

The Art of Food: Plant Pigments and Tannins

Grade Level: 2-5

Essential Skills: 2, 4, 9

NGSS: 2-PS1-1; 2-PS1-2;
5-PS1-3; 5-PS1-4; 4-LS1-1;
2-LS4-1

CCSS: W.2.7, W.2.8, SL.2.5,
W.2.7, W.5.7

Time: 90 minutes

Materials:

- 2 Tbsp Beet powder*
- 6, 3.25 oz cups*
- Paint brushes
- Baking soda
- Vinegar
- Teaspoon
- 6, Grown in Oregon maps*
- Printed Activity 1 & 2 sheets

*Provided by Oregon AITC

AITC Library Resources:

Check out these materials on our Lending Library:

Books

- *Growing an Artist*
- *The Organic Artist [for Kids]*
- *The Girl Who Thought in Pictures*
- *Planting a Rainbow*

Lessons

- *The Gift of Trees*
- *Eating Plants*
- *Poetry of Agriculture*

Description:

When we think of farmers in Oregon producing popular crops such as beets, blueberries, hazelnuts, onions, and grapes, we might not first think of art supplies. However, these food crops, along with many other plant materials, often find their way into the art studio! Many paints, drawing tools, and fabric dyes contain pigments and tannins, which come from agricultural commodities, even rocks and soil! This lesson allows students to utilize foods and other plant materials to discover exciting, naturally occurring colors growing in their gardens or school yards.

Background:

Plant pigments have been used for thousands of years to help humans put down into words and images their thoughts, ideas, and stories. Some of the oldest known examples of pigments being used to communicate can be found in the caves of Pech Merle in France. The drawings in the caves include handprints, mammoths, and other images familiar to people at the time. Since then, people have learned to use plants and other earth materials to create a whole rainbow of colors available for making art, dyeing fabric, printing words on paper, and other uses.

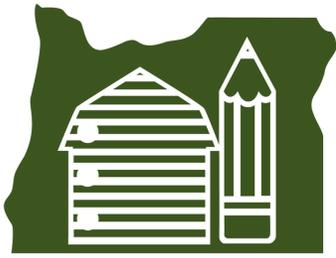
Farmers produce food crops and plants that contain pigments and tannins, but they may not do so with the intention of using them as art supplies. Some people do grow pigmented plants with the intention of using them creatively. Turning plant pigments and tannins into art materials is nothing short of magic, and this lesson brings that magic of creative, and sometimes tasty, discovery to students.

Learning Goals:

1. Students will learn the basic definitions for pigments, tannins, pH, acidic, and basic.
2. Students will use observation, hands-on learning, and collaboration to learn about the various agricultural commodities of Oregon to identify which are likely to contain pigments and tannins.



Crushed earth pigment was used by early humans to leave their mark in the world.



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Lesson to Grow

Vocabulary:

- **Pigment:** Pigments are tiny particles that give plants and other materials their color, such as how chlorophyll (a substance important in photosynthesis, which is the process by which plants make their food) gives plants their green color. The word pigment comes from the Latin word pigmentum, meaning "coloring matter, pigment, or paint." Pigments can also be red, purple, yellow, blue, and gray.
- **Tannin:** Tannin is a yellow or brown chemical that is found in plants such as tea, tree bark, and some unripe fruits, like wine grapes. It is used in the process of making leather and in dyeing. The word tannin comes from the French word tan, and means "crushed oak bark containing tannin."
- **pH:** The pH scale measures how acidic or basic a liquid is. pH is a number from 0 to 14. From 0 to 7 are acids, with 0 being the strongest. From 7 to 14 are bases with 14 being the strongest base. If a liquid has a pH of 7, it's neutral.
- **Basic:** The higher the pH, the more basic the substance is. These substances are often slippery and sour, and can be found in cleaning products, like soap or baking soda.
- **Acidic:** The lower the number, the more acidic a substance is. Acidic drinks or foods are sour as in citrus, and sharp as in vinegar.

