

My 5th Grade Science Fair Presentation 2023



I Wonder Questions

- I wonder how soil pH affects plants.
- I wonder what substances are used to change soil pH level.
- I wonder how I can use something inexpensive to test and alter the soil pH to the right levels.



My Topic Related to a UN Goal

- This relates to UN Goal #6 because it can help to check the soil pH level and make sure that the plants are growing properly.
- I wonder what color the pH strip changes to when it is exposed to an acid or a base.



My Research Summary



- The pH of soil affects how well plants grow.
- The most common factors that affect the pH of the soil are climate and weather, other plants in the area, the pH of the irrigation water, soil type, the kind of fertilizer you use, and nutrient availability.
- Soil pH varies from 3.5 (very acidic) to 8.5 (alkaline) and 7.0 is neutral.
- Soil pH level can be corrected by adding certain things depending on the testing results.

My Research Summary



- pH testing is basically measuring the amount of hydrogen atoms that carry a positive charge.
- We can use test strips, chemical test kits, digital pocket testers, and portable meters to test the soil pH.
- Red cabbage contains anthocyanin, which can be used as an acid-base indicator to test the acidity of the solution.

My Hypothesis, Variables, & Constants

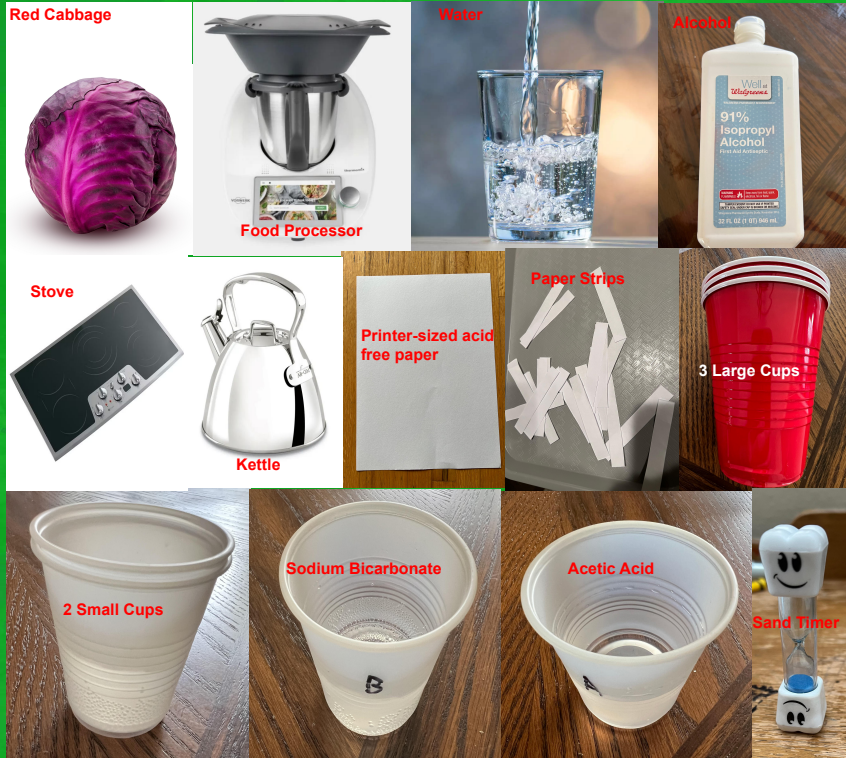
My Hypothesis: If I dip the pH testing strip in an acidic substance, it will turn red. I think this because the red cabbage salad started to turn slightly red after adding acetic acid (vinegar).

Independent Variable: Substances: acetic acid and sodium bicarbonate

Dependent Variable: pH of each substance (indicated by the color of the testing strip)

Constants: amount of ingredients to make the indicator solution, size of the strip, the time the indicator strip is soaked in the solution, amount of substance for testing

My Materials



- red cabbage
- food processor
- water
- 30 ml isopropyl alcohol (the amount doesn't matter)
- electric stove
- kettle
- printer-sized acid-free paper (cut the sheets into strips)
- three clean large plastic cups
- 2 small cups
- 43 ml sodium bicarbonate dissolved in water
- 43 ml acetic acid without color
- 2-minute sand timer

