Time needed: 45 minutes

(and teach about emulsion!)

How to Make a Simple Vinaigrette Salad Dressing

Why don't oil and vinegar mix? What are emulsifiers? How do emulsifiers work to make oil and vinegar mix? What is the effect of vinegar or oil on lettuce greens?

Description

In this simple lesson plan students will explore how to make a simple emulsified salad dressing. At the same time, students will explore what emulsion is, how it is achieved and why it makes for superior salad dressing. Plan on introducing students to new vocabulary words: **emulsion, soluble and emulsifying agent.**

Glossary

Emulsion: An emulsion is a homogenized mixture of two or more liquids that are not dissolved into one another.

Emulsifying Agent: Substances that are soluble in both fat and water and enable fat to be uniformly dispersed in water as an emulsion.

Soluble: For example, vinegar is very insoluble in oil, and the two substances will quickly separate into two layers even after being shaken well. When a substance is soluble, it means it is able to be dissolved.

Materials

- **1 cup Vegetable oil** *(You can use olive oil, canola oil, sunflower oil or another vegetable oil)*
- **5 tablespoons Balsamic Vinegar**
- **1 tablespoon water**
- **2 tbsp Dijon mustard** *(Canada produces 90% of the worlds mustard)* **or Honey** *(a great opportunity to talk about bees)*
- **4 clear jars with lids**
- **2 funnels**
- **Lettuce greens or salad from your Little Green Thumbs garden**

Another option is to have enough jars for a pair or small group of students to mix their own salad dressing. This would increase the number of jars to 2 for every group, plus an additional 2 jars for your 'invitation'. Increase the amount of oil, balsamic, water and Dijon mustard by the number of groups.

Tip: if you don't have balsamic vinegar, you can add a few drops of food colouring to white vinegar, so that it stands out against the oil.

Little GreenThumbs

Invitation

Advanced Set Up

Pre-mix an emulsion of 1/4 cup vegetable oil, 2-tbsp balsamic vinegar, 2-tbsp Dijon mustard. If possible, blend these ingredients. If you don't have a blender, simply shake the mixture to emulsify. Have oil and vinegar and an empty jar at front of room with you.

Activity

Ask the students if they have heard the saying 'oil and water don't mix'. What does it mean? Do we know why it doesn't mix? Did you know the same is true about oil and vinegar, two key ingredients in salad dressing – they don't mix!

What is an emulsion? At its most basic, an emulsion is what you get when you force two things that don't mix easily into a homogenous mixture.

Investigation #1, Part A:

Pour ¼ cup Oil and 2 tablespoons Vinegar into the same jar at the front of the room (if all students or groups have a jar, you can have them do this as well). Show the children how one liquid stays on top of the other and don't mix.

Now show them the example of the already emulsified dressing. Let them know that oil and vinegar are also in the already emulsified dressing.

So, how do we get our oil and vinegar to emulsify (or mix)? Ask students for suggestions. If they don't say it, prompt them and ask whether they think you should shake it up? Shake it up and set it on the table next to the emulsified dressing. Tell them, you'll have to wait to see if they stay mixed over time.

It will take about 5 minutes at room temperature for the balsamic to start separating out.

In the meantime, start Investigation #2.

Investigation #2, Part A: Oil Slicks

Advanced Set Up

Prepare 3 small bowls of 4-5 lettuce leaves (if you have enough greens each table or group can have their own 3 bowls), or arrange 3 piles of 4-5 leaves on a plate.

In this investigation, you will explore what effect oil and vinegar have on salad greens when applied separately, using water as a control. **You will need about 12-15 leaves of salad greens, arranged in three piles on a plate (4-5 leaves each pile), or in 3 different bowls.** If you have enough greens, you can provide each group with 12-15 leaves and have them separate into three piles on a plate or into a separate bowl, though one demonstration will often be enough, and you can have each of the groups come to the front to investigate separately.

