

Making Plant Based Dyes

Standards of Learning

Science 6.1, LS.1, PS.1, PS.5

Social Studies USI.4, USI.5

Objective

Students will:

- Conduct a scientific investigation to validate a hypothesis using controls, independent, and dependent variables.
- Conduct an experiment identifying chemical and physical changes of the dependent variable.
- Identify practices of colonial life in the Mid-Atlantic region.
- Explore the dyeing qualities of different plant materials which are mixed with hot water.

Materials

- Vegetation samples for dyes (Red cabbage, carrot tops, beets, berries, birch leaves, parsley, mint, tea leaves)
- Water
- Vinegar
- Heat source such as a stove, hotplate, or microwave
- Hot water
- Heat-resistant containers
- Spoons or stir sticks
- White fabrics: cotton fabric or roping, cotton balls, wool yarn, wool athletic socks
- Trays lined with paper toweling
- Knife, scissors, or other safe cutting instrument
- Hammer (or mortar and pestle) for grinding the samples into tiny bits
- Tweezers
- Rubber gloves

Background Knowledge

Throughout history mankind has used natural dyes to adorn clothing. In colonial times the color of clothing signified class and noted occasions. Roots, nuts and flowers are just a few common natural ways to get many colors. Early American colonists used (among other things) salt, vinegar, urine, and oak galls, which are the lumpy growths found on oak branches where insect larvae distort the normal growth. The ashes of burned juniper branches were used by Native Americans as well as used wood ash, rusty water and clay.

A number of methods can be used to dye fabric from plants. Plants are generally ground up and added to water then boiled. Cloth, yarn, or wool was then added to the boiling pot. Muslin, silk, cotton and wool work best for natural dyes and the lighter the fabric in color, the better. White or pastel colors work the best. Time and temperature played a factor in the intensity of color absorbed by the fabric. Metal pots themselves released metals into the dye baths, so copper, iron and other pots would sometimes yield different colors in the dyed product. Some colors permanently affixed to the fabric while others needed a mordant. A mordant was sometimes used to “fix” the dye color into a fabric. Vinegar and alum were often used for this purpose. Fabrics were treated pre and post dye.



Using a variety of fabrics and plants students can develop hypothesis regarding which fabrics take on color the best. In addition students will have the opportunity to analyze which plant materials yield the most intense dye. It's best to use an old large pot as your dye vessel. Wear rubber gloves to handle the fabric that has been dyed, the dye can stain your hands. It's also important to note, some plant dyes may be toxic. Practice lab safety throughout this or any experiment.

Plants to Grow and Collect* for Dyeing

| Color | Plant |
|-------------------|---|
| Blue | Leaves: red cabbage |
| | Fruit: elderberries |
| | Leaves & stems: tomato plants |
| Yellow | Leaves: mint, parsley, birch, onion skin |
| | Flowers: chamomile, dandelion, marigolds, zinnias |
| | Other: Paprika |
| Green | Leaves: carrots, red onion |
| | Flowers: black-eyed Susan |
| | Leaves & stems: spinach |
| Orange | Flowers: dyer's coreopsis |
| | Other: turmeric |
| | Flowers: sunflower |
| Gold/Brass | Leaves & stems: cocklebur, dock, goldenrod |
| | Seeds: sunflower |
| | Leaves: birch |
| | Nuts: acorns |
| Tan/Brown | Other: Coffee grounds, tea bags |
| | Roots: dandelion |
| | Leaves: red cabbage, strawberries, cherries, roses |
| Pink | Fruit: wild grapes, mulberries, beets, blackberries |
| Purple | Roots: madder |
| Red | Black walnut hulls |



Procedure

1. Each student will create a hypothesis regarding dyeing medium and dye. "If (independent variable) then (dependent variable)."
2. Students will choose a plant material and grind or cut the material into small pieces.
3. Add plant material and ½ cup of hot water to a container.
4. Add fabric material to container with plant material and hot water.
5. Soak material for 5 minutes.
6. Remove material with tweezers and spread on paper towel to dry.
7. Repeat adding 1 tablespoon of vinegar as a mordant.
8. Once dry test each fabric sample for colorfastness by adding water drops to fabric and observing changes in dyed fabric.
9. Additional trials may be conducted using various plant materials.
10. Record data including chart noting which plants were tested as dye to which fabrics, and whether a mordant was used.
11. Write a conclusion paragraph including whether the hypothesis was confirmed.

| Trial | Material Used | Independent Variable (plant dye) | Dependent Variable (dye result) | Colorfast test Results | Mordant |
|--------------|----------------------|---|--|-------------------------------|----------------|
| #1 | Ex: Cotton | Beet | Light Red | Color bleeds | Without |
| #2 | Cotton | Beet | Light Red | Holds Color | With |
| | | | | | |
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Extension

Increase the amount of time fabric is soaked in dye, water temperature, amount of mordant.

Use a copper pot for dyeing fabric. The copper reacts causing a chemical reaction and impacting dye color.

Attempt to remove stain from fabric. Discuss what seems to make some stains harder to remove, and how people may have learned in history what plants make good dyes.

References

<http://www.nationalgardenmonth.org/index.php?page=dye>

<http://www.pioneerthinking.com/naturaldyes.html>

<http://www.kidsgardening.com/growingideas/PROJECTS/may03/pg2.html>