Set Up:

1. Print enough copies of Activity sheets 1 & 2 for each student.
2. Display a few physical examples of plants with pigments and tannins, such as beets, broccoli, flowers, hazelnuts, and tree bark. These will help prime students for both Activity 1 & 2.
3. Prepare a demo of the beet powder activity by gathering beet powder, cup for mixing, a teaspoon, one mixing spoon or paintbrush, baking soda, and vinegar. Note that one extra cup has been provided for the teacher to mix up the demo.

Part I: Introduction to Pigments and Tannins

1. Explain that, "Today we are going to be learning about pigments and tannins, which is where we get the colors that are used in creating paints, colored pencils, crayons, fabric dye, and many other colorful things we use every day." Start by taking a poll from the class of their favorite colors to paint or draw with, writing their responses on the board. Now ask where they think the colors used in art supplies come from.
2. Explain to students that their favorite colors come from pigments and tannins found in plants! *Pigments and tannins are the colors that often come from natural materials, although sometimes, they are created synthetically in labs.* Read aloud the definitions for pigments and tannins.

Pigments come from plants that photosynthesize*, which means the way that green plants use sunlight to make their own food. Tannins are also a pigment, and they come from the parts of plants that are thicker, like bark, but they can also come from dead leaves and even grape peels. Tannins are darker and most often brown.

*Opportunity to ask students to recall what photosynthesis means.

3. Explain that, "Today we're going to learn more about pigments and tannins by playing and experimenting with plants."



Tannins on a sidewalk left behind by decaying leaves.

Part 2: Discovering Pigments and Tannins of Oregon Agriculture

1. Explain to students that, "You are now going to explore the commodities of Oregon to learn about some that have pigments and tannins." Distribute to students the worksheet, Activity 1: Pigments of Oregon Agriculture, as well as a copy of the Grown in Oregon map (available on our website for free). Students can work individually or in small groups to explore the map, then use their activity worksheet to fill in the blanks beneath each commodity with the name of a county that grows it and whether they think the item contains pigment or tannin.

2. As a class, proceed one by one through the chart to fill in the squares correctly. Invite students to share their reasoning for why certain items contain either pigment or tannin. The answers are as follows (from top left to top right, and so on):

- | | | |
|---------------------------------|-----------------------|--------------------|
| ◦ Row 1: Onion - Pigment | Tree - Tannin | Cherry - Pigment |
| ◦ Row 2: Grapes - Tannin | Blueberries - Pigment | Broccoli - Pigment |
| ◦ Row 3: Blackberries - Pigment | Sugarbeet - Pigment | Hazelnut - Tannin |

Note about other Oregon agricultural commodities: Mammals, such as cows and sheep, do not contain the same kinds of pigment and tannin as plants but instead have melanin. Crabs and fish also contain melanin, as well as the many kinds of pigments found in plants, but they do not contain tannins.

Part 3: Play with your Food!

1. Explain to students that, "We are now going to play with our food by doing an experimental art activity with plant pigment." The teacher will give a demonstration first, then everyone will have a chance to try. Set up your demo station where all students can see. Place a 1/2 teaspoon of beet powder into a small mixing jar or cup. Invite students to guess what plant food the pigment is and what color it will become when water is added. Mix 2 teaspoons of water into the powder and stir gently, demonstrating to students how doing so will avoid a big mess. Use a paintbrush to dip into one jar and use the mixture to make a small simple painting on a piece of paper. *Emphasize to students that we are able to taste test this paint because it is made out of food, but not all paint is so they should always ask an adult before putting it in their mouth.*

2. Have students wash their hands. When they are seated and ready to move on, distribute a white piece of paper (watercolor works best, avoid construction) to each student, as well as one small cup and a paintbrush. Pour 3/4 teaspoon of beet powder into each student's cup (or allow them to do it) and invite them to dip their finger in the powder to get just a small taste. Invite students to share their reactions to the flavor.

