# Make Your Own Markers

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Chem_p014/chemistry/make-your-own-markers
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## Experimental Procedure

*Note*: Natural dyes can be strong, and stains can be difficult to remove from surfaces and fabric. Protect your work surface and clothes at all times as you do this project.

### Prepare Your Dye

1. Pick out a plant source to extract your dye from. Make sure you have enough of the plant source to cover the bottom of a saucepan.
2. If your plant source is large, you will need to finely chop it into little pieces using your knife and cutting board. Have an adult help you with this step. If the color is concentrated into the skin, you might want to peel the skin off and use only the skin.
3. Add the plant material to your saucepan and add just enough water to cover the plant source. If you selected tea or a spice, add enough water so that it is floating or mixed into the liquid and not just absorbing the water or turning into a paste.
4. Bring the mixture to a boil and simmer covered on the stove for approximately 10-15 minutes. The pigment from the plant material will slowly begin to color the water in your saucepan.
    a. **Safety Notes:** Do not leave the plant-water mixture unattended on the stove. Remain nearby to make sure it does not burn. It is also a good idea to do this in a well-ventilated area, or with the stove top fan running, in case the cooking plants release bad-smelling fumes.
5. If the color of your water is too faint, you may want to concentrate the color by removing the lid of the saucepan and continue boiling until enough liquid has evaporated, leaving behind a darker liquid.
6. When the color of the water is rich in color, remove the saucepan from the heat and allow the dye to cool. If there are pieces of material in your saucepan, separate the dye into another bowl using a strainer and set the bowl of dye aside. If your plant source dissolved, just pour the liquid into a bowl and set it aside.
7. Now that you have your homemade dye, you will want to compare it to a dye from a similar color of water-soluble marker.

### Chromatography Test

To make sure you can compare your results, as many of your materials as possible should remain constant. This means that the temperature, type of water used, size of paper strips, where the dye is placed onto the paper, etc. should remain the same throughout the experiment.

1. Cut the chromatography paper into strips approximately 2 centimeters (cm) wide by 6.5 cm long. Prepare a total of 6 chromatography strips this way.
    a. *Science Buddies Kit*: The kit comes with 20 long strips of chromatography paper; two 6.5 cm strips can be cut from each long strip.
2. Take one of the chromatography strips and use a ruler and pencil to draw a line across it horizontally 1 cm from the bottom. This is the origin line, see Figure 2 for details. Repeat this step for all 6 of the chromatography strips.

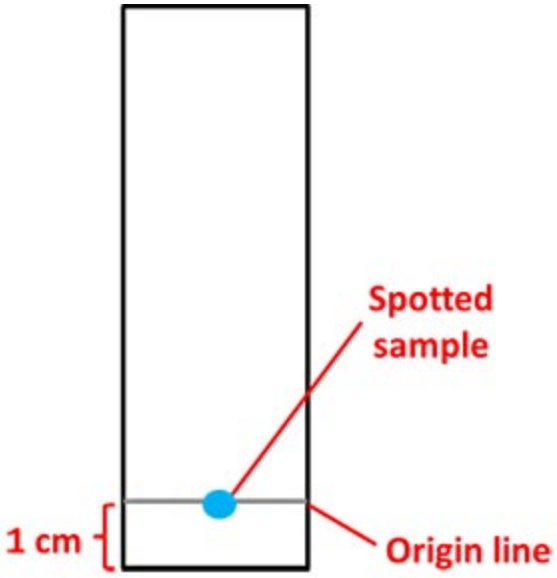


**Figure 2.** Draw an origin line on the chromatography strip. The dye to be tested will be spotted in the middle of the origin line.

3. Using the pipette, place a small dot of dye at the center of the origin line of one chromatography strip. The drop size should be about the size of a pencil eraser. This is your natural dye spotted sample.
    a. Use a *pencil* to label the chromatography strip "natural dye". Do not use a pen to label the strips: the ink might run when the water passes through the strips.
    b. Allow the spot to dry. If the spot is too faint, you will need to thicken your dye (see step 5 of the Prepare Your Dye section) and repeat step 3 on a new strip.
4. Using the water-soluble marker that is the same color as your dye, take a new chromatography strip and make a dot the size of a pencil eraser in the middle of the origin line of the strip. This is your marker-spotted sample, as shown in Figure 3.
    a. Use a *pencil* to label this the chromatography strip "marker."
    b. Allow the spot to dry.