Ask students: *Have you ever eaten a salad that has wilted after the dressing is put on? Why do you think that happens? Is it the vinegar that makes the leaves wilt, or the oil?*

Have students make a prediction about what will happen when oil is added to greens, as well as when vinegar is added to greens or when water is added to greens. You might ask students to make a prediction in their journal, discuss as a small group, or as a class.

Have each group pour 1 tbsp of each liquid onto a separate pile of greens. Let this sit at room temperature for 10 minutes. It will take time for the results to show.

Now you will revisit Investigation #1.

Enough for 24 students

Salad Dressing Recipe

This basic vinaigrette recipe yields enough vinaigrette to lightly dress a salad for 24 students!

Ingredients:

- 1 cup vegetable oil
- 6 tablespoons vinegar
- 1/2 tsp of kosher salt
- 6 turns of freshly ground black pepper
- 6 tablespoons mustard (try Dijon) or 4-6 tablespoons honey

Directions:

Add all of the ingredients to a small mason jar, screw on the lid, and shake until blended. You can also whisk the ingredients together in a bowl or blend them together in a blender.
Taste and adjust seasonings if desired. Add to salad, toss, and serve.

Keep leftover dressing in a sealed jar in the refrigerator for 2 – 3 days.

Optional add-ins:

- 5-6 tablespoons fresh chopped herbs like dill, basil, parsley, cilantro, mint, or thyme *(dried herbs work, too, just use 8-10 teaspoons instead)*
- A finely minced garlic clove
- 15-16 teaspoons finely minced or grated ginger
- 3-4 tablespoons finely chopped shallots, scallions, or onion
- 5-6 tablespoons finely grated or crumbled Parmesan, Pecorino Romano, Gorgonzola, or feta
- ½ teaspoon of crushed red pepper flakes, 12 tablespoon horseradish, or 1.5 teaspoon Sriracha

Oil

You can use extra virgin oil, canola oil, sunflower oil, or vegetable oil. Canola is a great fat to help you absorb all the fat-soluble vitamins (A, D, E and K) in your fruits and veggies. It has a light, neutral taste that won't compete with other flavours and most of the world's canola is grown right here in Canada.

Emulsifier

Mustard and honey are great emulsifiers, and 75%-90% of the worlds mustard is grown in Canada! Try a rough ratio of 2:1:1 (oil:vinegar:emulsifier).

Vinegar

Any type on vinegar or citrus can be used for salad dressings. Try balsamic, red wine, white wine, or apple cider. You can also use citrus juice such as lemon, lime or orange, which acts as your acid (hydrophilic 'water-loving' molecules)

Herbs and Spices

You can add almost any spice or herb: tarragon, basil, garlic, salt, pepper, parsley, mint, cilantro, and so much more. What other herbs and spices can you think to add? What did you grow in your garden?

Investigation #1, Part B:

Have the students investigate the mixed oil and vinegar from the first demonstration. By now, the balsamic will start to have separated out from the oil.

Explain that oil and vinegar are like cats and dogs. We can put them together and stir them up, but eventually, like cats and dogs, they will stick to their own kind. This is because vinegar and oil are made up of very different types of molecules that are attracted to their own kind.

For older students, you could dive deeper into this scientific exploration and talk about the qualities of polar and non-polar molecules. For younger students, explain that vinegar has 'water-loving' hydrophilic molecules, and oil has 'water-fearing' hydrophobic molecules.

So, how do we get the two to mix, like you see at the front in the first mixture that was shown? There is one thing we can do: **emulsify!** Add an emulsifier that is attracted to both oil and vinegar. Emulsifiers are the hand-holders of the molecule world, or the feline-canine ambassador you could say. Emulsifiers contain both hydrophobic and hydrophilic regions and are able to attract and "hold hands" with hydrophilic (water loving) and hydrophobic (water fearing) molecules simultaneously. When the molecules are pulled together in this way, they form a special type of mixture called an emulsion. **Common kitchen emulsifiers include egg yolks, mustard, and honey.**

When you add an effective emulsifier, such as mustard, to oil and vinegar and mix thoroughly, separation of the oil from the vinegar will take much longer or won't happen at all.

