rise and float. Ask for observations and probable explanations from the students.

Disposal

The grapes can be disposed of in the trash, while the soda can be poured down a sink following Flinn Suggested Disposal Methods #26a and #26b, accordingly.

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
Constancy, change, and measurement

Content Standards: Grades 5–8

Content Standard A: Science as Inquiry
Content Standard C: Life Science, structure and function in living systems, regulation and behavior

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry
Content Standard C: Life Science, the cell, matter, energy, and organization in living systems
Content Standard G: History and Nature of Science

Tip

- Extend the activity by allowing students to experiment with other fruit or objects or other liquids.

Reference

This activity was adapted from *A Demo A Day—A Year of Biological Demonstrations*, Bilash, Borislav, Shields, Martin; Flinn Scientific: Batavia, IL (2001), p 38.

Kits dealing with lipids and hydrophobic/hydrophilic interactions are available from Flinn Scientific.

Catalog No.	Description
AP1773	Properties of Lipids
AP5927	Measuring the Length of a Molecule

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