



MANAGING BY WATER ACTIVITY

Synchronize quality, maximize profits
with a cleaner, leaner quality metric.

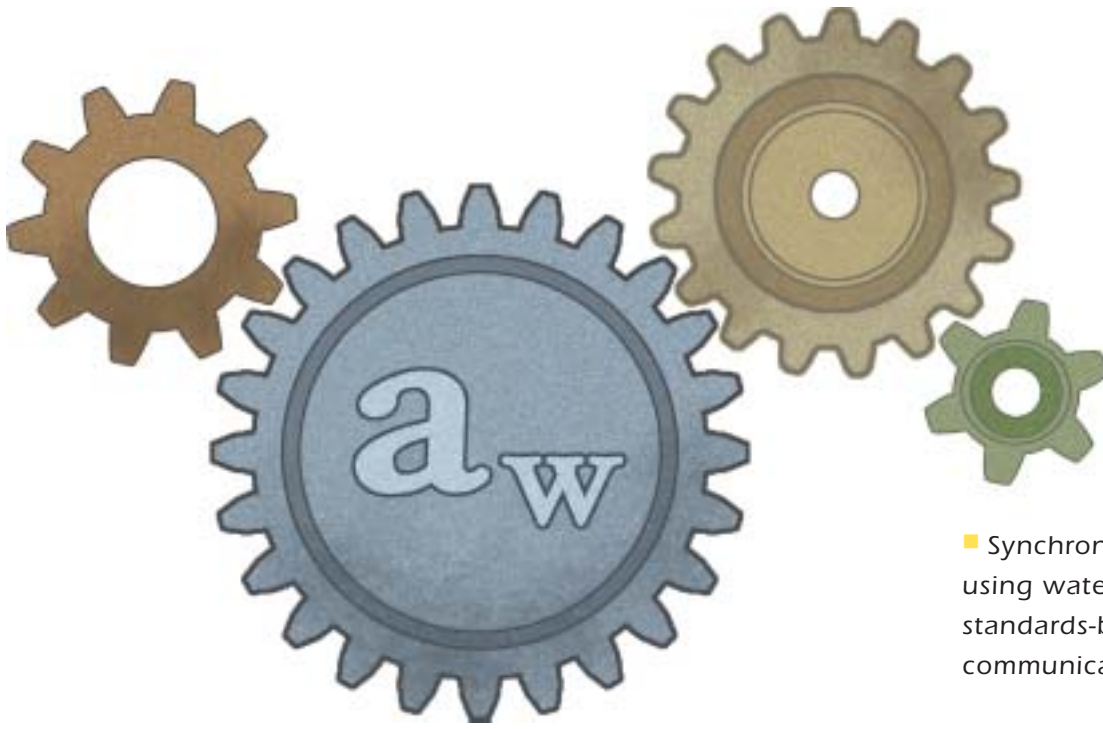
www.wateractivity.com



“My suppliers quote me what the moisture content was when the ingredient shipped.

That number’s meaningless.

They can say **whatever** they want because we don’t have reliable standards to measure against.”



■ Synchronize your operations using water activity—a clear, standards-based way to communicate about quality.

MANAGING BY WATER ACTIVITY

“The Atomic Clock of Quality Metrics.”

DO YOU USE a universal quality metric to communicate from R&D to production, between plants and even with your suppliers?

Moisture Content is Relative

Some people try to use moisture content. But even though every moisture meter has some kind of *calibration* mechanism, scientifically speaking, moisture content is a relative measurement. There’s no independently verifiable zero to the moisture content scale, so

there’s no independent standard to calibrate moisture content meters or methods to each other.

Water Activity is Absolute

By contrast, water activity is an absolute measurement. Saturated salt solutions have known water activity values. Any chemist can mix one up; any scientist will agree on what its water activity is.

Synchronizes Communication

You can use these saturated salt standards to verify the accuracy of your water

activity instrument. That makes water activity a universal metric.

Universal Quality Metric

It’s as if everyone across your organization sets their watch to the same atomic clock. That synchronization keeps everything running smoothly.

