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Alka-Seltzer[®] Rainbow

Publication No. 10456

Introduction

Produce a quick and moving rainbow of colors with an Alka-Seltzer[®] tablet and a little vinegar.

Chemical Concepts

- Acid–base reactions
- pH indicators

Materials (for each demonstration)

Alka-Seltzer, 1 tablet

Sodium hydroxide, NaOH, 0.1 M, 100 mL

Universal indicator, 10 mL

Water, distilled, 350 mL

Vinegar, CH₃CO₂H, 10 mL

Beaker, 600-mL

Graduated cylinders; 500-mL, 100-mL and 10-mL

Stirring rod

Safety Precautions

Sodium hydroxide is a corrosive liquid, skin burns are possible and it is dangerous to the eyes. Universal indicator is an alcohol-based solution and thus a flammable liquid. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please consult current Material Safety Data Sheets for additional safety information.

Preparation

1. Measure out approximately 350 mL of distilled water in a 600-mL beaker.
2. Add 100 mL of 0.1 M sodium hydroxide solution.
3. Add 10 mL of the universal indicator solution and stir. The solution should now be a dark purple.
4. Pour the solution into a 500-mL graduated cylinder.
5. Use a clean graduated cylinder to measure out 10 mL of vinegar.

Procedure

1. Drop an Alka-Seltzer tablet into the 500-mL graduated cylinder. Color changes should begin to occur as soon as the first carbon dioxide bubbles are formed.
2. When the tablet rises to the top, add about 10 mL of vinegar to the solution. The solution should now be red on the top.

Disposal

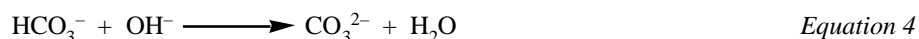
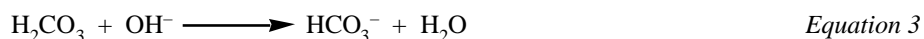
All materials may be disposed of according to Flinn Suggested Disposal Method #26b. Please consult your current *Flinn Scientific Catalog/Reference Manual* for proper disposal procedures.

Tips

- The Alka-Seltzer tablet may be placed in the graduated cylinder before adding the sodium hydroxide solution. The reaction occurs immediately as the solution is added, producing a rainbow of colors with more motion.
- Hydrometer cylinders or 600-mL tall form beakers can also be used. This demonstration can also be scaled down using half the reagents and a 250-mL graduated cylinder.
- To get the best rainbow of colors, add the vinegar as soon as the yellow color appears.

Background

The Alka-Seltzer tablets contain sodium bicarbonate and citric acid. As the Alka-Seltzer tablet dissolves in water, the citric acid reacts with the sodium bicarbonate to produce carbonic acid (Equation 1) and carbon dioxide (Equation 2). The carbonic acid then reacts with the basic sodium hydroxide to change the pH of the solution (Equations 3 and 4). As the base is consumed, the solution will slowly become more acidic, resulting in the color changes.



The Alka-Seltzer tablet initially sinks to the bottom of the cylinder. As the carbon dioxide bubbles adhere to the tablet, the tablet begins to rise and eventually floats. The buoyancy of the tablet and the final addition of vinegar (a weak acid) lead to a pH gradient. Universal indicator makes the pH gradient visible and produces the characteristic rainbow of colors.

Acknowledgment

Special thanks to Charles Ophardt, Ph.D., Elmhurst College, Elmhurst, IL, for bringing this demo to our attention.

Materials for Alka-Seltzer® Rainbow are available from Flinn Scientific, Inc.

Catalog No.	Description	Price/Each
A0111	Alka-Seltzer tablets, 24/pkg	Consult Your Current <i>Flinn Catalog/Reference Manual</i> .
S0149	Sodium hydroxide, 0.1M, 500 mL	
U0001	Universal indicator, 100 mL	
V0005	Vinegar, white, 4 L	