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Orange Juice to Strawberry Float

A Foamy Acid–Base Demonstration

Introduction

It's big, it's colorful, it's messy, and it's chemistry! Watch as the "orange juice" in a beaker changes into a foamy "strawberry float." What a great way to introduce acids and bases to your students!

Concepts

- Acids and bases
- Acid–base indicators

Materials

Alconox [®] soap, 50 g	Water, tap, approximately 300 mL
Hydrochloric acid, 3 M, HCl, 270–280 mL	Aquarium, large tray or sink
Methyl orange, 0.2% solution, 100 mL	Beakers, 2-L and 600-mL
Sodium bicarbonate, NaHCO ₃ , 50 g	Stirring rod, long

Safety Precautions

Hydrochloric acid (3 M) is moderately toxic by ingestion and inhalation; it is corrosive to body tissues, especially to the eyes. Methyl orange solution (0.2%) is slightly toxic by ingestion. Alconox[®] and sodium bicarbonate are irritants, especially to the eyes. This demonstration rapidly generates a foamy mixture that may spray in all directions. 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.

Procedure

1. Place a very large tray on the demonstration table.
2. Add approximately 300 mL of tap water to a 2-L beaker.
3. Add 50 g sodium bicarbonate and 50 g Alconox to the 2-L beaker. Stir the solution with the long stirring rod. All of the solid may not dissolve.
4. Add 100 mL of 0.2% solution methyl orange indicator to the beaker containing the sodium bicarbonate and Alconox. Stir. The resulting solution should look somewhat like orange juice; however, the orange solution is thicker and darker in color than actual orange juice.
5. Add approximately 270–280 mL of 3 M hydrochloric acid to a 600-mL beaker.
6. Place the beaker containing the sodium bicarbonate mixture in the center of a very large tray or in the sink or in an aquarium.
7. Wearing chemical splash goggles, quickly but carefully, add the 270–280 mL of HCl all in one pour to the beaker containing the orange sodium bicarbonate mixture. Stand back as the mixture will immediately erupt out of the beaker.
8. Note the color change of the mixture. The solution will look like a strawberry float, but after some time, parts of the solution will turn yellow.

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 resulting mixture may be diluted with water, neutralized, and flushed down the drain with excess water according to Flinn Suggested Disposal Method #24b.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

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, chemical reactions

Tips

- This demonstration is very messy and may produce over 10 liters of soap bubbles that may still contain small amounts of hydrochloric acid. Please practice this demonstration before performing it in front of your students. All persons watching the demonstration should be wearing chemical splash goggles. All amounts can be cut in half for a safer and less messy (yet less dramatic) alternative.
- This demonstration can also be performed in a 1-L or 3-L beaker. It is advised not to use an Erlenmeyer flask or a graduated cylinder as excessive splattering will erupt out of the narrow mouth.
- It is possible to substitute 75 g or 25 g of Alconox (rather than 50 g) for more or less foam, respectively. Liquid dish detergent also works (about three healthy squirts) but gives a lower quality foam. A less foamy reaction will occur using 25 g of sodium bicarbonate (rather than 50 g) and 1 M hydrochloric acid (rather than 3 M) with the same amount of soap (50 g).

Discussion

The sodium bicarbonate reacts with the hydrochloric acid in a neutralization reaction to produce sodium chloride, water and carbon dioxide gas according to the following equation:



Methyl orange is an acid–base indicator that turns from a yellow–orange color at pH 4.4 to a red color at pH 3.0. The initial basic solution has a deep orange color. The intensity of the yellow–orange solution is due to the high indicator concentration. Upon adding the acid, the pH drops and a strawberry red color forms. One of the products of this neutralization reaction is carbon dioxide gas, which is rapidly produced and becomes trapped in the soap bubbles. Over 13 liters of CO₂ gas are produced in this reaction, resulting in an abundance of soap bubbles.

Acknowledgments

Special thanks to Ken Runkle, Carlinville High School, Carlinville, IL for bringing this demonstration to our attention. Ken saw this demonstration performed by Robert J. Harris, Morristown High School, Morristown, NJ at Fairleigh-Dickenson University during the summer of 1991.

Materials for the *Orange Juice to Strawberry Float* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP4778	Orange Juice to Strawberry Float—A Foamy Acid–Base Demonstration
A0126	Cleaner, Alconox®
H0034	Hydrochloric Acid Solution, 3 M, 500 mL
M0076	Methyl Orange, 25 g
S0043	Sodium Bicarbonate, 500 g

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

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