Minnesota Farmers' Market Association
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Calibrating and Using the Elitech GSP-6 To Test Foods for Water Activity A_w

Congrats on buying your water activity meter kit!

We wish you all the best as you perfect your recipes to sell as a cottage food in Minnesota. There are cheaper water activity meters (they do NOT work!) and the really good ones are over $25,000. This Elitech GSP-6 that the University of Minnesota Food Lab researched and developed[1] with the testing protocol outlined in this document is an excellent balance of cost and effectiveness.

What's in the Aw Kit

Your kit should arrive with the following items:

1. Instructions on how to calibrate and use the GSP-6 meter.
2. The box with the GSP-6 meter in it
    a. The instructions that come with the meter we do NOT use since we don't use the meter in the manner the manufacturer intended
3. The Food Sample jar with the lid that has the 2 probes inserted
    a. pointy one that measures the temperature
    b. round one that measures the humidity

    NOTE: if the probes move too easily through the lid, you can apply a silicone viscous gel (*thick* gel) on the rubber disc around the probes to ensure no outside air enters in the sample jar. Be careful if removing the probes from the lid, to ensure the silicone does not run into the sensor opening on the humidity probe.

4. 4 jars with lids and inner liners, color-coded to match the 4 tubes of standards you will use to annually calibrate the meter
    a. Red = .25
    b. Green = .50
    c. Blue = .76
    d. Purple = .92
5. 4 tubes of standards you will use to annually calibrate the meter
    a. Red = .25
    b. Green = .50
    c. Blue = .76
    d. Purple = .92

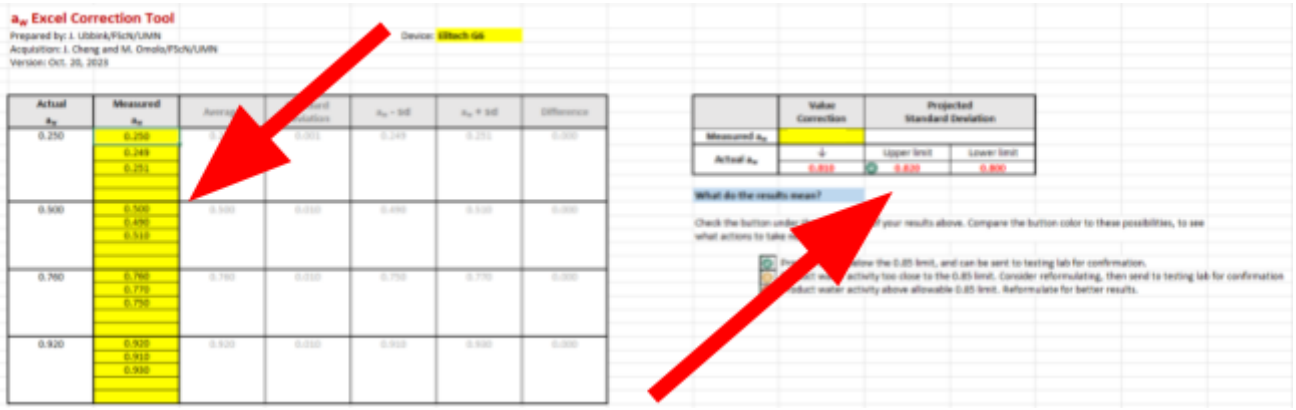
[1] The original research on using the Elitech GSP-6 was funded by a 2021-2023 grant from the University of Minnesota Healthy Foods, Healthy Lives Institute. The grant was given to the University of Minnesota Food Science and Nutrition Department, and Extension. Research was conducted by Dr. Job Ubbink, Dr. Morrine Omolo, Graduate Research Assistant Janice Cheng.

Calibrating the Elitech GSP-6 annually

1. It will take 30 hours to calibrate the meter.
    a. You can spread that process over a few days - just make sure you complete recording all 5 measurements of a standard before stopping.
2. Record dates you calibrate your meter: _____
3. Remove the lid and inner liner with the 2 probes from the Food Sample jar.
4. Then remove the lid and inner liner from the red .25 jar.
5. Open the red .25 standard tube and squeeze the entire solution out of its tube into the matching .25 jar.
6. Tighten the lid with the two inserted probes onto the red .25 jar.
    a. Start your timer for 1.5 hours.
7. At the end of 1.5 hours, record the middle number on the meter in the first box below in the .25 Red column.
    a. On the meter, it's a percentage, so move the decimal point to the left 2 spots and write that number in the #1 cell in the chart. For example in the display to the right, 60.5% becomes .605 in the chart.
8. Repeat this process 4 more times - recording the number every 1.5 hours, for #2 through #5.

