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Old Foamey

A Classic Demonstration of a Catalyst

Introduction

Bubbles and heat, foam and steam, "Old Foamey" has it all! Mix hydrogen peroxide with dishwashing liquid, add sodium iodide catalyst, then stand back and marvel as the decomposition reaction erupts in a cascade of steaming foam.

Concepts

- Catalyst
- Decomposition reaction

Materials

Hydrogen peroxide, H_2O_2, 30%, 20 mL
Sodium iodide solution, NaI, 2 M, 5 mL
Dishwashing liquid, 10 mL
Food coloring (optional)
Beaker, 100-mL
Graduated cylinder, Pyrex®, 100-mL
Graduated cylinder, 10-mL
Plastic demonstration tray
Wood splint (optional)

Safety Precautions

Hydrogen peroxide, 30%, will act as an oxidizing agent with practically any substance. This substance is severely corrosive to the skin, eyes and respiratory tract; a very strong oxidant; and a dangerous fire and explosion risk. Do not heat this substance. Sodium iodide is slightly toxic by ingestion. Although the dishwashing liquid is considered non-hazardous, do not ingest the material. Do not stand over the reaction; steam and oxygen are produced quickly. Wear appropriate 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

Prepare the 2 M sodium iodide solution by dissolving 30 grams of sodium iodide in 25 mL of distilled or deionized water in a 100-mL beaker. Add water to give a total volume of 100 mL and mix well.

Procedure

1. Place a 100-mL graduated cylinder on a plastic tray that is several inches deep.
2. Measure out 20 mL of the 30% hydrogen peroxide into the 100-mL graduated cylinder. *Caution:* Wear chemical resistant gloves and goggles when handling 30% hydrogen peroxide. Contact with skin may cause burns.
3. Measure out 10 mL of dishwashing liquid into the 10-mL graduated cylinder and add it to the cylinder containing the hydrogen peroxide. Add a few drops of food coloring, if desired. Have your students observe that little or no reaction occurs.
4. Measure out 5 mL of sodium iodide solution using the 10-mL graduated cylinder. Quickly but carefully add the sodium iodide solution to the 100-mL graduated cylinder.
5. Step back and observe the reaction.
6. *(Optional)* Light a wood splint and blow out the flame to produce a glowing splint. Insert the glowing splint into the foam—it will reignite.

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 leftover foam and solution in the cylinder may be rinsed down the drain with excess water according to Flinn Suggested Disposal Method #26b.

Tips

- The decomposition reaction produces lots of foam—so much that this demonstration is often called "Elephant's Toothpaste." Carry out the demonstration in a large plastic demonstration tray or, if none is available, in the laboratory sink. Cleanup, at least, is easy because of the generous amount of dishwashing liquid used.
- The decomposition reaction is highly exothermic. Carry out the reaction in heat-resistant, borosilicate (e.g., Pyrex®) glassware and check all glassware for chips or cracks before use. Allow the glassware to cool before disposing of the reaction mixture.
- This demonstration can be scaled up for larger audiences. A 500-mL or 1-L Pyrex graduated cylinder works well with about 100 mL of hydrogen peroxide. The amount of dishwashing liquid and catalyst solution do not have to be increased proportionally.
- A slight brown tinge is observed at the edge of the foam at the beginning of the reaction. The yellow-brown color is due to the presence of free iodine produced by the oxidation of the catalyst, sodium iodide. The yellow color disappears when the catalyst is regenerated.
- Other catalysts that will catalyze this reaction include manganese(IV) oxide, MnO_2, and manganese metal, Mn.

Discussion

The decomposition reaction of hydrogen peroxide is highly exothermic and produces lots of heat and steam. The action of a catalyst is demonstrated through the use of sodium iodide, which speeds up the decomposition reaction. The products of the reaction are water vapor and oxygen gas. The presence of oxygen gas in the foam is demonstrated by the glowing splint test. When a glowing splint is inserted into the foam, it spontaneously reignites due to the increased concentration of oxygen.

$$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(g) + O_2(g) + \text{Energy}$$

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, transfer of energy
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, chemical reactions, interactions of energy and matter

Acknowledgment

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Reference

Stone, C. H. *J. Chem. Ed.* **1944,** *21,* 300.

Materials for *Old Foamey* are available from Flinn Scientific, Inc.

Catalog No.	Description
S0083	Sodium Iodide, 25 g
H0037	Hydrogen Peroxide, 30%, 100 mL
C0241	Dishwashing Liquid
AP2085	Old Foamey—Chemical Demonstration Kit

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