

Chemical Weathering



Introduction

Why is Washington, DC's majestic Lincoln Memorial starting to deteriorate?
Could it be the result of acid rain, a type of chemical weathering?

Concepts

- Acid rain
- Chemical weathering
- Erosion
- Mechanical weathering

Background

Weathering is a breakdown of the materials that form the Earth's crust, the breaking down of rocks into smaller and smaller particles. Many of the statues, monuments, and buildings on the Earth are made of materials that are susceptible to weathering. The movement of particles by water, wind, ice, or gravity is called erosion. The two primary types of weathering are chemical and mechanical. Chemical weathering generally occurs when the Earth's crust is exposed to acidic water in the form of groundwater or rain. It can also result from snow, fog, dew, or even from the deposition of dry particles. Mechanical weathering, on the other hand, involves physical forces such as freezing and thawing, the movement of water, prying by roots, abrasion, or wind.

Weathering can be very damaging to some of the most priceless man-made structures on the Earth such as ancient monuments and statues. This activity focuses on one form of chemical weathering called acid rain.

Materials

- | | |
|--|---|
| Baking soda (sodium bicarbonate), NaHCO_3 , 120 g | Pie pan or large weighing dish |
| Vinegar (dilute acetic acid), 6 mL (75 drops) | Pipets, Beral-type, or medicine droppers, 2 |
| Water | |

Safety Precautions

Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Please consult current Material Safety Data Sheets for additional safety, handling and disposal information.

Preparation

1. Obtain approximately 20 g of baking soda in a pie pan or large weighing dish. *Note:* This is between 3.5 and 4 teaspoons.
2. Using a pipet filled with water, wet the baking soda until it reaches a dough-like consistency.
3. Roll the baking soda into a small sphere approximately 2 cm in diameter.
4. Place the sphere on a small pie pan or plastic weighing dish and allow it to dry.
5. Repeat steps 1–4 to make a total of six spheres.

Procedure

1. Obtain the pie pan with the six baking soda spheres.
2. Using a Beral-type pipet or medicine dropper, slowly drip 25 drops of water onto one of the baking soda spheres.
3. Record observations in a data table.
4. Repeat steps 2 and 3 with two additional baking soda spheres.

- Using a clean pipet or medicine dropper, slowly drip 25 drops of vinegar onto another one of the baking soda spheres.
- Record observations in a data table.
- Repeat steps 5 and 6 with two additional baking soda spheres.

Disposal

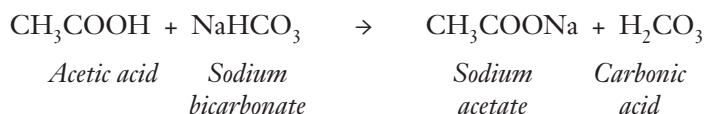
Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. The materials in this activity may be placed in the trash according to Flinn Suggested Disposal Method #26a.

Tips

- Drip the water and vinegar slowly and allow the liquid to soak in and any fizzing to stop before adding the next drop.
- The spheres should remain on the container or pie pan once they are made. Removing them will cause them to crumble.

Discussion

Dripping water on the baking soda “mountains” represents the effect of mechanical weathering as a result of moving water. Dripping vinegar on the baking soda “mountains” represents the effect of chemical weathering by acid rain, as a result of the chemical reaction that takes place between the baking soda and vinegar.



Carbonic acid quickly decomposes into carbon dioxide and water



Erosion is also evident as the particles are moved by the flowing fluids. Many buildings and monuments are made of limestone and marble, which will also undergo a chemical reaction with acid and are therefore susceptible to the effects of acid rain.

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 B: Physical Science, properties and changes of properties in matter.
- Content Standard D: Earth Science, structure of the Earth system, Earth’s history.

Content Standards: Grades 9–12

- Content Standard B: Physical Science, structure and properties of matter.
- Content Standard D: Earth and Space Science, energy in the earth system, origin and evolution of earth system.

Materials for *Chemical Weathering* are available from Flinn Scientific, Inc.

| Catalog No. | Description |
|-------------|---------------------------|
| V0005 | Vinegar, White, 4 L |
| S0043 | Baking Soda, 500 g |
| AP1718 | Pipet, Beral-type, pkg/20 |

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