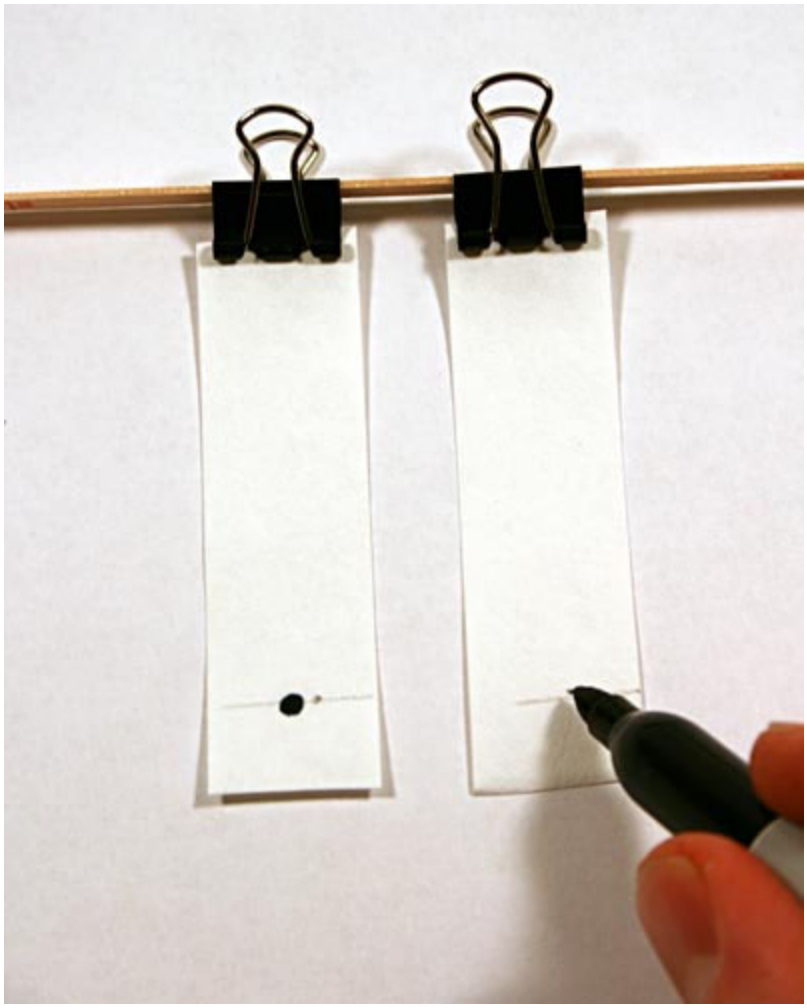

**Figure 3.** A single spot of dye or a marker dot should be placed in the middle of the origin line on the chromatography strips.

4. Using your binder clips, clip the two prepared chromatography strips to a wooden splint, as shown in Figure 3. Make sure the two strips do not touch each other and that the bottoms align.
5. Rest the wooden splint on top of the 500 mL beaker so that the strips hang into the beaker and do not touch the sides of the beaker, nor the bottom of the beaker. Estimate the distance between the bottom of the beaker and the end of the chromatography strips.
6. Remove the wooden splint with the chromatography strips and add water to the beaker so the water would just reach the end of the chromatography strips if they are placed back.
7. Place the wooden splint back on top of the beaker. Do both strips touch the water? The goal is to have the strip just touching the surface of the water, as shown in Figure 4. As long as the water touches the strips and the water level is below the dye dots, you are good to go!
    a. If necessary, repeat step 6 and 7 until you reach the desired water level, when the ends of the strips just touch the water.

**Figure 4.** The ends of the chromatography strips should just touch the water.

5. Watch as the water rise up the strips. What happens?
6. Let the water run up until it is about 0.5 cm from the top, then remove the strips from the water by taking the wooden splint out.
7. Let the strips dry on a clean waterproof surface, like a plate.
8. Lay your strips side by side to compare the color components. Make a drawing of each strip in your lab notebook. What do you notice? Make a list of similarities and differences.
9. Scientists repeat experiments several times before drawing conclusions to ensure the experiments are done correctly. You will do the same, repeating steps 3–8 two more times for a total of three trials.
10. Analyze your results:
    a. Were your findings for the three trials identical? If so, your experiments were reproducible and you can make strong conclusions.
    b. Were your findings different? Which ones were the same in each trial and which ones varied? What can you conclude from your experiments?