STANDARDS-BASED QUALITY METRICS

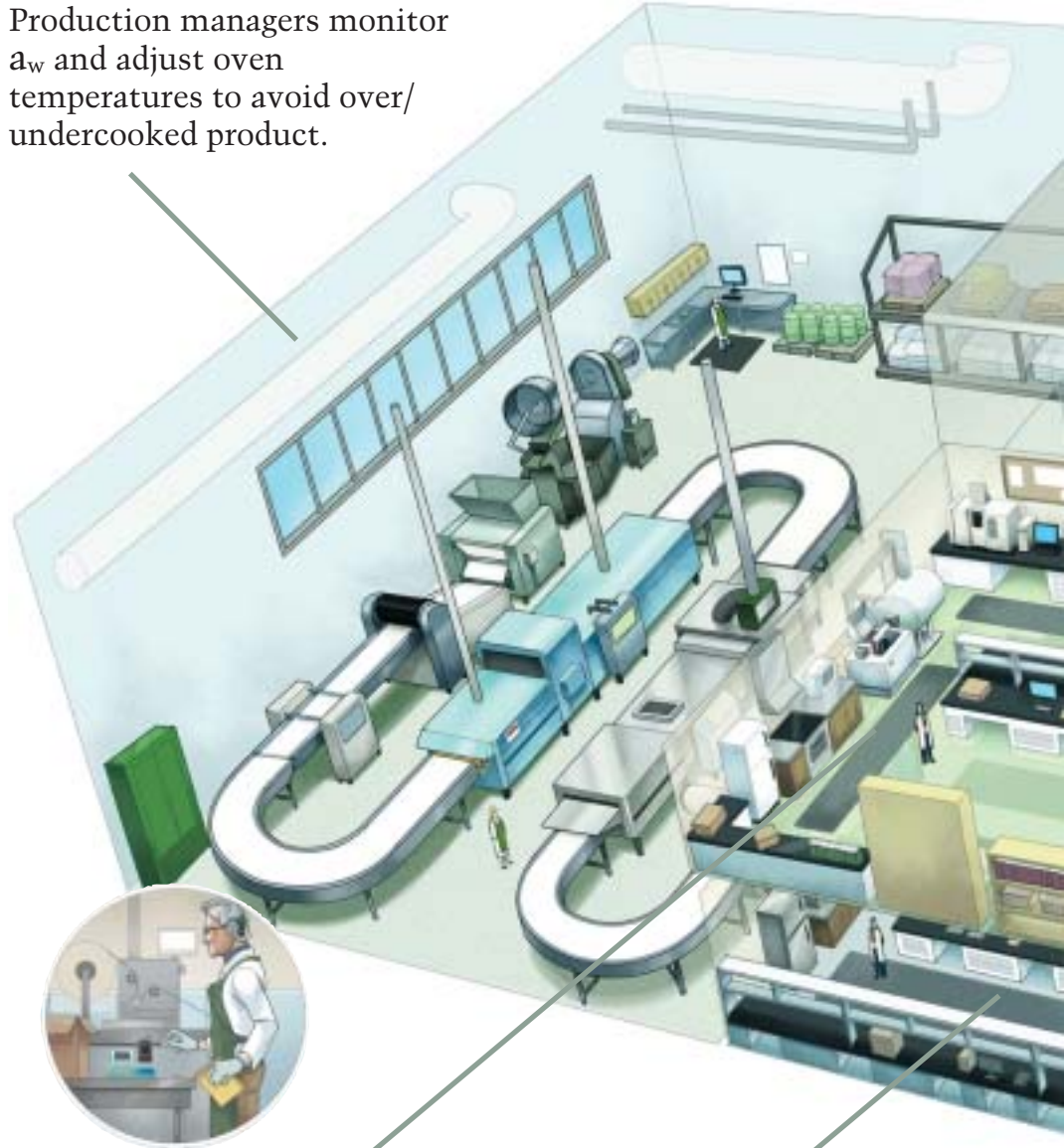
Yardstick for Quality

WATER ACTIVITY is directly related to rates of mold and microbial growth. It's also directly related to many of the chemical reactions that change taste and texture to make your product unacceptable.

And because water activity is based on scientific standards, it's a reliable, universal way to communicate about quality.

■ Production

Production managers monitor a_w and adjust oven temperatures to avoid over/undercooked product.



■ QA/QC

Quality Assurance verifies that lots and batches comply with all specifications, including HACCP water activity specs and quality specs set by R&D.

■ R&D

R&D uses isotherms and a_w to formulate products with optimum taste, texture, safety, and shelf life, creating relevant specs for each product.

■ **Shipping**

Finished product is released based on water activity specification.



■ **Incoming Ingredients**

Isotherm testing establishes optimal a_w values for incoming ingredients. Raw materials a_w specs are checked before acceptance. Isotherms determine storage parameters to eliminate materials waste.



