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Chemical Education

A CHIMIA Column

Topics for Teaching: Chemistry in Nature

Moving Colors

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Abstract: To attract children's interest in Chemistry, the authors on behalf of the youngSCS composed this easy science experiment about chromatography. It shows in a beautiful and simple way the science behind colors and explains a common laboratory technique. To best reach its target audience this experiment was published in "Kaleio", a bimonthly Swiss girl's magazine.

Keywords: Chromatography · Colors · Experiments for children · youngSCS · Kids

We here provide an English version for a paper chromatography experiment conceived and prepared[2] by the youngSCS and published in the magazine "Kaleio".[1] This experiment can be performed by children with easily accessible items found in most households. We therefore invites you to try out this experiment with your school class, kids, nephews, nieces alone and/or grandchildren.

1. The Experiment

What you need:

white filter paper | an empty glass | water-soluble pens | glas of water | scissors

Tip: The experiment also works if you use blotting paper cut in a circle, you just need more patience. Other solvents, like disinfectant or oil can be used to further explore the behavior of colors.

2. How Does it Work?

The Mixture Is Important

You probably know color mixtures: e.g., blue and yellow afford green. In this experiment, you did the opposite: You separated a color mixture into the individual dyes it was composed of. As an example, the black pen from the photo (Figure 1, Step 2) contains mainly two dyes: blue and red. On the filter paper the black circle separates into these two colors (Figure 1, Step 5). If you did the experiment using more than one color and/or pens from different brands you may have noticed that not all colors separate in the same way. The same color mixture can be com-

1. Fold the filter paper once and cut a small hole in the middle with the scissors.
2. Choose one or more colored pens and draw a small circle around the hole. Do not worry, the circle does not have to be perfect.
3. Roll up a second piece of paper and stick it through the hole cut in the first filter paper.
4. Place the filter over a glass of water, so that only the rolled-up filter paper reaches the water. You must wait some time for the water to climb up and start the chromatography.
5. Observe how the circle of color drawn on the filter paper starts to separate.
6. Take a new filter paper and explore! Try various colored pens and solvents combinations. There is no limit! Do all the pens separate into several colors? What happens if you add disinfectant, nail polish remover or cooking oil to the glass instead of water and repeat the experiment?

Fig. 1. Experimental set-up visualized in six steps.

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Fig. 2. Examples of paper chromatography with colorful pens.

posed of different dyes. Black can be a mixture of blue and red, but also of yellow, dark blue, and red.

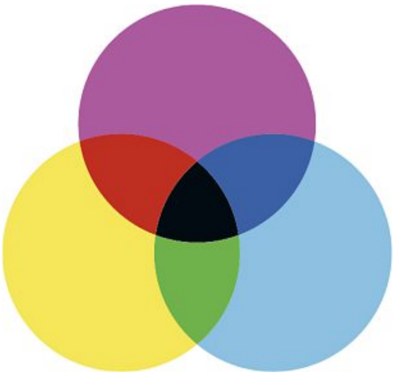

Fig. 3. Mixing the three basic colours yellow, magenta and cyan leads to new colors.

Chromatography – To Write with Colors

The term "chromatography" is derived from the Greek words χρῶμα (chroma), which means "color", and γράφειν (graphein), which means "to write". Chromatography is used to separate mixtures of substances (e.g. the color of your pen) into their individual components with the aid of a stationary and a mobile phase. In your paper chromatography, the paper is the stationary phase and the water (or another solvent which runs through the paper) is the mobile phase. The mixture is important. You have probably found that the colors migrate across the paper at different rates. I would cross mixture away or moves it back: "the same color can be composed of different dyes/ dye mixtures". Some color compo-nents stick to the paper and cannot be moved by the water. Others are transported by water: they move away from the circle you drew. Because of this variable behavior of the color components, the separation occurs differently. Now you can clearly recognize the individual colors.

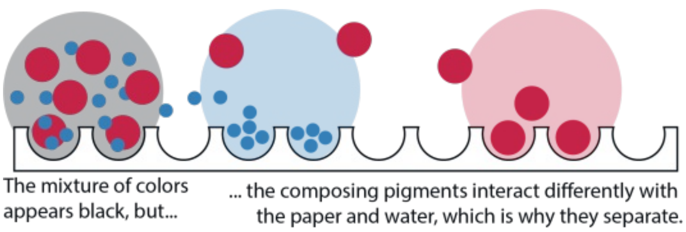

Fig. 4. Principle of paper chromatography.

Make the Invisible Visible

Chromatography is a technique that is used every day in many laboratories around the world. For example, environmental scientists use this technique to look for dangerous pollutants in water. As in your color experiment, the various substances and pollutants in the water can be separated and detected. Nothing remains hidden!

Fig. 5. Chromatography in the lab.

Reaching the Target Audience

To reach children all over Switzerland and excite their interest for chemistry, the youngSCS collaborated with the Swiss girl's magazine "Kaleio". This experiment was published in German and French in their May/June issue. Should you be interested in more fun experiments and child-oriented reports about psychology, environment, science, and society, please visit their website at www.kaleiomag.ch to check out their current and past issue.

Fig. 6. The published experiment in the girl's magazine "Kaleio".

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[1] M. Gut, M.D. Scheidt, C. Papadimou, S. Linker, *Kaleio*, **2022**, *9*, 28.
[2] Farben trennen mit Papierchromatographie - Experiment, https://www.entdeckerlab.de/blog/papier-chromatographie-experiment/, accessed June 1, **2022**.