## Optional: Do-It-Yourself Marker

1. Now you are ready to make your dye into a marker.
2. Pour some of your natural homemade dye that you made earlier in the project in a glass until the dye reaches about 1 cm up the glass.
3. Gather all your materials. Figure 5 shows everything you need to make one marker.

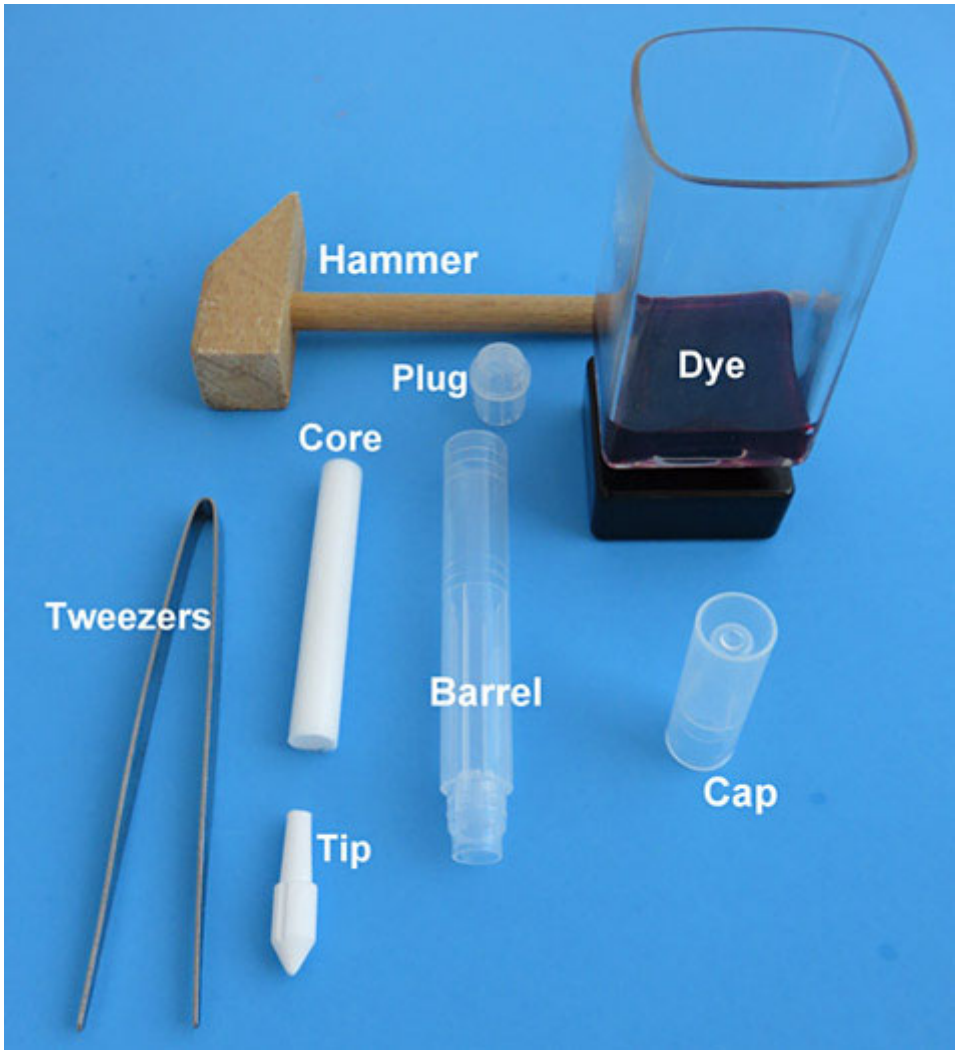


**Figure 5.** Materials needed to make your homemade marker.

4. Start by pressing one tip into the narrow side of the marker barrel.
5. Place a marker core into the glass filled with about 1 cm of dye and watch how it soaks up the dye. Consult Figure 6 whenever you feel unsure about a step. The illustrations can guide you through the process.
6. Once the core is completely soaked, use your tweezers to press the core into the barrel, as shown in Figure 6.
7. Snap on the plug and cap.
8. Place your marker cap down on a hard surface.
9. Ask an adult for help or supervision with this step. Give a quick hit on the plug with a hammer. Be careful not to hit any fingers!
10. If you see that the tip soaked up the dye, you know everything snapped together well. The marker is finished!

