

Write Secret Messages with Disappearing Ink

At-Home



Would you like to write a secret message to someone? Write a message with disappearing ink then send it to someone who can make the message appear with chemistry!

Question to investigate

How can you write and reveal a secret message using chemistry?

Chemistry concepts

- Acids and bases are classes of materials that have different properties.
- Acid-base indicators change color depending on whether they are in acids or bases.
- Turmeric powder contains a chemical called curcumin that is yellow-gold in an acid but changes to a red-orange color in a base.

Activity logistics

- **Ages:** As written, this activity is suited for ages 8–12.
- **Time:** 45 minutes–1 hour

Be safe

- Safety goggles required.
- Protective clothing suggested.
- Do not eat or drink any of the materials used in this activity.
- Cover your area with newspaper.

- Work in an area with good ventilation.
- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels.
- Wear Personal Protective Equipment (PPE), such as goggles, safety glasses, or gloves.
- Tie back long hair, roll up sleeves, and secure loose clothing.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well before and after the activity

Disposal: Dispose of all solid waste in the trash. The liquids can be safely disposed of down the drain with plenty of water.

What you'll need

- Piece of yellow or dark yellow construction paper
- 1/8 tsp. (0.6 mL) powdered turmeric (available in the spice section of the supermarket)
- 1 tsp. (2.5 mL) rubbing alcohol (isopropyl alcohol)
- Spray bottle of ammonia-based window cleaner
- Water
- Cotton swab or small paintbrush
- Small bowl or cup
- Measuring spoons



Procedure

Write Your Message

1. Lay your construction paper on a flat surface.
2. Prepare a yellow-colored solution by carefully stirring together the turmeric powder, 1 tbsp. (2.5 mL) water, and rubbing alcohol in the bowl or cup. Do your best to break up any clumps of turmeric.
3. Write a secret message on the yellow paper! To do this, dip the paintbrush or cotton swab into the turmeric solution then brush it onto the paper in your desired pattern. Allow the writing to dry.

Reveal Your Message

4. Spray the window cleaner on the paper where you wrote your message.
5. Wait a few minutes for the window cleaner to dry.

What did you observe?

After the window cleaner dried, what happened to your message? Why do you think that happened?

Spray the paper with the window cleaner again and describe what happens.

How does it work?

Chemists classify substances as **acids** or **bases**. Lemon juice and vinegar are both examples of acids. On the other end of the spectrum are bases, like baking soda or the window cleaner you used in this experiment. Some substances are **neutral**, meaning they are neither an acid nor a base, like water.

Acid-base indicators can tell us whether something is an acid, a base, or neutral. Indicators change color depending on whether they are mixed with an acid or a base. Turmeric is a powdered spice made of the crushed roots of a plant. It contains a natural indicator called **curcumin** that stays yellow-gold in an acid like lemon juice or in neutral solutions like water. However, it changes to a red-orange color in a base.

The window cleaner you used in this experiment contains a stinky gas called ammonia, which is a base. When sprayed with ammonia, the turmeric powder turns red-orange, revealing the message against the yellow paper! When the ammonia evaporates into the air, the original yellow-gold color returns.

This activity is adapted from an activity that originally appeared in the Celebrating Chemistry issue for National Chemistry Week 2016, written by Marilyn Duerst.