

Stop-‘N-Go Light

Purpose

To introduce oxidation-reduction reactions with a dynamic and colorful demonstration that can easily be repeated.

Materials

Dextrose Solution (0.133M, 100mL)

Indigo Carmine Solution (1% aqueous, 10mL)

Sodium Hydroxide solution (1.0M, 100mL)

500mL Erlenmeyer flask

Rubber stopper (without hole)

Procedure

1. 0.133M Dextrose stock solution- add 23.96g Dextrose, Anhydrous to 1L of water. Mix until homogenous.
2. 1% aqueous Indigo Carmine stock solution- add 10.0g Indigo Carmine to a 1L beaker containing 500mL of water. Then fill the beaker to the 1L mark with water. Indigo Carmine solution has a limited shelf life (6-12 months). If the solution is not royal blue, the solution is no longer good and the reaction will not work.
3. Place 100mL of the dextrose solution and 100mL of the sodium hydroxide solution into an Erlenmeyer flask.
4. Add 10mL of the Indigo Carmine indicator solution. Stopper flask tightly.
5. Let the solution sit and become fully reduced (amber).
6. Shake the flask to obtain all the colors.

Additional Information

1. Indigo Carmine is a redox indicator, which is easily reduced by the alkaline sugar. It takes on an amber yellow color in its fully reduced form.
2. The indicator becomes red colored when the amber colored form is agitated, due to the oxygen which partially oxidizes it. When it is further agitated, it becomes completely oxidized and turns green.

3. as the solution sits, most of the available dissolved oxygen is used up, so the alkaline sugar will slowly reduce the indicator back to its amber colored form.
4. The redox reaction will cease after about 10 or 15 cycles.
5. the process can be repeated if the stopper is removed, enabling fresh air to enter the flask.
6. Solution will last approximately 20 minutes. Colors fade with time.
7. Indigo Carmine solution has a limited shelf life.

Questions for the Students

1. Why does the color of the solution change from amber to red when agitated?
2. Why does more agitation cause color change?
3. How is it possible that the reaction can be done multiple times in a row?
4. Why does the introduction of fresh air help enable the process to occur again once the reaction ceases?

Safety

Indigo Carmine indicator is toxic by ingestion. The Sodium hydroxide solution is a corrosive liquid and can cause skin burns.

Disposal

Stop-‘N-Go light solution may be rinsed down the drain with excess water.

Reference

1996 Flinn Scientific Publication Vol. 96-2