The Vanishing Valentine

Oxidation and Reduction of Resazurin

Introduction

If you like to perform holiday demonstrations, this one's for you! In this demonstration, a flask containing a clear solution is shaken, turning the solution into a pink valentine solution. Then, by allowing the solution to sit undisturbed, it will fade back to colorless. The cycle can be repeated many times.

Concepts

- Oxidation–reduction
- Indicators

Materials

Dextrose solution, 0.133 M, $C_6H_{12}O_6$, 100 mL
Sodium hydroxide solution, 1.0 M, NaOH, 100 mL
Resazurin solution, 0.1%, 1 mL
`Erlenmeyer flask, 250-mL or 500-mL
Medicine dropper or Beral-type pipet
Stopper, to fit the flask

Safety Precautions

The dextrose and resazurin solutions are not considered hazardous. Sodium hydroxide solution is a corrosive liquid; skin burns are possible; it is very dangerous to 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.

Preparation

1. Prepare the 0.1% resazurin solution by dissolving 0.1 g of resazurin in enough distilled or deionized water to make 100 mL of solution.
2. Prepare the 0.133 M dextrose solution by dissolving 2.4 g of dextrose in enough distilled or deionized water to make 100 mL of solution.
3. Prepare the 1.0 M sodium hydroxide solution by dissolving 4.0 g of sodium hydroxide in enough distilled or deionized water to make 100 mL of solution.

Procedure

1. Place 100 mL of the dextrose solution and 100 mL of the sodium hydroxide solution into the Erlenmeyer flask.
2. Add 8 drops of the resazurin solution to the flask. Stopper well and swirl the solution to mix. The solution will be blue.
3. Let the solution sit and become fully reduced (colorless) and then it can be shaken to obtain the pink valentine color.

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 Vanishing Valentine solution may be neutralized according to Flinn Suggested Disposal Method #10.

Tips

- The solution will be blue initially and will change to a pink color shortly. Allow the solution to sit undisturbed until it becomes colorless. This may take as long as 10 minutes. Show the colorless solution to the class and then place it behind your back and shake it gently. Show the students that it is now pink. The Vanishing Valentine solution will last 1 hour or so, depending on how often it is shaken and how much oxygen is reintroduced by opening the bottle.

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The color will become less vivid with time. The resazurin solution may have a limited shelf life (6 to 12 months). A freshly-made solution is a deep blue color. The reaction may not work if the color of the solution has changed.

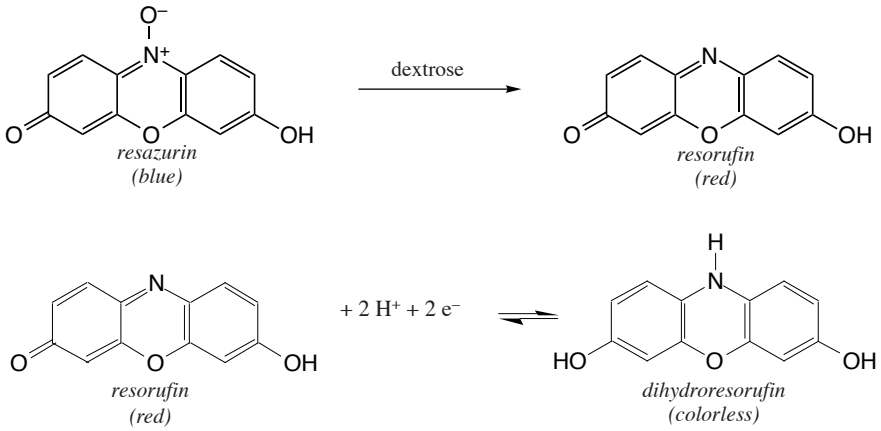
- If available, perform this demonstration in a separatory funnel since its shape resembles a heart. Clear, square PETG plastic bottles also work well for this demonstration.

Discussion

Dextrose first reduces resazurin to resorufin. (This is an irreversible reduction.)

The red resorufin molecule is then further reduced (reversibly, this time) to the colorless compound, dihydroresorufin.

The colorless, fully-reduced dihydroresorufin is easily oxidized back to resorufin. A gentle shake of the flask will introduce enough atmospheric oxygen into the solution to oxidize the dihydroresorufin back to the red resorufin solution.



resazurin (blue) → *resorufin (red)*

resorufin (red) ⇌ *dihydroresorufin (colorless)*

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

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: Structure and properties of matter, chemical reactions

Acknowledgment

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Reference

Shakashiri, B. Z. *Chemical Demonstrations: A Handbook for Teachers in Chemistry;* University of Wisconsin: Madison, WI; 1989; Vol. 2, pp 142–146.

Materials for *The Vanishing Valentine* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP5929	Vanishing Valentine—Chemical Demonstration Kit
R0012	Resazurin, 1 g
S0074	Sodium Hydroxide, 100 g
D0002	Dextrose, 500 g
AP8963	Bottle, square, PETG, 500-mL

Consult the Flinn Scientific website for current prices.