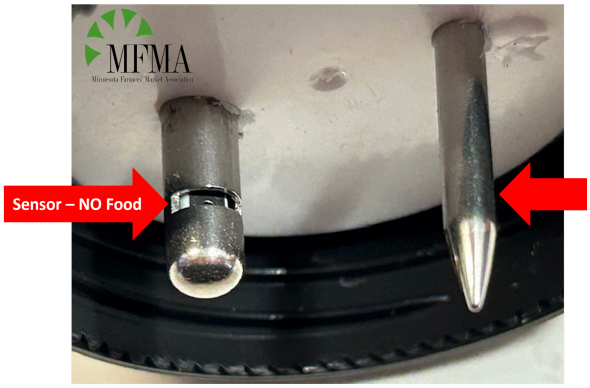
Reading from Elitech GSP-6	Standard .25 Red	Standard .5 Green	Standard .76 Blue	Standard .92 Purple
#1				
#2				
#3				
#4				
#5				

9. Once you've finished with the red .25 standard you can safely pour that standard down the drain, rinse, dry and put the red .25 lid and jar away.
10. Repeat this entire process with the green .50 jar and .50 standard, then the blue .76, and finally the purple .92.
11. Email info@mfma.org to get your copy of the **"A_w Excel Correction Tool"** (A_w ECT). The A_w ECT only works correctly if emailed; it loses some functionality if downloaded or used as a Google Sheet. The functions that are lost if not used in Excel are the green, yellow, and red icons – the mathematical formulas still work.
12. Type the numbers you recorded on this sheet into the A_w ECT in the corresponding cells in yellow.
13. The table to the right in the A_w ECT will automatically formulate the standard deviation of your GSP-6. You are now ready to test any food that requires a water activity value.



14. Save the A_w ECT so it's ready for you to use when needed to test food.
    a. You could add the date to the name of the file, as a reminder to calibrate your GSP-6 in 1 year. For example: "A_w ECT 12-01-2025."

Testing Foods for Water Activity (A_w)



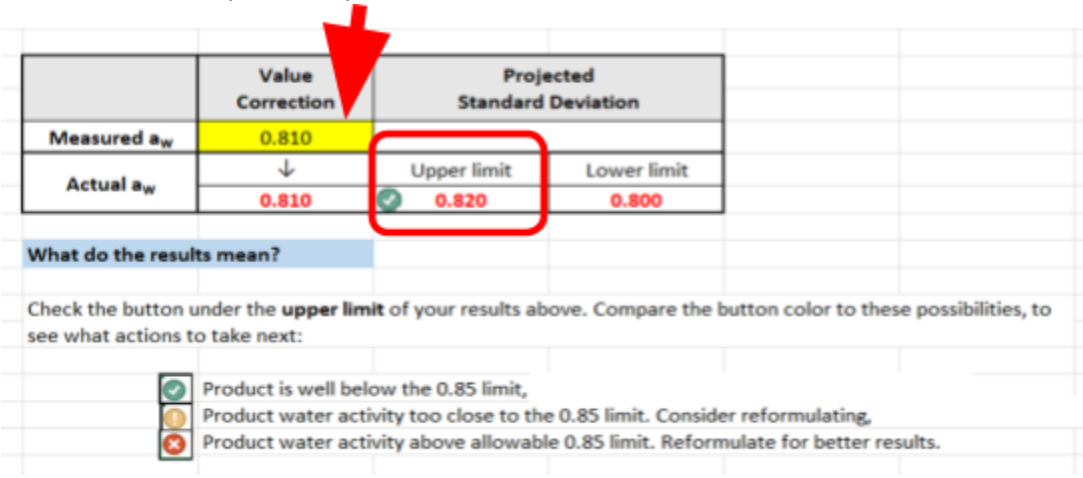
1. Clean, sanitize, rinse, and dry the "Food Sample" jar.
2. Place a small amount of food into the bottom of the jar, ensuring no food will touch the probes in the lid that has the probes inserted.
    a. If food gets into the opening on the wide probe, the GSP-6 may no longer work correctly.

Preparing Your Food Sample

For the safest results, take a small portion of your food from the moistest part of your food.

