

# Extraction of Capsaicin from Chili Peppers



## Purpose

To perform a serial dilution, extract a medicinal compound from plant materials, and use Scoville units to determine the heat index of various peppers.

## Background

Chili peppers are the fruits of the genus *Capsicum*. There are several chili pepper varieties and they have been domesticated for years. Chili peppers are used to season foods in many cultures and they have become a staple in the diets of Italians, Spaniards, Hungarians, Indians, Chinese, Indonesians, and Africans.

The chemicals that cause the sensation of heat when you eat a pepper are called capsaicinoids. Capsaicin being the main capsaicinoid found in chili peppers. This chemical is so hot that just one drop mixed with 10,000 drops of water will cause the tongue to blister.

When you eat a pepper the capsaicin irritates the lining of your mouth causing that familiar burning sensation. Your brain responds to this stimulus by producing endorphins, your body's own natural pain reliever. The production of endorphins in response to eating chili peppers may explain why they can be addicting.

The capsaicin found in peppers also has medicinal uses. It relaxes the arteries (which lowers blood pressure) and can be used in creams as a topical pain reliever. Currently, capsaicin and capsaicin derivatives are used to treat arthritis, shingles, diabetic neuropathy, neuralgia, and as a pain reducer following surgery. Some studies have even shown that consumption of capsaicin-containing peppers reduces the amounts of clotting protein in you blood, thereby reducing a person's risk of having a stroke.

The *hotness* of a chili pepper is measured in Scoville units. These units were invented by **Wilbur Scoville**, a pharmacist, in 1912. To determine the "hotness" using Scoville units, a panel of 5 tasters sample extracts of the peppers that are diluted in sugar water. The dilution that can be detected by 3 of the 5 tasters is considered the heat level of the pepper.

The ratio of the extract dilution is the **Scoville unit**. For example, the jalapeno is usually detected by 3 of 5 tasters when diluted at a ratio of 1/2500 to 1/5000; the Scoville unit for the jalapeno is 2500 to 5000. Just to compare, the habanero pepper can have 100,000 to 300,000 Scoville units.

In this lab, you will be using a variation of Scoville's test to determine the *hotness* of several types of capsicum peppers.

## Materials

glass mortar & pestle  
5% sucrose solution  
weighing boat

5 2-dram vials with caps  
95% ethanol  
knife

graduated pipettes  
electronic balance  
various chili peppers

latex gloves

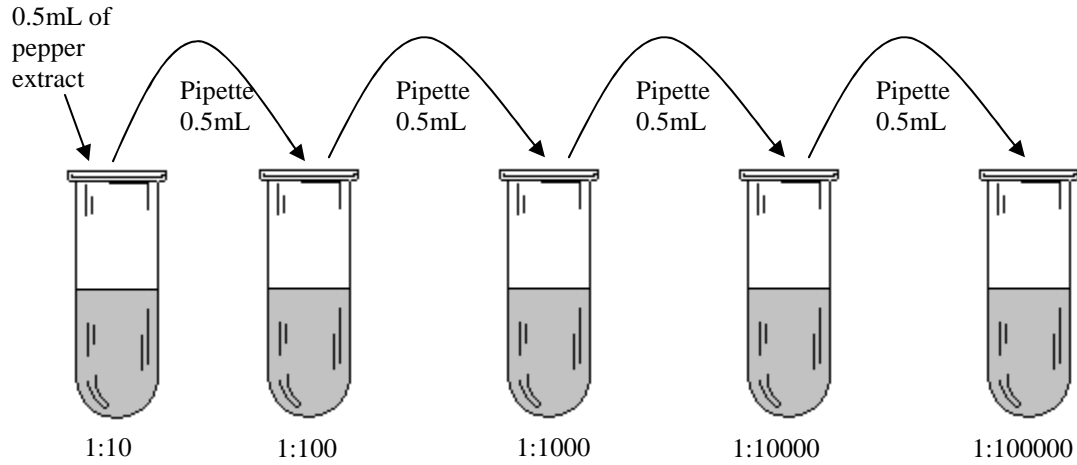
## Safety Precautions

Be careful not to contaminate any of your equipment, keep it safe for consumption of the capsaicin extract. Keep your hands **away** from your face and eyes.

