From Dull to Dazzling: Using Pennies to Test How pH Affects Copper Corrosion

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p090/chemistry/copper-corrosion (http://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p090/chemistry/copper-corrosion)

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Experimental Procedure

Important Note Before You Begin: The procedure below is designed for students who have not yet had a chemistry class in school. It can be modified to provide more-accurate readings of the copper concentration by using more-advanced test kits, if desired. See the Variations (#makeityourown) section for sources of more-advanced chemistry kits.

Creating the Control Solutions

1. Using the graduated cylinder, fill one of the test tubes with 10 milliliters (mL) of distilled water.
2. Fill another test tube to 10 mL with white vinegar.
3. Add one copper test tablet to each tube.
4. Using skewers, mix the contents in the test tubes until the tablets disintegrate and fall apart.
5. Make a note of the colors of the solutions in your lab notebook. Depending on your solution, the colors can vary from reddish-orange to pink as shown in Figure 3.
    a. These are **control solutions** that show the baseline color—meaning, without exposure to copper.

Figure 3. Once the copper test tablets are fully dissolved, the color of your solutions should look reddish-orange or pink. These photos show the range in color you might see.

Placing the Pennies in the Water and Vinegar Solutions.

1. Label four of the plastic cups, as follows:
    a. Water 1
    b. Water 2
    c. Vinegar 1
    d. Vinegar 2
2. Using the liquid measuring cup, pour 100 mL of vinegar in the cup labeled *Vinegar 1.*
3. Pour 100 mL of distilled water in the cup labeled *Water 1.*
4. Drop five pennies into each cup.
    a. *Note:* The kit suggests adding salt, but leave it out for this procedure. Vinegar contains acetic acid, which makes the reaction proceed faster.
5. Start the timer. Wait for 10 minutes.
6. Remove the pennies from the cups, using the strainer, as follows.
    a. Pour the contents of the *Water 1* cup into the *Water 2* cup, catching the pennies with the strainer.
    b. Rinse the pennies with tap water and place them on some dry paper towels. Make sure you keep track of from which cup they came.
    c. Pour the contents of the *Vinegar 1* cup into the *Vinegar 2* cup, catching the pennies with the strainer.

d. Rinse the pennies with tap water and place them on some dry paper towels, again keeping track of from which cup they came.

Testing the Solutions for Copper

1. Using the graduated cylinder, fill a clean test tube to 10 mL with the water from the cup labeled *Water 2* (which was originally the water from the *Water 1* cup).
    a. Always rinse and dry the graduated cylinder between uses.
2. Fill another test tube to 10 mL with vinegar from the cup labeled *Vinegar 2* (which was originally the vinegar from the *Vinegar 1* cup).
3. Add one copper test tablet to each test tube.
4. Use the skewers to mix the contents of the test tubes until the tablets disintegrate and fall apart.
    a. The solution will turn blue if a large enough quantity of copper is present as shown in Figure 4.
5. Hold the test tube against the white part of the Copper Color Chart that is supplied with the kit.
6. Match the color of the solution to the color on the chart.
7. Record the results in your lab notebook.

Figure 4. In the presence of large enough quantities of copper, the copper test tablets will turn the water blue as shown in this picture.

Cleaning the Test Tubes and Repeating the Tests

1. Pour out the contents of the two test tubes from the cups with pennies into a sink.
2. Wash the solutions down the drain with running water.
3. Rinse out the test tubes with water.

4. Place them upside down on paper towels.
5. Carry out the procedure two more times, as follows. This will demonstrate that your results are repeatable.
    a. Start with the *Placing the Pennies in the Water and Vinegar Solutions* section.
    b. *Do not repeat the controls.*
    c. Use fresh pennies and cups.
6. When the procedure is complete, rinse out the test tubes that contained the samples and the controls and allow them to dry on paper towels.
7. Make a data table showing the color of the water and vinegar test solutions for each trial.
8. What do your results tell you about how pH affects the corrosion of copper pipes?

Frequently Asked Questions (FAQ)

FAQ for this Project Idea available online at https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p090/chemistry/copper-corrosion#help (http://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p090/chemistry/copper-corrosion#help).