Taking the Sting Out of Bites

By Veronica I. Jaramillo, Kit Cheung, and Edith Kippenhan

Introduction

Bites or stings from certain bugs, such as red fire ants or bees, can be extra irritating. The reason is that in addition to containing venoms, they are also acidic. Acids can break down human tissue. The acid from fire ants (known as formic acid) reacts with your skin and damages it. Other compounds in their venom react with your skin and nerves. No wonder these bites and stings hurt so much!

Some common remedies to treat bites include soap, baking soda, rubbing alcohol, and calamine lotion. Do any of these remedies counteract the acid in the bite? Let's investigate!

Materials

- cochineal or red cabbage indicator (explained below)
- 4 clear plastic cups — 2 oz. (about 60 mL) or smaller works well
- measuring spoons (1 tablespoon, or about 15 mL, and ¼ teaspoon, or about 1.25 mL)
- vinegar
- baking soda
- rubbing alcohol (approx. 70%)
- liquid hand soap
- calamine lotion
- filtered water or distilled water
- snack size zip-closing plastic bag
- measuring cup
- plastic pipet or eye dropper
- marker for labelling

Procedure

To track what is happening with the acid, we will use an indicator that is made from natural, cochineal dye (which has been extracted from the body of a female cochineal insect). Cochineal dye will change colors if the solution is acidic, basic, or neutral.

You will need an indicator to do this experiment. You can make your own using the cochineal insects from the activity on page 5 in this edition of *Celebrating Chemistry*. If you don't have access to cochineal insects, you can make another kind of indicator by soaking a few chopped or torn leaves of red cabbage in ¾-cup (about 200 mL) of warm tap water for five minutes, then removing the solids.

Since we do not want to use the real acid from bug bites, we will substitute vinegar. Vinegar is a common acid you can find in your kitchen. When you spill some vinegar on your skin, it normally does not sting. That is because the amount of acid in vinegar is fairly small, only 3-5%, but it is a good model for the acid from an insect bite.

1. Label 4 clear plastic cups: "baking soda," "rubbing alcohol," "liquid hand soap," and "calamine lotion."
2. Add 1 tbsp. of vinegar to each of the four cups.
3. Use a pipet or dropper to add 10 drops of your indicator solution (juice from cochineal bugs) to each of the four labeled plastic cups. Swirl gently. Record observations in table below.
4. Add ¼ tsp. of baking soda to the appropriate cup and swirl. Record your observations in the table.
5. Add ¼ tsp. of rubbing alcohol to the appropriate cup and swirl. Record your observations.
6. Add two pumps of the liquid hand soap to the appropriate cup and swirl. Record your observations.
7. Add ¼ tsp. of calamine lotion to the appropriate cup and swirl. Record your observations in the table.

Safety Suggestions

- ✓ Safety goggles required
- ✓ Protective clothing and gloves suggested
- ✓ Caution: hot liquids
- ✓ Do not eat or drink any of the materials used in this activity
- ✓ Thoroughly wash hands after this activity
- ✓ Gloves

Disposal: Neutralize all solutions before pouring down the drain. Wash reusable items with soap and water. Disposable items, such as zip-closing plastic bags, may be disposed of safely with the household trash or recycling.
Note: Cover your workspace and protect your clothing to avoid unwanted stains from the insect dye.

What did you observe?

Observation Table

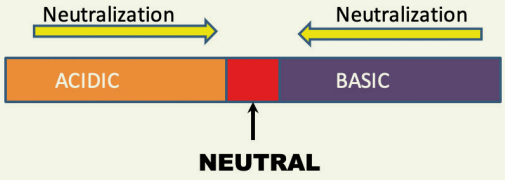
Cup	Remedy to be Tested	Color before addition of remedy	Color after addition of remedy	Was there a color change? (Yes or No)
#1	baking soda			
#2	rubbing alcohol			
#3	hand soap			
#4	calamine lotion			

How does it work?

Acids, bases, and neutral substances can all be compared on a spectrum called the pH scale. "Neutral" is where most of our body fluids are: neither acid nor base, but in the middle of the scale. Acids and bases are chemical opposites. If you add a base to an acid, it will help neutralize it. If you add an acid to a base, the same thing happens. "Neutralization" moves acidic or basic materials toward the middle of the scale.

Cochineal dye is orange when it's in an acidic environment, red when neutral, and purple when it's in base. If you add too much neutralizing agent when starting with an acid, you can end up basic, which is another non-ideal situation for living things. Baking soda is a base, so adding the amount we did neutralizes the vinegar, but goes beyond where we want to be. Neither the alcohol nor the soap did much to neutralize the acid, but the calamine lotion does.

So, let's review! The best of our treatments for counteracting the acid in a bite would be baking soda and calamine lotion. Alcohol and soap are commonly recommended to help with bites because they serve a very important role — preventing infection! As a bonus, alcohol cools the skin as it evaporates, easing the annoying itchy feeling.



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