## Procedure

1. Get into a group of 5 and obtain the necessary materials. Each person in your group should obtain a different type of pepper.
2. Label the dram vials 1:10, 1: 100, 1: 1,000, 1: 10,000, 1:100,000.
3. Fill each dram vial with 4.5 mL of 5% sucrose solution.  
*(If you are unsure about how to read the pipette, please ask.)*
4. Place the weighing boat on the electronic balance. Zero the balance by pushing the “zero” button.
5. Cut off a small piece of the pepper and place it in the weighing boat. You want a 5 grams sample of pepper. Cut off or add more pepper until the balance reads 5 grams (re-zero the balance if necessary).
6. Place the pepper sample in the glass mortar and add 5mL of 95% ethanol. Use the pestle to grind up the pepper in the ethanol.
7. Use a **clean pipette** to transfer 0.5mL of the extract into the vial marked 1:10. Cap and shake the vial.
8. Use a **clean pipette** to transfer 0.5mL of the extract in the 1:10 vial into the vial marked 1:100. Cap and shake the vial.
9. Use a **clean pipette** to transfer 0.5mL of the extract in the 1:100 vial into the vial marked 1:1,000. Cap and shake the vial.
10. Use a **clean pipette** to transfer 0.5mL of the extract in the 1:1,000 vial into the vial marked 1:10,000. Cap and shake the vial.
11. Use a **clean pipette** to transfer 0.5mL of the extract in the 1:10,000 vial into the vial marked 1:100,000. Cap and shake the vial.
12. Place a clean pipette in the 1:100,000 vial.
13. Perform the taste test with the other four members of your group. Using the clean pipette in the 1:100,000 vial to place a drop of the solution on each person’s coffee stirrer. All members should place the drop on their tongues and determine if they can detect the capsaicin.
14. Move the same pipette (you do not need a new one for each vial) to the next vial (1:10,000) and repeat the taste test. Continue until at least three people in your group can detect the capsaicin in the solution, then mark the appropriate box in the data table.
15. Eat an unsalted cracker and drink some water.
16. Repeat steps 12-15 until all 5 peppers have been tested.
17. Record the Scoville units in the data table. Remember that if capsaicin is detected at the 1:10,000 dilution, then the Scoville unit for that pepper is 10,000.
18. Wash and dry all of the materials and place them back in the proper place. Your box of materials should have the mortar & pestle, 10 dram vials, and 15 pipettes in it before you leave the room.

## How to perform the serial dilution:



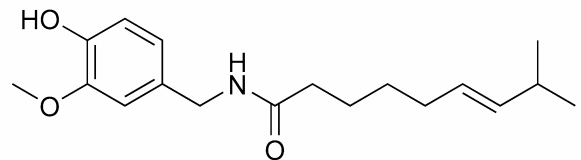
## Data Table

Mark the dilution for which 3 or more people could detect the capsaicin.

Name of Pepper	Dilution					Scoville unit
	1:10	1:100	1:1,000	1:10,000	1:100,000	

Rank the peppers from mildest to hottest:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_



8-methyl-N-vanillyl-6-nonenamide or  $C_{18}H_{27}NO_3$



# Texas **Spicy** Salsa

This recipe is bursting with flavor! It is fresh and spicy, and did I mention easy? This is the closest thing to restaurant style salsa you will find. The jalapenos and hot pepper sauce (e.g., Tabasco) add spice to the mix and the cilantro, lime juice, and green onions create freshness.



## Ingredients:

- 5 roma tomatoes, seeded and chopped
- 10 green onions
- 2 fresh jalapeno peppers, seeded
- 1/4 cup chopped fresh cilantro
- 2 tablespoons fresh lime juice
- 2 tablespoons hot pepper sauce
- 1 teaspoon ground black pepper
- 1 teaspoon garlic powder
- 1 teaspoon salt

## Directions:

In a blender or food processor, pulse the tomatoes, green onions, jalapeno peppers, and cilantro to desired consistency. Transfer to a bowl, and mix in the lime juice, hot pepper sauce, black pepper, garlic powder, and salt.