Lesson to Grow

3. Distribute 1 tablespoon (3 teaspoons) of water into each student's cup (or allow them to do it), and have them stir gently until mixed. Invite students to use their paint brushes to paint an image or practice writing their name on the paper with the beet pigment. Ask them to save just a little bit of their paint for one final experiment.

4. Explain with this last experiment that they will be changing the color of their paint just a little bit. Half of the students will be adding baking soda to their paint, and the other half will be adding vinegar. This will change the pH of their paint into either basic (baking soda) or acidic (vinegar). **Elaborate: When we talk about pH, and whether something is basic or acidic, we're talking about ions, or groups of atoms or molecules, which are the building blocks of life, we're made of them. So, by adding baking soda we're making the mixture basic because it has more hydroxide. But if we add vinegar, we're making the mixture acidic, meaning it has more hydrogen. (The baking soda mixture will become purple-red, and the vinegar mixture will turn blush-red.)

5. Have students return to their desks and before distributing the baking soda and vinegar, ask them to turn and talk to a peer, sharing their hypothesis about what they think will happen to their beet solution when the base or acid is added. Explain that half the students will add 1 teaspoon of baking soda to their mixture, and the other half will add 1 teaspoon of vinegar to theirs. Distribute the baking soda and vinegar to each student's sample, reminding them to stir gently. Students will observe the chemical reaction unfold over 2-5 minutes, paint with it on their piece of paper, and share if their hypothesis was correct.



Part 4: Pigments and Tannins Scavenger Hunt activity sheet

1. Invite students to work individually or in pairs to complete the activity sheet. Students will need a writing tool such as a pencil or pen. To complete the activity sheet, students will go outside to collect samples noted and rub them into their corresponding squares to complete each one.

2. Establish a time limit and ground rules/boundaries for completing the activity outside such as staying within eyesight, staying within the school or park boundaries, and not harming living creatures or tearing up plants to complete the sheet. Return as a group and share the samples collected.

Part 5: Debrief Questions

- What are some ways we can test to see if a plant has pigments or tannins?
- How do acids and bases affect natural pigments?
- Besides beets, what other plants do farmers in Oregon grow that also contain pigment?

Extension Activities:

1. Expand further into a lesson on the pH scale.
2. Utilize lessons that focus on plant parts to experiment with other edible plants containing pigments and tannins. See Oregon AITC lesson: *Eating Plants*.

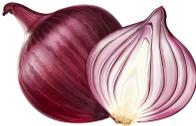


Activity 1: Pigments and Tannins of Oregon Agriculture

Directions

1. Using your Grown in Oregon map, write on the first line below each picture the name of the county in Oregon where that plant is grown. If there is more than one county growing it, choose one that is new to you!

2. Write on the second line if you think the plant has pigment or tannin.

 _____ _____	 _____ _____	 _____ _____
 _____ _____	 _____ _____	 _____ _____
 _____ _____	 _____ _____	 _____ _____



Activity 2: Pigments and Tannins Scavenger Hunt

Directions

See how many shades of pigments and tannins you can find! Gather pieces of plants and other natural materials (no bugs or other living creatures!) and rub them onto the matching squares below to save your findings! Try to use plant pieces that have already fallen or share with a friend!

Circle your favorite color

★ Draw a star next to the most surprising color

Leaf	A stick or bark	A blade of grass
Rock	A flower	Plant roots
The soil	Another leaf	Another flower or stick



Activity 2: Pigments and Tannins Scavenger Hunt

See how many shades of pigments and tannins and other natural materials (no bugs or other living things) you can find. Gather pieces of plants and other natural materials (no bugs or other living things) already fallen or shared.

Circle your favorite color ☆ Draw

Leaf	
Rock	



Activity 1: Pigments and Tannins of Oregon Agriculture

1) Using your Grown in Oregon map, write on the first line below each picture the name of the county in Oregon where that plant is grown. If there is more than one county growing it, choose one that is new to you!

2) Write on the second line if you think the plant has pigment or tannin.

