

Testing for Zinc

Grade Level: 6 – 8

Introduction:

Look at a box of cereal in your kitchen. Chances are, it says it is fortified, or includes vitamins and minerals children need. Many foods have vitamins and minerals added to them. Vitamins, like Vitamin C and Vitamin D, are important to stay healthy. So are minerals like iron and zinc. In some places in the world, getting enough nutrients is a major health issue. Food with a lot of nutrients, like fruits and vegetables, aren't always available to families. Some places also don't have nearby doctor's offices or hospitals. This makes it hard for families to diagnose and treat malnutrition - a condition where the body isn't getting enough nutrients to work properly.



Real World Connection:

[Georgia Tech researchers have created a new way to test for zinc](#), an important nutrient, using a small amount of blood. By creatively using the insides of bacteria, the test is cheap and uses only a small amount of blood. These are two important features when working in rural communities in developing countries. By testing patient's blood, they can determine if someone is at risk of developing malnutrition.

By using the insides of bacteria that change color based on whether or not zinc is present, the test relies on colorimetry - the detection of a substance via a color change. When zinc is present in the sample, the color changes to purple. The more zinc present, the more intense the purple color is. Colorimetry isn't a new science, but scientists and engineers are continually creating new and ingenious ways to use it to solve the world's problems.

In this activity, you will use colorimetry to confirm whether or not zinc is present in zinc supplements. Although this test wouldn't work for testing blood, it demonstrates the power of color-changing chemistry!

Vocabulary to Know:

- ▶ **Malnutrition** – a condition caused by chronic lack of nutrients in an individual's diet
- ▶ **Colorimetry** – a method of detecting the presence or amount of a chemical in a sample based upon color
- ▶ **Complex** – a unique arrangement of a metal ion surrounded by large molecules
- ▶ **Fortified** – reinforced or added to; for food, this usually means the addition of vitamins and minerals
- ▶ **Colorimetry** – a method of detecting the presence or amount of a chemical in a sample based upon color
- ▶ **Indicator** – a type of molecule that causes a solution to change color based upon pH
- ▶ **pH** – a measurement of how much H⁺ is present in a solution
- ▶ **Anthocyanin** – a type of pigment molecule present in fruits and vegetables

Continued.

Activity

Materials:

- Red cabbage
- Kettle or microwave
- Heat-safe bowl
- Water
- Spoons
- Small plastic bag (such as Ziploc or similar)
- Zinc supplement tablet
- Small glasses or cups
- Tablespoon measuring spoon

Instructions:

1. Begin by making the indicator, or the substance that will change color based on the presence of Zinc. Heat up 100 mL of water (about 1/2 cup) using a kettle or microwave. Be careful to not let it boil - just get hot enough so that some small bubbles or droplets form. Be sure to use a microwave-safe dish that is vented if using the microwave.
2. While the water is still warm, add it to the heat-safe bowl. Rip up some red cabbage and stir it into the water. Be careful - the liquid will stain! Let stand for 10 minutes.
3. Remove the red cabbage pieces from the liquid with the spoon and continue to let it cool.
4. Put a couple of the Zinc tablets in the plastic bag. Seal tightly and then crush using the backside of a clean spoon.
5. Set out a cup. Fill the cup with four tablespoons of the red cabbage indicator liquid. Observe the color of the indicator liquid.
6. Using a spoon, add the Zinc supplement tablet powder to the cup. Observe to see what changes are occurring. Stir carefully to help dissolve the powder.
7. When you're finished, be sure to carefully pour the liquid down the sink and rinse the sink with plenty of water - be careful to not let the liquid sit in a bowl or sink too long!

Exploration Questions:

1. Try to test to see if the color changes depending on if more or less zinc is added. Create different trials that observe the color change with one tablet, two tablets, etc.
2. What other substances would change the color of the cabbage juice indicator? See if there's any patterns in the how the color changes by creating new experiments to test other substances in your kitchen (vinegar, milk, etc.)

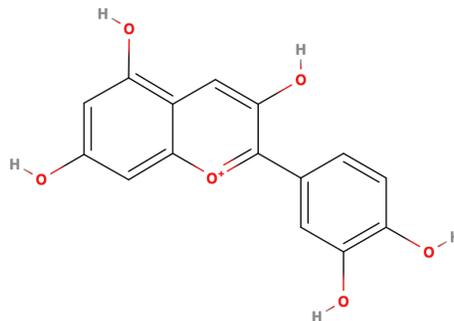
Explanation:

The zinc in the tablet reacts with the water in the cabbage juice indicator. This reactions changes the pH of the cabbage juice. The molecules that give the cabbage juice its color depend on pH. When the pH changes, the color of the indicator changes.

Although this wouldn't work to detect zinc in the blood, it does show how colorimetry can be used to testing for the presence and amount of a chemical.

Additional Resources:

- [Chemistry in Pictures: One fish, two fish...](#)
- [Red Cabbage Chemistry](#)



Cyanidin – one of many anthocyanin molecules present in red cabbage. The color of the solution changes depending upon the pH because of chemical reactions involving the anthocyanin molecules (image from molview.org)