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Indicator Sponge

A Discrepant Event Demonstration

Introduction

The discrepant event of placing a red sponge in a red solution and having it turn blue is sure to capture your students' attention and stimulate a lively discussion of possible explanations.

Concepts

- Acids and bases
- pH indicators

Materials

Congo red indicator, 1 g
Hydrochloric acid, HCl, 1 M, 100 mL
Sodium hydroxide, NaOH, 1 M, 100 mL
Red food coloring, 1 mL
Blue food coloring, 1 mL
Indicator sponge
Beakers or large jars, 1000-mL or larger, 2
Tongs
Sponge

Safety Precautions

Hydrochloric acid is corrosive to skin and eyes and toxic by ingestion and inhalation. Sodium hydroxide solution is corrosive to skin and eyes. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Indicator Preparation

Make a 1% solution of Congo red indicator by adding 1 g of Congo red to 100 mL of distilled or deionized water. Rinse the sponge (including new sponges) with water to remove residual soap, surfactants, or acids. If the sponge is too large for the beaker, of indictor solution, cut the sponge in half. Place the sponge in the Congo red solution, immersing it completely. Wear rubber gloves to keep from staining hands, periodically squeeze out the liquid. Allow the sponge to soak in the liquid for about 15 minutes. Squeeze out as much liquid as possible and rinse the sponge with fresh water a few times. The indicator sponge is now ready to use. The remaining Congo red solution can be used to make additional indicator sponges.

Demonstration Preparation

1. Add 100 mL of 1 M hydrochloric acid to a 1000- or 2000-mL beaker. Fill the beaker about ¾ full with tap water.
2. Add enough red food coloring (about 1 mL per 1000 mL solution) to the acid solution in the beaker until it is a deep red color.
3. Add 100 mL of 1 M sodium hydroxide solution to a 1000- or 2000-mL beaker. Fill the beaker about ¾ full with tap water.
4. Add enough blue food coloring to the basic solution in the beaker until it is a deep blue color.
5. If the sponge is red, then wet the sponge with tap water and rinse it out.
6. If the sponge is blue, place the sponge in the base solution to convert it to a red color.

Procedure

1. Slowly place the red sponge into the beaker containing the red acid solution. Use tongs or a gloved hand. The sponge will immediately turn blue!
2. Remove the sponge and squeeze out as much red acid solution as possible back into the acid beaker.

3. *Optional:* Rinse the sponge in tap water to show that the sponge is actually blue and it is not just saturated with a blue solution. This step also minimizes the amount of acid and base being transferred between solutions. If most of the liquid is squeezed out of the sponge, this step may not be necessary.
4. Slowly place the blue sponge into the beaker containing the blue base solution. Use tongs or a gloved hand. The sponge will immediately turn red!
5. Remove the sponge and squeeze out as much blue base solution as possible back into the blue beaker.
6. Rinse the sponge in tap water, if necessary, to show that the sponge is actually red and it is not just saturated with a red solution.
7. Repeat the demonstration if requested.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The acid and base solutions can be used several times before they become neutralized or the dyes start to decompose. When ready to dispose, simply mix the two solutions to neutralize them and then pour down the sink with excess water according to Flinn Suggested Disposal Method #26b.

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 Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter

Tips

- Food coloring is an excellent dye and will stain fingers and clothing—wear gloves and an apron.
- The concentration of the acid–base solutions are not critical as long as they are above 0.05 M. If the sponge is rinsed out between the acid and the base, then the two solutions do not even have to have similar concentrations.
- Rinsing the sponge out between each color change will keep the acid and base solutions fresher. It minimizes the amount of acid and base and also the amount of food coloring that is transferred between beakers. *Note:* The liquid coming out of the sponge is the color of the solution and not the color of the sponge. Squeezing out as much solution from the sponge will also keep each solution fresher.

Discussion

The indicator sponge is saturated with congo red solution. Congo red is a dye, a biological stain, and a pH indicator. It has been used as a direct fabric dye for cotton to produce a bright red fabric. Biologists use Congo red as a general contrast stain for cellulose. Congo red is also used as a pH indicator. The color transition is between pH 3.0 and 5.0. Below a pH of 3.0 (very acidic solutions), the indicator is blue. Above pH 5.0, the indicator is red.

When a cellulose sponge is soaked in a Congo red solution, the dye becomes permanently bonded to the cellulose fibers. The active acid/base sites on Congo red are still available and the sponge now becomes an indicator sponge for acids. It can also be used to check for acid spills on counters after students have used acids.

Materials for *Indicator Sponge* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP6160	Indicator Sponge—A Discrepant Event Demonstration Kit

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