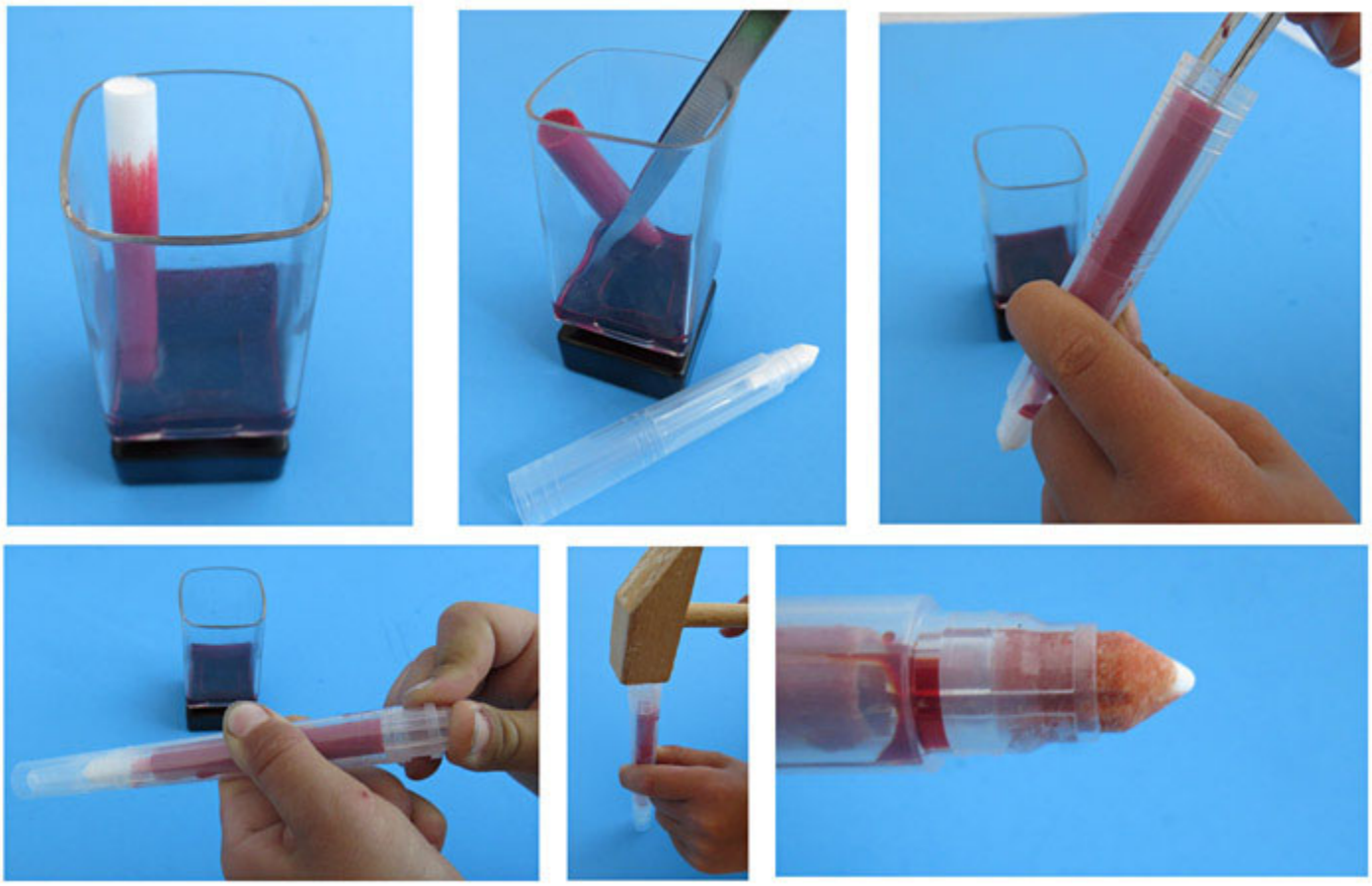

**Figure 6.** To make a marker, let the core soak up the dye before you place the core into the barrel. Add the plug and cap, and a quick tap of a hammer will snap it all together. If all has been done well, you will see the dye coloring the tip of your homemade marker.

11. Now you are ready to write a message or draw a picture with your new homemade marker!