Document Title: Description, AN, water activity of dry and dehydrated products		Part # and Rev. 13455-00	
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Rev.	Description	Revision By	Date

Production Filename: 13455 (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

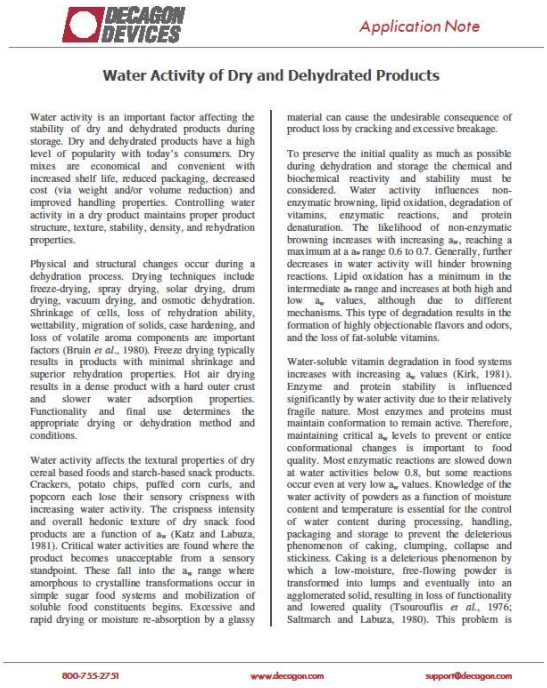
Colors: Color Print on White

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

Water Activity of Dry and Dehydrated Products

Water activity is an important factor affecting the stability of dry and dehydrated products during storage. Dry and dehydrated products have a high level of popularity with today's consumers. Dry mixes are economical and convenient with increased shelf life, reduced packaging, decreased cost (via weight and/or volume reduction) and improved handling properties. Controlling water activity in a dry product maintains proper product structure, texture, stability, density, and rehydration properties.

Physical and structural changes occur during a dehydration process. Drying techniques include freeze-drying, spray drying, solar drying, drum drying, vacuum drying, and osmotic dehydration. Shrinkage of cells, loss of rehydration ability, wettability, migration of solids, case hardening, and loss of volatile aroma components are important factors (Bruin *et al.*, 1980). Freeze drying typically results in products with minimal shrinkage and superior rehydration properties. Hot air drying results in a dense product with a hard outer crust and slower water adsorption properties. Functionality and final use determines the appropriate drying or dehydration method and conditions.

Water activity affects the textural properties of dry cereal based foods and starch-based snack products. Crackers, potato chips, puffed corn curls, and popcorn each lose their sensory crispness with increasing water activity. The crispness intensity and overall hedonic texture of dry snack food products are a function of a_w (Katz and Labuza, 1981). Critical water activities are found where the product becomes unacceptable from a sensory standpoint. These fall into the a_w range where amorphous to crystalline transformations occur in simple sugar food systems and mobilization of soluble food constituents begins. Excessive and rapid drying or moisture re-absorption by a glassy material can cause the undesirable consequence of product loss by cracking and excessive breakage.

To preserve the initial quality as much as possible during dehydration and storage the chemical and biochemical reactivity and stability must be considered. Water activity influences non-enzymatic browning, lipid oxidation, degradation of vitamins, enzymatic reactions, and protein denaturation. The likelihood of non-enzymatic browning increases with increasing a_w, reaching a maximum at a a_w range 0.6 to 0.7. Generally, further decreases in water activity will hinder browning reactions. Lipid oxidation has a minimum in the intermediate a_w range and increases at both high and low a_w values, although due to different mechanisms. This type of degradation results in the formation of highly objectionable flavors and odors, and the loss of fat-soluble vitamins.

Water-soluble vitamin degradation in food systems increases with increasing a_w values (Kirk, 1981). Enzyme and protein stability is influenced significantly by water activity due to their relatively fragile nature. Most enzymes and proteins must maintain conformation to remain active. Therefore, maintaining critical a_w levels to prevent or entice conformational changes is important to food quality. Most enzymatic reactions are slowed down at water activities below 0.8, but some reactions occur even at very low a_w values. Knowledge of the water activity of powders as a function of moisture content and temperature is essential for the control of water content during processing, handling, packaging and storage to prevent the deleterious phenomenon of caking, clumping, collapse and stickiness. Caking is a deleterious phenomenon by which a low-moisture, free-flowing powder is transformed into lumps and eventually into an agglomerated solid, resulting in loss of functionality and lowered quality (Tsourouflis *et al.*, 1976; Saltmarch and Labuza, 1980). This problem is

800-755-2751 www.decagon.com support@decagon.com