- Small portion: must fit in the 2-inch "Food Sample" jar, big enough to get a good reading but small enough so it doesn't touch the probes in the lid.
- Moistest part, for example:
    - the middle of the banana bread, not the crust
    - equivalent portions of the frosting + cupcake
- Safest results: to keep your food "non-potentially hazardous," so it is safe at room temperature and won't cause a foodborne illness, you should err conservatively, so you don't get a false reading on the meter.

3. Tighten the lid with the probes onto the "Food Sample" jar and start your timer for 2 hours.
4. At the end of 2 hours:
    a. Open your A_w ECT spreadsheet.
    b. If the display screen isn't active, press the button on the GSP-6. The middle number will appear as a percentage.
        i. You need to convert that percentage to a fraction by moving the decimal point 2 spots to the left. Example: 84.3% becomes .843
        ii. Write that number down.
    c. Repeat the step above two more times, to get 3 readings total over 6 hours.
        i. Average those 3 readings to get the most accurate A_w value for your food using your GSP-6.
    d. Type that averaged number into the yellow cell as shown below. The embedded formula will create the standard deviation specific to your GSP-6.



	Value Correction	Projected Standard Deviation	
Measured a_w	0.810		
Actual a_w	↓	Upper limit	Lower limit
	0.810	0.820	0.800

What do the results mean?

Check the button under the **upper limit** of your results above. Compare the button color to these possibilities, to see what actions to take next:

- Product is well below the 0.85 limit,
- Product water activity too close to the 0.85 limit. Consider reformulating,
- Product water activity above allowable 0.85 limit. Reformulate for better results.

What the Numbers Mean

Once you type your fraction number into the yellow box, the spreadsheet is formulated to use the standard deviation specific to your GSP-6 that you created when you calibrated it. It will adjust your real time number to reflect a more accurate water activity value, based on your specific GSP-6.

The critical number to refer to is the "Upper limit" number in the chart - that tells you if your food is within the .85 water activity limit to make your food eligible to be sold as cottage food under Minnesota's cottage food law. If the food is well below the .85 limit, a **green** ✅ appears, and your food qualifies. Record this test in your Food Test Log in case a food inspector questions the A_w value of your food. Your record could include date, water activity value, name of the recipe.

However, if either the **yellow !** or the **red** ☒ appears, you should reformulate your recipe to make it dryer or sweeter or saltier, and then retest to see if it can qualify under .85 water activity. If it does not, that food cannot be sold as a cottage food in Minnesota; you would need a food license and a commercial-grade kitchen to make this food.

Other Options

You can always submit a food sample to a food lab for a test. Please see the list of food testing labs in our cottage food manual..

Available to Order

MFMA is selling at cost to cottage food producers the following items to use the Elitech GSP-6 correctly. To order, go to the MFMA Store.

1. The whole kit
2. The partial kit if you already have the Elitech GSP-6: the needed 5 jars to calibrate, and the calibration standards
3. The calibration standards you'll need to calibrate every 12 months

Whole Kit

Partial Kit

4 Calibration Standards

Pro Tips

1. After you write your values in the table on page one, save this paper in your water activity kit container as a backup to your A_w ECT file.
2. Use this Food Test Log or something like it to record your food samples as you test them.

What is Water Activity (A_w)?

Water activity (Aw) refers to the amount of free water that is available in food for microbial growth. It is a measurement of the water that is not bound to components in the food, and therefore available for microbial growth.

Water activity is measured in values from 0.0 to 1.0. The lower the Aw value, the more "dry" a food item is considered. However, water activity should not be regarded as moisture content. The scientific definition of water activity refers to its measurement in equilibrium relative humidity. You can think of water activity as the humidity of a food.

When water activity is above .85, several pathogenic bacteria can grow and may cause food poisoning. MN's cottage foods law requires cottage foods to have an A_w value of .85 or less to prevent the growth of potentially harmful bacteria. The water activity of a food product can be lowered in a variety of ways.

- Salt and/or sugar can be added. Both salt and sugar work by binding with free water in the food product, making that water no longer available to microorganisms for growth. Salt is more effective at binding water than sugar, but the influence of taste should be considered before choosing to alter your recipe.
- Water activity may also be decreased by removing water from the food product. This can be an amount of time and allowing more water to evaporate.
- Water can also be removed post-cooking through dehydration. This method is often used to preserve fruits and meats. Dehydration works by removing free water, reducing the amount that is available for microorganisms to grow.

Excerpted from "Understanding the Water Activity of Your Food," Virginia Cooperative Extension, 2012.