Document Title: Description, AN, Complete moisture analysis		Part # and Rev. 13435-00	
		Release Date:	
Rev.	Description	Revision By	Date

Production Filename: 13435 (In Product Library)

Path to Working Files: DecaDoc\Application Notes\Master

Dimensions: 8.5 inch wide, 11 inch tall

Material: Paper, 92 Bright White or better, 75g/m² or heavier

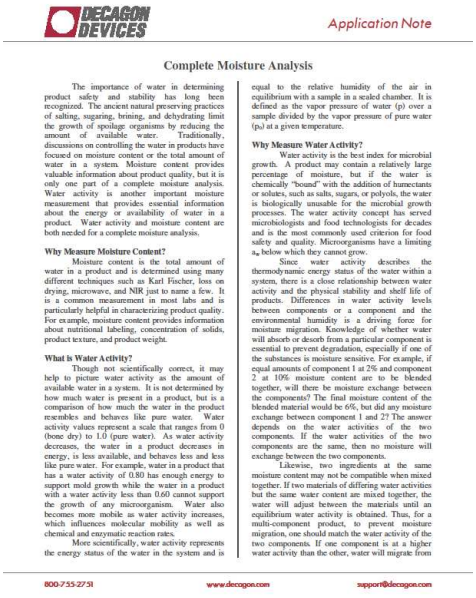
Colors: Color Print on White

Printer: HP Color LaserJet 8550-PS

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale ** (Shown page 1 of 2)



DECAGON DEVICES Application Note

Complete Moisture Analysis

The importance of water in determining product safety and stability has long been recognized. The ancient natural preserving practices of salting, sugaring, brining, and dehydrating limit the growth of spoilage organisms by reducing the amount of available water. Traditionally, discussions on controlling the water in products have focused on moisture content or the total amount of water in a system. Moisture content provides valuable information about product quality, but it is only one part of a complete moisture analysis. Water activity is another important moisture measurement that provides essential information about the energy or availability of water in a product. Water activity and moisture content are both needed for a complete moisture analysis.

Why Measure Moisture Content?

Moisture content is the total amount of water in a product and is determined using many different techniques such as Karl Fischer, loss on drying, microwave, and NIR just to name a few. It is a common measurement in most labs and is particularly helpful in characterizing product quality. For example, moisture content provides information about nutritional labeling, concentration of solids, product texture, and product weight.

What is Water Activity?

Though not scientifically correct, it may help to picture water activity as the amount of available water in a system. It is not determined by how much water is present in a product, but is a comparison of how much the water in the product resembles and behaves like pure water. Water activity values represent a scale that ranges from 0 (bone dry) to 1.0 (pure water). As water activity decreases, the water in a product decreases in energy, is less available, and behaves less and less like pure water. For example, water in a product that has a water activity of 0.80 has enough energy to support mold growth while the water in a product with a water activity less than 0.60 cannot support the growth of any microorganism. Water also becomes more mobile as water activity increases, which influences molecular mobility as well as chemical and enzymatic reaction rates.

More scientifically, water activity represents the energy status of the water in the system and is equal to the relative humidity of the air in equilibrium with a sample in a sealed chamber. It is defined as the vapor pressure of water (p) over a sample divided by the vapor pressure of pure water (p_o) at a given temperature.

Why Measure Water Activity?

Water activity is the best index for microbial growth. A product may contain a relatively large percentage of moisture, but if the water is chemically "bound" with the addition of humectants or solutes, such as salts, sugars, or polyols, the water is biologically unusable for the microbial growth processes. The water activity concept has served microbiologists and food technologists for decades and is the most commonly used criterion for food safety and quality. Microorganisms have a limiting a_w below which they cannot grow.

Since water activity describes the thermodynamic energy status of the water within a system, there is a close relationship between water activity and the physical stability and shelf life of products. Differences in water activity levels between components or a component and the environmental humidity is a driving force for moisture migration. Knowledge of whether water will absorb or desorb from a particular component is essential to prevent degradation, especially if one of the substances is moisture sensitive. For example, if equal amounts of component 1 at 2% and component 2 at 10% moisture content are to be blended together, will there be moisture exchange between the components? The final moisture content of the blended material would be 6%, but did any moisture exchange between component 1 and 2? The answer depends on the water activities of the two components. If the water activities of the two components are the same, then no moisture will exchange between the two components.

Likewise, two ingredients at the same moisture content may not be compatible when mixed together. If two materials of differing water activities but the same water content are mixed together, the water will adjust between the materials until an equilibrium water activity is obtained. Thus, for a multi-component product, to prevent moisture migration, one should match the water activity of the two components. If one component is at a higher water activity than the other, water will migrate from