Water, Water Everywhere—Even in My Food!

Introduction: Determining the Percentage of Water in a Substance

Meaning of Percent:

Percent tells the ratio of each part of something to 100 of the whole thing. For example, to say that 15% of a piece of meat is fat means that there are 15 grams of fat for every 100 grams of meat. Similarly, you can calculate your score on a quiz by seeing how many points you achieved of the total possible points, even if there were less than 100 points on the quiz. If you scored 40 points on a quiz that was worth 50 points, your percentage on the quiz was 40 divided by 50 or 0.80 (x 100) = 80%.

Calculating Percent:

In order to calculate a percent, the quantities of both the part and the whole must be measured in the same units. To perform the actual calculation, the quantity of the part is divided by the whole quantity, and the result multiplied by 100%.

Why Percent is Important:

Percent is important to chemist in a number of ways, but especially as a means of providing information about chemical compounds. Chemical compounds are pure substances composed of two or more elements. The chemical composition of a compound tells the percentage by mass of each element in the compound. For example, water is composed of the elements hydrogen and oxygen. The composition of the water is 11% hydrogen and 89% oxygen. This means that in every 100-gram sample of water, there are 11 grams of hydrogen and 89 grams of oxygen

Activity Description:

In this activity you will be able to determine the percentage of water in a vegetable as well as the percentage of water in a common chemical substance called Epsom Salts, which is found in hardware stores, grocery stores and pharmacies.

Experimental Design:

You will be planning and designing an experiment in which you will gently warm/heat a vegetable (or more than one) to remove the water in the vegetable. As you may

know, many vegetables are "wet" when you slice them. The wetness is water that has been incorporated into the vegetable as it grows. Even vegetables which appear to be dry like potatoes have water in them which give them moistness.

How you perform the experiment depends on the equipment you have available at school and at home. If you do not have a dehydrator or air fryer at school, you can use your oven at home and transport the vegetables back and forth to school for weighing on a balance. The vegetables which are suggested are ones that have plenty of water in them. You may do more than one vegetable, but whatever vegetables you choose, you should do two trials for each.

Materials:

Source of heat:

- Air fryer (can use as dehydrator)
- Food dehydrator
- Toaster oven
- Oven on kitchen stove (DO NOT USE A MICROWAVE OVEN or heat on a burner or hot plate—that is too much concentrated heat and the food will burn—a chemical reaction which you don't want to happen)

Vegetable of choice: (you may want to do two of them, but don't need to do more than one)

Tomatoes
Green peppers
Cucumbers
Squash
Potatoes (white or sweet)

Balance
Aluminum foil, or aluminum pie plate
Knife to cut up the vegetable

General Procedure:

After you have chosen your vegetable, make sure that the surface is clean and dry.

1. Determine the mass of the vegetable in grams using the balance
2. Determine (and record) the mass of the container that will be used for the vegetable. If pie plates are not available, then a piece of aluminum foil can be used as a container.
3. Slice or chop the food carefully and place on the container.
4. Determine (and record) the mass of the container and the food in it using the balance
5. Using your preferred method of gently heating the food in the container, warm the food until it appears totally dry. This may take overnight or over several day's time depending on the method. Your teacher will have suggestions depending on the method used.
6. After heating and when the substance appears dry, allow it to cool and reweigh it in its container. Record that mass.
7. Place the substance back in the source of heat to remove more water. Reweigh it—if it is close to your last measurement of mass, then stop. If it is substantially less, then heat it again because all of the water has not been removed.
8. If you perform two trials, they can be done at the same time, if your heating device is large enough.
9. Different groups of students may choose different vegetables to test.

Data Table:

TRIAL 1

Mass of empty container (g)	
Mass of container plus food substance before heating (g)	
Mass of container plus food substance after heating (g) first time	
Mass of container plus food substance after heating (g) second time	
Mass of container plus food substance after heating (g) last time	

TRIAL 2

Mass of empty container (g)	
Mass of container plus food substance before heating (g)	
Mass of container plus food substance after heating (g) first time	
Mass of container plus food substance after heating (g) second time	
Mass of container plus food substance after heating (g) last time	

Calculations Table:

TRIAL 1

Beginning Mass of vegetable (g)	
Mass of water lost (g)	
% of water in the vegetable	

TRIAL 2

Beginning Mass of vegetable (g)	
Mass of water lost (g)	
% of water in the vegetable	

Questions to Answer:

1. What was the percentage of water in your vegetable?

2. How does that compare with other vegetables in your class?

3. What is the "correct" percentage of water in your food? **

4. How did your results compare with those accepted values?

Resources: http://apjcn.nhri.org.tw/server/info/books-phds/books/foodfacts/html/data/data2b.html
https://www.berkeleywellness.com/healthy-eating/food/article/how-much-water-your-food
https://www.myfooddata.com/articles/vegetables-high-in-water.php#vegetables-high-in-water