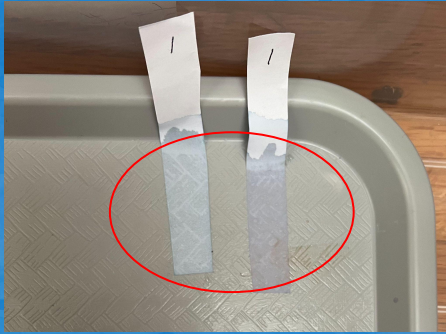
My Procedure

1. Chop $\frac{1}{4}$ of a head of the red cabbage to fine shreds using a knife.
2. Put the shreds into the food processor.
3. Heat the water until boiling with a stove.
4. Pour 400 grams of boiling water into the food processor.
5. Grind the shreds until the solution is a deep-purple color.
6. Let it cool.
7. Pour the solution through a strainer into a clean large plastic jar.
8. Add 10 ml isopropyl alcohol.
9. Cut each printer-sized paper into small strips.
10. Dip $\frac{3}{4}$ of the paper strip into the solution.
11. Soak the strip for 2 minutes (can be timed with a sand timer).
12. Remove the strips of paper from the solution.
13. Let the strips of paper dry in a tray.
14. Dip one strip into the sodium bicarbonate and record or remember the color.
15. Dip another strip into the acetic acid and record or remember the color.
16. Repeat S1-S15 3 times.
17. Record results into a chart.

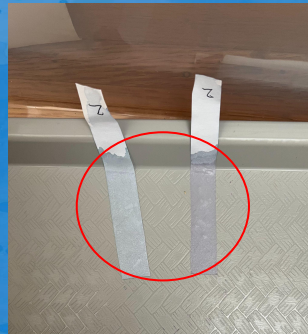


My Trials and Trial Data Collected

Trial 1



Trial 2



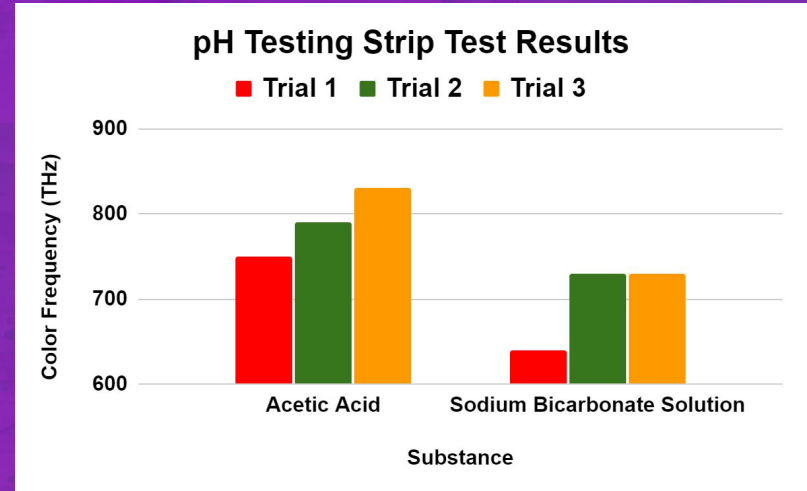
Trial 3



- The testing strip on the left in the circle was dipped in sodium bicarbonate, a weak base. It changed to a light blue color.
- The testing strip on the right in the circle was dipped in acetic acid, a strong acid. It changed to a purple color.
- The purple color in Trial 2 is slightly deeper than it was in Trial 1.
- The purple color in Trial 3 is slightly deeper than it was in Trial 2.

My Results: Data Table and Graph

pH Testing Strip Test Results			
	Color of Strip After Testing in Frequency (THz)		
	Trial 1	Trial 2	Trial 3
Acetic Acid	750	790	830
Sodium Bicarbonate Solution	640	730	730



- The pH testing results are recorded by colors of testing strips.
- The colors are plotted by their frequencies to differentiate them.
- The strips that were dipped in acetic acid are in varying shades of purple and the strips that were dipped in the sodium bicarbonate solution are in varying shades of blue.
- The results show that the testing strips can be used to indicate whether a solution is an acid or a base.

My Conclusion

- My topic question was "I wonder what color the pH strip changes to when it is exposed to an acid or a base."
- My prediction that the testing strip turns into red when dipped in the acetic acid (vinegar) is incorrect.
- The color of the testing strip turns into purple if it is dipped in an acid.
- The color of the testing strip turns into blue if it is dipped in a base.

My Conclusion Continued

- There were a few irregularities in my data:
 - I replaced the brown acetic acid with the one without color and repeated trial 1.
 - The purple and blue colors of the strips vary slightly in different trials.
- If I was to conduct this experiment again,
 - I would control the density of the cabbage solution more carefully.
 - I would also add less water when making the cabbage solution.
- This experiment provided me the path to inexpensive pH testing.
 - I wonder what pH of my backyard soil is.
 - I wonder what pH the rainwater that fell recently is.
 - I wonder what pH my potting mix is.

Thanks for Listening!