■ **Management**

Uses standards-based quality metrics to evaluate performance and reduce variation and waste.

R&D CASE STUDY

Very Cherry Protein Bar

SETTING MEANINGFUL SPECIFICATIONS



RESEARCH & DEVELOPMENT

WATER ACTIVITY HAS a well-established relationship

with many of the chemical reactions that change the taste and texture of food products, including:

- Lipid oxidation (rancidity)
- Loss of crispness and crunchiness.

- Staleness and hardening.
- Off-flavors and odors.
- Vitamin degradation.
- Glass transition reactions that lead to gumminess, caking, and clumping.
- Moisture migrating from

one component to another causing texture changes and structural instability.

The case study shows how one R&D lab used water activity to set meaningful specifications—water activity specs based on the reactions that end shelf life.

Problems

▶ **If the cherries, nuts, and cake-like part of the bar are at different water activity levels, moisture migration will cause texture changes.**

▶ **Dried cherry supplier specs 13 to 15% moisture content for cherries. Component mixing model shows all components need to be at 0.57 a_w for stability within the bar.**

▶ **Protein powder tends to clump in the hopper, forcing the line to shut down. Plant manager wants to stop having to bang on the pipes.**

▶ **A batch of nuts that met moisture spec on arrival molded in storage. Working with India-based supplier to tighten spec, but worry that there may be a repeat.**

Solutions

R&D uses isotherms to match water activity of fruit, cake, and nuts. Accelerated shelf life testing sets the water activity spec for the finished product. Isotherm testing allows precise packaging calculations.

R&D runs an isotherm on the dried cherries. At 0.57 a_w , they will have 17% moisture content. Supplier specs set at 0.57 a_w and supplier requested to provide water activity data as well as moisture content.

R&D uses an isotherm to pinpoint protein powder glass transition at 0.43 a_w . Receiving tests powder before accepting delivery, monitors storage conditions and eliminates clumping in the hopper.

R&D uses isotherm to relate the historic moisture content (5%) to water activity. With current spec, dangerous water activity levels fall within the margin of error. R&D specs a water activity instead of moisture content. Supplier certifies water activity before shipping; receiving tests water activity on arrival before accepting delivery. No more mold.

To talk to a food scientist about your specific application, call 1-509-332-5599.

CASE STUDY

Components

Dried Cherries
Almonds
Protein Powder

Goals

Select Best Packaging
Determine Shelf Life

Challenges

Staleness
Texture Changes
Microbial Growth

STANDARDS-BASED QUALITY METRICS

If you can microwave a burrito, you can run a highly accurate water activity test.

PLANT PRODUCTION FLOOR

IN PRODUCTION, a water activity meter gives you almost instant feedback for process control.

Easy to Use

Production workers don't need to understand the science or have lengthy training. Anyone who can microwave a burrito can run a highly accurate water activity test.

Precision Metric

Using water activity, you can measure at the line with the same scientific standards you get in R&D or in the QA/QC lab.

Consistent Quality

By standardizing the measurement, you know you are making exactly the product designed by R&D.





Water Activity and Regulatory Compliance

Water activity is not just a check on specs from R&D, but also a critical control point in HACCP plans. Water activity is an FDA-approved safety measurement and an ANSI/NSF standard.

As a reliable measure of microbial susceptibility, water activity data can be used to show compliance and demonstrate product safety.

QUALITY ASSURANCE AND CONTROL

RELIABLE, REPEATABLE INFORMATION
QA/QC is about making consistent, reliable products from inherently variable natural ingredients. Problems and surprises are part of the process.

Eliminate Variability

Using a standards-based quality metric like water activity eliminates the variability in the measurement itself.

Identify Problems

It clears up the picture and lets QA/QC find the sources of problems and variations so they can correct them.

**Synchronize
your operations:
three key
instruments**

**Want to talk about your specific application?
Call 1-509-332-5599.**

**AQUA
LAB**
BY DECAGON

FAST, ACCURATE WATER ACTIVITY

Administrative Functions can be set to control access to data.

Easy to Clean

The sample chamber lid flips up so contaminated sensors are quick to spot and easy to clean.



AquaLab 4TE
Scientific accuracy
for everyone.

Use (Almost) Anywhere

Internal temperature control lets you set a measuring temperature between 15°C to 50°C and use the instrument anywhere—even outside a climate-controlled facility.