Try mixing another jar with oil and vinegar, and now add mustard. Explain that mustard will be the emulsifier in this solution. You might choose to mention that Canada produces 75-90% of the worlds mustard each year!

Now shake up this emulsion. Shake the oil and vinegar only emulsion one more time too. Set them down together, and have students track how long they take to separate. As you can see, the container without the mustard separated more rapidly than the container with mustard.

Investigation #2, Part B:

Return to your investigation of the effect of vinegar, oil and water on the leaves of the salad. The greens dressed with plain oil should have wilted significantly faster than those dressed in vinegar. In fact, the vinegar-coated greens should fare pretty much just as well as those dressed in water!

The truth is that salad greens, like any leaf, spend their time exposed to the elements, and as such, need to protect themselves from the rain. They do this via a thin, waxy cuticle. It's like a little built-in raincoat for the leaf. On the other hand, this oily cuticle makes it very easy for the olive oil to penetrate the spaces between cells (dogs and dogs stick together, remember), causing damage to the leaf.

Investigation # 3: Ok, but what does this really mean for our salad?

Advanced Set Up

Take your two funnels and place them each into a glass jar. Ensure that the bottom of the funnel is not blocked by the bottom of the jar. Put one ounce (about 10 leaves) into each funnel.

At this point, your students might be thinking what you're thinking: this is all very neat, but what difference does it make to our salad?

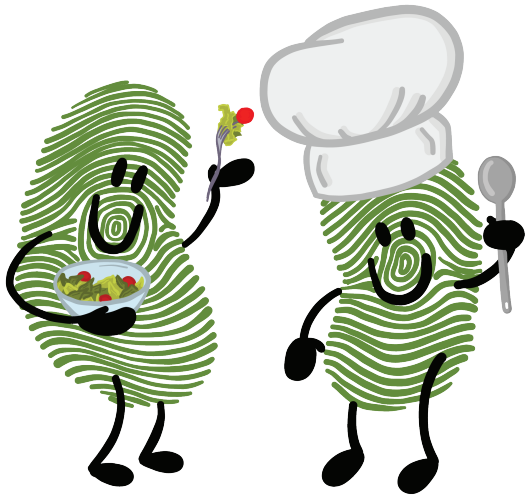
Ask students: *what do you think would be the difference to their salad if they used an emulsified or non-emulsified dressing? Let's investigate!*

Dress the first salad in the funnel with the homogenized salad dressing, which contains mustard.

Dress the second salad in the funnel with the mixture of oil and vinegar, without the mustard. Place each funnel and jar side by side so that the students can observe.

Almost immediately, the non-mustardy salad on the right will start dripping a steady trickle of vinegar into the cup, while the well-emulsified dressing should stay firmly in place.

After a few minutes, you might prompt student to examine how the dressing clings to the leaves. On the batch of salad with the vinegar and soil mixture (without mustard), you might see drops of vinegar suspended above the leaf by larger drops of oil. Ask students to try lifting up a leaf, which should prompt a cascade of vinegar to tumble back into the funnel, while the oil will stay clinging to the surface of the leaves. What do we know that oil alone will eventually do to the salad leaves? (what we learned in Investigation #2)



So what does this REALLY mean?

Unless you emulsify your vinaigrette, you end up with a pile of leaves dressed in oil, and a pool of vinegar at the bottom of the salad bowl. This will affect the flavour of your dressing, but also the badly emulsified vinaigrette salad leaves should show signs of wilting, while the salad dressed in the proper vinaigrette should still look crisp and fresh-tasting. The power of emulsification to help both oil and vinegar cling tightly to the leaves.

What is the ideal way to mix the emulsion? Some advocate slowly whisking in the oil to the vinegar and emulsifier. Others shake it up in a mason jar. Still others insist on the blender. A blender will give you the tightest emulsion, which will last closer to a week, while the shake-it-in-a-jar version should last around 30 minutes (though could last much longer).

When finished, you can store your dressing in the fridge. Simply shake it up before you use it. In reality, your dressing only has to stay emulsified long enough than it takes to eat a salad, which for some students could be a looooonnng time!