Cloverbud Investigators: STEM for Every Season

June

Bleaching out the Color

Background:
Bleach has always been a go to product when it comes to cleaning, but how does it work? What is bleach? Bleach is a chemical compound resulting from natural sources used to whiten, deodorize, and sterilize fabrics. The active ingredient in chlorine bleach is sodium hypochlorite (NaOCl), which comes from salt (NaCl).

How does bleach work? It's always fun and games until you spill something on your favorite white shirt! Now there is this horrible stain and all you want to do is get it out. A stain is basically a chemical compound on the fabric. Into the wash goes your favorite shirt, detergent, and a small amount of bleach. Bleach whitens clothes by a process called oxidation. When water is added to bleach, it starts to break down rather fast into oxidized salt and biodegradables. This allows the stain to also break apart into smaller pieces and lift off the fabric with the help of the washing machine's agitator and detergent to speed the up process. Deodorizing and sterilizing works in the same manner, by breaking down germs and odors while exposing them to oxygen.

Bleach also works on colored fabrics as well, but this results in the colors changing if color safe bleach is not used. Many people use chlorine bleach to wash their white clothes to make them odor free and bright. Since a dye color is like a large stain on the fabric the bleach also wants to lift out the color. Bleach favors the dye since strong colored organic compounds are often joined with double carbon bonds. Bleach interacts with the organic compounds by adding oxygen to remove the bonds by breaking them up. Then, if you add water to the mix the color can then be totally removed or can become lighter depending on how much bleach is used.

How we see colors is also important in the understanding of how bleach works or makes the color disappear. To see colors we need light, whether it be from the sun or man-made. Light travels in waves. Wavelengths are all different lengths and not all can be seen by our human eye. The length of the wave determines the color and how our eyes see it. The color that we see from the shirt is seen because of how the light reflects off of it. The chlorine bleach is able to oxidize the bonds that make the color and takes away its ability to absorb any light. When the color can no longer absorb light, the color appears to be white.

In this investigation, we are going to make a design on our shirts. Instead of adding colors for our design we are going to break down the chemical bonds and remove the color where we want with bleach.

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

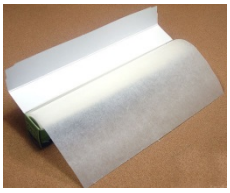
Updated by T. Riehm, 1/2019

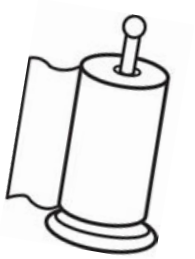
June's Mystery: How can we change the colors of fabrics?

Supplies:

- Solid-color Dark T-Shirt
- Waxed paper
- Chalk
- Bleach pen (sodium hypochlorite (NaOCl).
- Paper towel

Safety:*Bleach is a chemical and caution should be used, wear old clothes, rubber gloves, and have a well ventilated area.





Science Behind Bleaching out the Color:

Chlorine itself is a gas at room temperature. Ordinary table salt (sodium chloride, NaCl) is half chlorine; a simple electrochemical reaction with salt water produces chlorine gas. That same reaction produces sodium hydroxide (NaOH), and by mixing chlorine gas with sodium hydroxide you create sodium hypochlorite (NaOCl). When you buy a gallon of bleach at the grocery store, what you are buying is the chemical sodium hypochlorite mixed with water. Oxidizing bleach works by breaking the chemical bonds of a chromophore (part of a molecule that has color). This changes the molecule so that it either has no color or reflects color outside the visible spectrum.

What to Do:

Step 1: Wash and dry the shirt then slip a piece of waxed paper inside it to prevent bleeding to the opposite side of the shirt.

Step 2: Sketch your design on the shirt with chalk. Because the bleach can spread, keep the design simple, and draw with lines and dots, as shown, rather than try to fill in large areas.

Step 3: Shake the bleach pen and give it a few test squeezes on a paper towel to make sure it's flowing well. Trace over your chalk lines with the bleach pen. Leave the bleach on the shirt until the fabric has clearly changed color. This can take anywhere from 10 minutes to 2 hours, depending on the shirt.

Step 4: Rinse the shirt with water to stop the bleach from running.

Step 5: Wash the shirt by itself in the washing machine, and then dry it.

Updated by T. Riehm, 1/2019

Go Over Findings:

What is bleach?

Why does the bleach remove the color?

Do you need a lot of bleach? Which color shirt did the bleach change the color the fastest?

Investigate, Create, & Take: Investigators can take with them:

- ✓ Their Bleach Designed Shirt

Sources:

Melissa Sandoval "How Bleach Works" 24 November 2009. HowStuffWorks.com. <http://home.howstuffworks.com/bleach.htm> 22 January 2016

Dr. Laundry "What is Bleach?" January 23, 2012. www.clorox.com. https://www.clorox.com/dr-laundry/bleach/#IpDHQuZFALmeu7C2.99

How products are made "Bleach" http://www.madehow.com/Volume-2/Bleach.html

Additional Links:

"Power of Bleach", Sick Science! #180, https://www.youtube.com/watch?v=seOe1ythYbQ

Developed By: Tiffany Sanders Riehm, Gallia County 4-H Program Assistant, Ohio State University Extension 4-H Youth Development, riehm.11@osu.edu and Tracy Winters, Gallia County 4-H Extension Educator, Ohio State University Extension 4-H Youth Development. Edited by Michelle Stumbo, Meigs County 4-H Extension Educator, Director, Ohio State University 4-H Youth Development.