Document Title: Description, AN, Measuring Moisture Content Using Water Activity		Part # and Rev. 13902-01	
		Release Date:	
Rev.	Description	Revision By	Date
-01	Updated SEP values in Table 1	DDH	07/13/09

Production Filename: 13902 (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

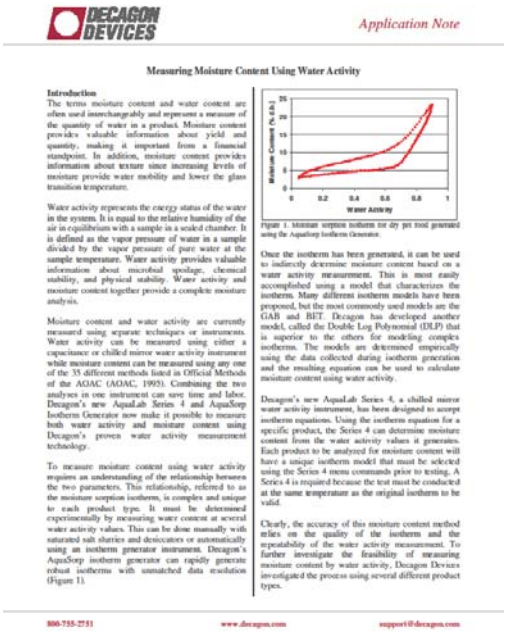
Colors: Color Print on White

Printer: HP Color LaserJet 8550-PS

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale ** (Shown page 1 of 3)



DECAGON DEVICES

Application Note

Measuring Moisture Content Using Water Activity

Introduction

The terms moisture content and water content are often used interchangeably and represent a measure of the quantity of water in a product. Moisture content provides valuable information about yield and quantity, making it important from a financial standpoint. In addition, moisture content provides information about texture since increasing levels of moisture provide water mobility and lower the glass transition temperature.

Water activity represents the energy status of the water in the system. It 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 in a sample divided by the vapor pressure of pure water at the sample temperature. Water activity provides valuable information about microbial spoilage, chemical stability, and physical stability. Water activity and moisture content together provide a complete moisture analysis.

Moisture content and water activity are currently measured using separate techniques or instruments. Water activity can be measured using either a capacitance or chilled mirror water activity instrument while moisture content can be measured using any one of the 35 different methods listed in Official Methods of the AOAC (AOAC, 1993). Combining the two analyses in one instrument can save time and labor. Decagon's new AquaLab Series 4 and AquaSorp Isotherm Generator now make it possible to measure both water activity and moisture content using Decagon's proven water activity measurement technology.

To measure moisture content using water activity requires an understanding of the relationship between the two parameters. This relationship, referred to as the moisture sorption isotherm, is complex and unique to each product type. It must be determined experimentally by measuring water content at several water activity values. This can be done manually with saturated salt slurries and desiccators or automatically using an isotherm generator instrument. Decagon's AquaSorp isotherm generator can rapidly generate robust isotherms with unmatched data resolution (Figure 1).

Figure 1. Montmorillonite sorption isotherm for dry pet food generated using the AquaSorp Isotherm Generator.

Once the isotherm has been generated, it can be used to indirectly determine moisture content based on a water activity measurement. This is most easily accomplished using a model that characterizes the isotherms. Many different isotherm models have been proposed, but the most commonly used models are the GAB and BET. Decagon has developed another model, called the Double Log Polynomial (DLP) that is superior to the others for modeling complex isotherms. The models are determined empirically using the data collected during isotherm generation and the resulting equation can be used to calculate moisture content using water activity.

Decagon's new AquaLab Series 4, a chilled mirror water activity instrument, has been designed to accept isotherm equations. Using the isotherm equation for a specific product, the Series 4 can determine moisture content from the water activity values it generates. Each product to be analyzed for moisture content will have a unique isotherm model that must be selected using the Series 4 menu commands prior to testing. A Series 4 is required because the test must be conducted at the same temperature as the original isotherm to be valid.

Clearly, the accuracy of this moisture content method relies on the quality of the isotherm and the repeatability of the water activity measurement. To further investigate the feasibility of measuring moisture content by water activity, Decagon Devices investigated the process using several different product types.