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Description,
AN, DDI vs. other moisture sorption isotherm methods</td><td colspan="2">Part # and Rev.
13506-00

Release Date:</td></tr>
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Production Filename: 13506 (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

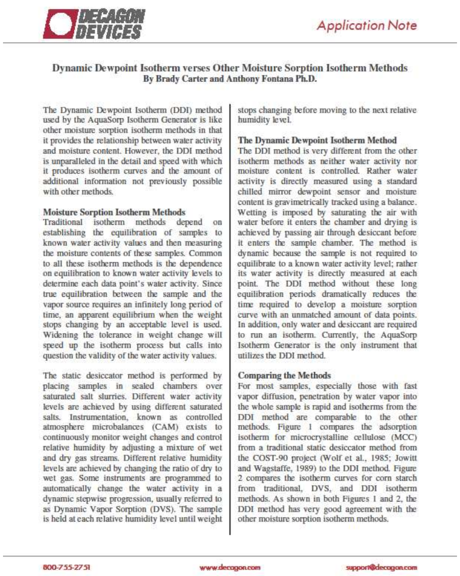
Colors: Color Print on White

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

Dynamic Dewpoint Isotherm verses Other Moisture Sorption Isotherm Methods
By Brady Carter and Anthony Fontana Ph.D.

The Dynamic Dewpoint Isotherm (DDI) method used by the AquaSorp Isotherm Generator is like other moisture sorption isotherm methods in that it provides the relationship between water activity and moisture content. However, the DDI method is unparalleled in the detail and speed with which it produces isotherm curves and the amount of additional information not previously possible with other methods.

Moisture Sorption Isotherm Methods
Traditional isotherm methods depend on establishing the equilibration of samples to known water activity values and then measuring the moisture contents of these samples. Common to all these isotherm methods is the dependence on equilibration to known water activity levels to determine each data point's water activity. Since true equilibration between the sample and the vapor source requires an infinitely long period of time, an apparent equilibrium when the weight stops changing by an acceptable level is used. Widening the tolerance in weight change will speed up the isotherm process but calls into question the validity of the water activity values.

The static desiccator method is performed by placing samples in sealed chambers over saturated salt slurries. Different water activity levels are achieved by using different saturated salts. Instrumentation, known as controlled atmosphere microbalances (CAM) exists to continuously monitor weight changes and control relative humidity by adjusting a mixture of wet and dry gas streams. Different relative humidity levels are achieved by changing the ratio of dry to wet gas. Some instruments are programmed to automatically change the water activity in a dynamic stepwise progression, usually referred to as Dynamic Vapor Sorption (DVS). The sample is held at each relative humidity level until weight stops changing before moving to the next relative humidity level.

The Dynamic Dewpoint Isotherm Method
The DDI method is very different from the other isotherm methods as neither water activity nor moisture content is controlled. Rather water activity is directly measured using a standard chilled mirror dewpoint sensor and moisture content is gravimetrically tracked using a balance. Wetting is imposed by saturating the air with water before it enters the chamber and drying is achieved by passing air through desiccant before it enters the sample chamber. The method is dynamic because the sample is not required to equilibrate to a known water activity level; rather its water activity is directly measured at each point. The DDI method without these long equilibration periods dramatically reduces the time required to develop a moisture sorption curve with an unmatched amount of data points. In addition, only water and desiccant are required to run an isotherm. Currently, the AquaSorp Isotherm Generator is the only instrument that utilizes the DDI method.

Comparing the Methods
For most samples, especially those with fast vapor diffusion, penetration by water vapor into the whole sample is rapid and isotherms from the DDI method are comparable to the other methods. Figure 1 compares the adsorption isotherm for microcrystalline cellulose (MCC) from a traditional static desiccator method from the COST-90 project (Wolf et al., 1985; Jowitt and Wagstaffe, 1989) to the DDI method. Figure 2 compares the isotherm curves for corn starch from traditional, DVS, and DDI isotherm methods. As shown in both Figures 1 and 2, the DDI method has very good agreement with the other moisture sorption isotherm methods.

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