

An NWO Hands-On STEM Activity

Poinsettia Chemistry

Make Your Own pH Paper



Ohio Standards Alignment

Grades 9-12 (Current Ohio ACS – Physical Sciences)

Grades 7-12 (Ohio Revised Standards – Physical Sciences)

What You Need (for each group of students):

- Poinsettia plant (several leaves for each group)
- 400 mL Beaker Or 16 oz. Glass Jar
- Boiling Water Or Microwave Oven
- Toothpicks Or Eyedropper
- Scissors
- Coffee Filters Or Filter Paper
- Vinegar
- Baking Soda Solution (2g / 200ml Water)
- Rubber Gloves
- Safety Goggles
- Paper
- Colored Pencils

What To Do:

1. Start by putting on gloves and safety goggles.
2. Tear or cut the red poinsettia petals into strips, and place the strips into a beaker or glass jar.
3. Add boiling water, just enough to cover the plant material, or add cold water to the jar and microwave it for about one minute.
4. Allow the mixture to steep like tea for about thirty minutes.
5. Remove the plant matter from the jar so you are only left with the poinsettia solution. Alternatively, strain the solution into another container.
6. Soak a coffee filter or clean filter paper in the poinsettia solution for a few minutes.
7. Remove the filter paper and allow it to dry.
8. Cut the dry filter paper (which should be a shade of pink) with scissors to make pH test strips.
9. To test the pH of a liquid, use an eyedropper or toothpick to apply a little liquid to a test strip or dip your test strip into small amounts of liquid.
10. Start by using the vinegar and baking soda solution as the first two tests. Each liquid will create a different color on the pH strips.
11. Consult a pH chart (e.g., staff.jccc.net/pdecell/chemistry/phscale.html) to learn the pH of vinegar and baking soda.

Allow students to select other liquids to test depending on what's available to you and the age of your students:

- Lemon Juice
- Shampoo
- Dishwashing Liquid
- Hand soap
- Sodium or Potassium hydroxide
- Hydrochloric acid
- Water

12. Use the pH numbers from the chart and the colors from your pH strips, begin to create your own pH chart using colored pencils. (The color range for acids and bases will depend on the particular plant you used to make the pH test strips.)
13. Use the online chart to learn the pH of other liquids that you can then test and include on your own pH chart. Once you have a range of colors and pHs, you can begin to test unknown liquids.
14. Questions to answer:
 - What color does the test strip turn when it is exposed to an acid (vinegar)?
 - What color does it turn when it is exposed to a base (baking soda solution)?
 - What other liquids would you like to test? Gather your materials and test them.
 - See the box above for some ideas.

Important Safety Note: *While the popular poinsettia has very low toxicity, care should be taken to minimize skin contact since some people have higher sensitivity or allergy and may develop a rash. Care should also be taken to prevent children from eating any part of the poinsettia plant since it may cause a mild stomachache, vomiting or diarrhea.*

Inquiry Corner: What else could you try?

- Compare your poinsettia paper to litmus paper in your school lab or classroom. Are the indicator colors different when you test the same liquids?
- What if you steep the plant material longer? Does it affect the color change that occurs when different liquids are tested?
- Compare pH paper made from the poinsettia to other plant juices such as cherries, beets, blueberries and carnations. Is there a difference in the test colors? Why or why not?

What's the Science?

Many different plants have pigments that are very sensitive to changes in acidity. The poinsettia is one example. When acids or bases come into contact with the paper dyed with the plant extract, a color change occurs. That color change allows us to use the poinsettia as litmus paper in this science experiment. The part of the poinsettia that most people refer to as the flowers are really leaves, or bracts. The actual flowers are the small yellow cyathia in the center of the red bracts.

Poinsettia Facts:

The Aztecs were first known to cultivate the poinsettia (*Euphorbia pulcherrima*) in Mexico long before Europeans came to the Western Hemisphere. The Aztecs used the bracts for a reddish-purple dye and latex derived from the plant to counteract fever. Franciscan priests during the 17th century observed the plant blooming during the Christmas season near Taxco, Mexico. These priests incorporated the plant into the Fiesta of Santa Pesebre nativity procession, which is believed to be how the plant became associated with Christmas and the holiday season. Joel R. Poinsett, a botanist and the first U.S. minister to Mexico under President James Monroe, sent some plants to his home in South Carolina in 1825 and began cultivating them here in the U.S. The popular plant is named for him.

*Adapted from Poinsettia pH Paper - Holiday Chemistry Project
by Anne Marie Helmenstine, Ph.D.*

