

Upset Tummy? MOM to the Rescue!

A Colorful Antacid Demonstration



Introduction

Mix milk of magnesia (MOM) with universal indicator and observe the dramatic rainbow of colors as the antacid dissolves in the simulated stomach acid! This is a great demonstration to teach concepts of acids and bases, solubility, K_{sp} and “antacid-testing” consumer chemistry.

Concepts

- Acid–base neutralization
- Solubility and K_{sp}
- Antacids

Materials

Hydrochloric acid, HCl, 3 M, approximately 20 mL	Beral-type pipets, 2
Milk of magnesia, 20 mL	Graduated cylinder, 25-mL or 50-mL
Universal indicator solution, 1%, 4–5 mL	Ice, crushed (or ice cubes)
Water, distilled or deionized, 800 mL	Magnetic stir bar
Beaker, 1-L (or other large beaker)	Magnetic stir plate (or stirring rod)

Safety Precautions

Milk of magnesia is intended for laboratory use only; it has been stored with other non–food-grade laboratory chemicals and is not meant for human consumption. Hydrochloric acid solution is toxic by ingestion and inhalation and is corrosive to skin and eyes. Universal indicator solution is an alcohol-based flammable solution. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Measure 20 mL of milk of magnesia using a graduated cylinder and pour it into a 1-L beaker.
2. Place the 1-L beaker on a magnetic stir plate. Add a magnetic stir bar to the beaker.
3. Add water and crushed ice (or ice cubes) to give a total volume of approximately 800 mL. Turn on the stir plate so as to create a vortex in the mixture.
4. Add about 4–5 mL (about 2 pipets full) of universal indicator solution. Watch as the white suspension of milk of magnesia turns to a deep purple color. The color indicates that the solution is basic.
5. Add 2–3 mL (1 pipet full) of 3 M HCl. The mixture quickly turns red and then goes through the entire universal indicator color range back to purple.
6. Repeat this process, adding HCl one pipet full at a time, waiting after each addition until the mixture turns back to blue–purple.
7. The process can be repeated a number of times before all of the $Mg(OH)_2$ has dissolved and has reacted with the HCl. As more acid is added, the color changes will occur more rapidly and eventually the suspension will be completely dissolved. This will be apparent by a clear, red solution.

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 final solution may be neutralized according to Flinn Suggested Disposal Method #24b. Excess milk of magnesia may be placed in the trash according to Flinn Suggested Disposal Method #26a.

Discussion

The active ingredient in milk of magnesia is magnesium hydroxide, $\text{Mg}(\text{OH})_2$. Magnesium hydroxide forms a suspension in water since it has a very low solubility—0.0009 g/100 mL in cold water and 0.004 g/100 mL in hot water.

Initially in the demonstration, the solution is basic due to the small amount of $\text{Mg}(\text{OH})_2$ that goes into solution. The universal indicator gives the entire solution a violet color, indicating a pH of about 10. (See Universal Indicator Color Chart below.) Upon adding hydrochloric acid (the simulated “stomach acid”), the mixture quickly turns red because the acid disperses throughout the beaker, first neutralizing the small amount of dissolved $\text{Mg}(\text{OH})_2$, and then turning the solution acidic from the excess acid that is present.

Universal Indicator Color Chart							
Color	Red	Orange	Yellow	Green	Green-blue	Blue	Violet
pH	4	5	6	7	8	9	10

The excess acid causes more $\text{Mg}(\text{OH})_2$ from the suspension to gradually dissolve. As more of the $\text{Mg}(\text{OH})_2$ goes into solution, the acid is neutralized and eventually the solution becomes basic again from the excess $\text{Mg}(\text{OH})_2$ that is present. The addition of universal indicator allows this process to be observed. During the process, the color of the mixture goes through the entire universal indicator color range—from red to orange to yellow to green to blue and finally back to violet. By adding more “stomach acid,” the process can be repeated several times before all of the $\text{Mg}(\text{OH})_2$ is dissolved and eventually neutralized.

Connecting to the National Standards

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

Unifying Concepts and Processes: Grades K–12

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement

Content Standards: Grades 5–8

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science, structure and properties of matter, chemical reactions
- Content Standard C: Life Science; matter, energy, and organization in living systems

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References

Summerlin, L. R.; Borgford, C. L.; Ealy, J. B. *Chemical Demonstrations: A Sourcebook for Teachers*, Vol. 2; American Chemical Society: Washington, DC. 1988; p 173.

Materials for the *Upset Tummy? MOM to the Rescue!* are available from Flinn Scientific, Inc.

Catalog No.	Description
H0034	Hydrochloric Acid Solution, 3 M, 500 mL
U0001	Universal Indicator Solution, 100 mL
AP5934	Upset Tummy? MOM to the Rescue!—Chemical Demonstration Kit
AP8184	Magnetic Stirrer, Flinn

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