Secure Data

The 4TE stores time, date, and user information with every measurement and calibration, and can store up to 10,000 secure data points.

Speed and Accuracy

Measure water activity in 5 minutes or less (average read time: 2.5 minutes) with $\pm 0.003 a_w$ accuracy.

Use AquaLab to get lab-quality water activity measurements at the line, receiving dock, processing plant, storage facility—anywhere you need to verify the safety and quality of your products and ingredients.

The AquaLab 4TE is:

Easy to Use. Anyone, from a researcher in the lab to an operator at the line, can measure water activity in 5 minutes or less with $0.003 a_w$ accuracy.

Fast and Accurate. AquaLab is the fastest, most accurate water activity meter available.

Verifiable. Confirm AquaLab performance by using independently verifiable water activity standards.

Watch a video demo of the AquaLab 4TE:
www.wateractivity.com/info

**AQUA
LAB**
BY DECAGON

MOISTURE CONTENT + WATER ACTIVITY

Non-destructive

No chemicals, odors, or high temperatures.



AquaLab DUO

Complete
moisture analysis.

Precise

Up to 10x the precision of typical moisture meters.

Fast

Less than 5 minutes for most samples (average read time 2.5 minutes). Custom programming for your products included.

Use Anywhere

Temperature controlled for use at the line and the receiving dock.



Is moisture content an important part of your specs?

AquaLab DUO can give you dew point moisture content—moisture content readings comparable to your historical numbers but calibrated to water activity's independently verifiable third party standards.

Dew point moisture content is:

Highly accurate. Precision varies with the product being tested, but for many products, dew point moisture content has 10x the precision of a typical moisture meter.

Verifiable. DUO's moisture content readings are comparable to your historical numbers, but are calibrated to water activity's independently verifiable third party standards.

Simple to perform. Operators vary in education, training, and skill. DUO eliminates that variability from the measurement. Anyone who can microwave a burrito can use DUO to measure moisture content with scientific-grade accuracy.

Secure Data

Administrator passwords and access restrictions ensure the integrity of your data.

Get moisture content calibrated to water activity's independent third-party standards. Call 1-509-332-5599 to learn more.

COMPLETE MOISTURE ISOTHERM

Set Specifications

Determine the most stable water activity for your food product and predict reactions and textural changes that end shelf life.



AquaLab Vapor Sorption Analyzer

Guide Formulation

Map out how an ingredient or recipe will respond as you change formulation.

See Details

Typical isotherms have fewer than a dozen points. AquaLab Vapor Sorption Analyzer generates over 100 for each isotherm curve.



High Resolution Isotherm in Two Days

Isotherms are the moisture schematic of food products. They tell the hidden moisture story. Using isotherms, you can:

Diagnose and solve problems. After thirteen years of successfully shipping pecans dried to 5% moisture content, a grower has a crop that molds in transit. An isotherm tells him why (and helps him avoid spoilage issues in the future).

Formulate intelligently. A confectioner formulates and freezes a cake, but on thawing it becomes soggy and the icing slides off. Isotherms give him the information he needs to design a better product.

Maximize safety and profit. A sports drink mix manufacturer wants to package to ensure a two year shelf life while still minimizing packaging costs. An isotherm gives him the numbers he needs for reliable packaging calculations.



Measure Shelf Stability

Predict how abuse conditions like high humidity will affect shelf life.

Read how isotherms can solve problems and boost profits: www.wateractivity.com/info

STANDARDS-BASED QUALITY METRICS

How do you measure quality?

CHOOSING THE BEST YARD STICK

Water activity is the right quality metric because:

■ **It has stunning scientific credentials.** Most people understand its relationship to microbial stability. Fewer realize that it has direct relationships with many of the reactions that end shelf life. It can help you scientifically predict quality.

■ **It's a test anyone can run to precise scientific standards.**

If you can microwave a burrito, you can measure water activity to $\pm 0.003 a_w$.

■ **It's standards-based.** Unlike moisture content, water activity has a scale with a known zero. Measurements aren't relative—they're absolute. You can compare water activities between different departments, different factories, and even different companies no matter where they're located.

Most quality specifications describe *how* to make a product, but not *why*. Water activity makes specifications meaningful—relates them directly to the reactions that end shelf life.

Call me at **1-509-332-5599** if you're ready to find out how water activity can make your operations run more smoothly.



Scott Campbell
AquaLab Product Manager



AquaLab instruments are used by over 80% of the top 100 food companies to ensure the safety and quality of their products.

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