

Document Title: Description, AN, Moisture Sorption isotherm method		Part # and Rev. 13433-01	
		Release Date:	
Rev.	Description	Revision By	Date

Production Filename: 13433 (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)



Application Note

Moisture Sorption Isotherm Method

The relationship between water activity (a_w) and moisture content at a given temperature is called the moisture sorption isotherm. This relationship is complex and unique for each product due to different interactions (colligative, capillary, and surface effects) between the water and the solid components at different moisture contents. An increase in a_w is almost always accompanied by an increase in the water content, but in a nonlinear fashion. Moisture sorption isotherms are sigmoidal in shape for most foods, although foods that contain large amounts of sugar or small soluble molecules have a J-type isotherm curve shape.

The moisture sorption isotherm of a food is obtained from the equilibrium moisture contents determined at several water activity levels at constant temperature. There are three types of isotherm curves; adsorption (starting from the dry state), desorption (starting from the wet state), or working (native state). An isotherm prepared by adsorption will not necessarily be the same as an isotherm prepared by desorption. This phenomenon of different moisture contents for the same a_w is called moisture sorption hysteresis, and is exhibited by many foods. Some reasons for hysteresis are:

differences in the filling and emptying of pores and capillaries, swelling of polymeric materials, transition between glassy and rubbery state, and supersaturation of some solutes during desorption. Many disciplines use water content calculations to regulate product quality, however, water content measurement can be inaccurate, time-consuming and require a precision balance.

One way to obtain a moisture sorption isotherm is by placing a food, either dried (absorption), hydrated (desorption) or native (working), into controlled humidity chambers at constant temperature and measuring the weight until equilibrium as measured by constant weight is established. Isotherms, by definition are done at constant temperature ($\pm 1^\circ\text{C}$), with room temperature not advised because of changes during evenings and weekends. One needs six to nine different water activity levels and must wait for vapor equilibration, which may take one to three weeks. Saturated salt solutions are typically used to create the controlled water activity levels. Several types of containers (desiccators, glass jars, or fish tanks) can be used for holding the samples at constant