



Medallion Laboratories

INFO@Medlabs.com

Phone 800-245-5615

Technical Bulletin

By Collin Consdorf

As either food industry professionals or as consumers, we all have experience regarding how a packaging moisture barrier is used to maintain the quality of a food product. As consumers, we've gone to our pantries and discovered once crispy crackers that have become soggy or once succulent dried fruits that have become tough. Perhaps we've deemed these products to be of unacceptable quality to consume ourselves or serve to our families. In this instance, we may blame ourselves as consumers for not doing an adequate job of re-closing the package after we've opened it. But as food industry professionals, are we doing all we can do to ensure that our products are reaching the consumers' pantry at optimal quality? Medallion labs can help you understand the quality implication regarding selecting a moisture barrier film for your product. To do this we need to run some simple storage tests that will help us understand: the moisture tolerance of your product, the actual moisture barrier our package is providing, then apply this information to pertinent storage environments with classic packaging equation (1).

MOISTURE TOLERANCE OF A FOOD

To understand this aspect of our product we need to know two things; what moisture our food starts out at, and what moisture we no longer want the product available to the consumer. We typically refer to these as the production moisture range and the storage moisture range. For example a breakfast cereal containing dried fruit, such as a raisin bran, the production moisture range for the blended moisture of the flakes and cereal may be around 8% or 9%. This is the moisture the product will be at when it leaves the plant. The flakes may become very tough at around 10.5% blended moisture and the raisins may become tough at around 6.5% to 7% moisture. Thus we must select a packaging film that provides adequate protection to ensure we stay within the storage moisture range over the shelf life of the product.

What is the storage moisture range for a product? We can provide some fundamental information that will help you make this critical business decision. This is generally done by generating a moisture sorption isotherm at pertinent temperatures on the product. This will provide some basic information on texture and moisture as a function of water activity and storage humidity. This basic information of product texture as a function of moisture can be further tested and refined in a simple storage study, in which packaged product is exposed to a humid storage environment and a dry (low humidity) storage environment. DOD (Degree of Difference) sensory scores, initial analytical moisture values, and storage moisture values generated by package weight change will provide key insight to the moisture tolerance of your food.

MOISTURE BARRIER OF THE PACKAGE

The first indication we have regarding the moisture barrier protection provided by the package is the WVTR (water vapor transmission rate) value stated in the packaging film specification. While this is a good and convenient place to start, it rarely provides the entire picture we need to understand the product quality consumers will be experiencing. There are two issues with applying the specification WVTR value to moisture limited shelf life questions. First, this value is generally expressed as a maximum value. Film manufacturers typically produce their films at a lower (better barrier) WVTR to prevent any lots of film from being rejected. Thus the WVTR specification is typically one end of a classic bell shape curve, with the actual film average being two or more standard deviations of production variability under (better) the stated specification value.

The second consideration is that we need to understand how the film to package conversion process impacts the moisture barrier of our finished package. An excellent packaging production process may result in finished packages with almost the same package WVTR as the film WVTR. A less controlled process may result in finished packages with only the fraction of the barrier of the film. The simple moisture by weight gain study described earlier will allow us to calculate the average and the range of WVTR for the finished package. This information may be applied to help understand the actual moisture barrier protection provided by your finished package. Knowing this information is critical to understanding the product quality our customers will see and ensuring you are getting the moisture barrier protection you are paying for from the packaging film.

APPLYING THE INFORMATION

Once we understand the moisture tolerance of our food and the barrier protection provided by the finished package, we can apply a modified version of the packaging equation developed by Labuza to help us gain insight to how the product and package should perform in the field. A caveat with the application of this equation is that we need to ensure that the packaging is absolutely controlling the moisture transfer with the environment. For example, a 1 oz bag of corn snack chips in a metallized packaging film is a good example of a package controlled product. The rate of time it would require the moisture to equilibrate throughout the bulk of the chips would be rapid compared to the rate at which the water vapor permeated the packaging film. A five pound bag of flour is an example of a very poor product to apply this equation to. On the flour package, it would be the bulk of the food that would limit the rate of moisture transfer, not the paper based packaging material.

The true value of the predictive tool is that it allows us to apply the data to any pertinent environment where we have temperature and humidity data. Temperature and humidity data from a recorder in the actual storage environment is preferred, but weather service information can generally be applied for storage in unconditioned warehouses in a given city or region. Combining this information with the data generated, we can ask questions such as

1. How will your product at the target moisture in an average package fare in the range of storage environments you are concerned with?
2. How will high production moisture product fare in the most humid storage environment (location and seasonality) in the typical package versus the package with the poorest barrier? And conversely how will low production moisture product do in the driest pertinent storage environment?
3. If we change the packaging barrier, production moisture range, or storage moisture range how will the estimated quality of the product in the field change?

Obviously, we are making a number of assumptions when we address these questions with the tools described. Using these tools to estimate quality of market pull samples or longer term storage study samples are the only means to confirm or refine these assumptions and to also understand other mechanisms (rancidity, browning, flavor loss etc.) that will impact storage quality. But the basic moisture tolerance information described will provide you with tremendous insights to help you make better business decisions regarding the moisture limited storage quality of the product your customers will be placing in their pantries.

REFERENCES:

[1] Labuza et al, Cereal Foods World 46, no. 5 216-219 (May 2001)

For more Information, please contact Medallion Laboratories:

Mail:
9000 Plymouth Ave.
Golden Valley, MN
55427

Email:
info@medlabs.com

Website:
www.medlabs.com

Phone:
800.245.5615