Water Activity Measurement Using the DA7200 Diode Array NIR Analyzer

Introduction

Water Activity is a critical measurement in determining the safety and quality of food products. Accurate instruments that measure water activity in less than 5 minutes are available, however even faster analysis time is needed for certain applications. Using the AquaLab DA7 200 Diode Array NIR analyzer, it is now possible to measure water activity in as little as 6 seconds.

The Near Infrared Reflectance (NIR) technique is particularly suited for rapid measurement, but in the past instrument limitations have not permitted users to reap the full benefits of NIR. Sample preparation requirements such as grinding or special cups made analyses laborious, time consuming and error-prone.

Diode Array 7200

The AquaLab DA 7200 is a new full-spectrum, NIR instrument designed for use in the food industry. Using novel diode array technology, it performs a multi-component analysis including water activity in only 6 seconds with no sample grinding or sample preparation required. During this time 180 full spectra are collected and averaged. The sample is analyzed in an open dish avoiding the problems associated with sample cups and minimizing operator influence on results.

The AquaLab DA 7200 predicts water activity by illuminating a food sample with light in the NIR region and measuring the amount of light that interacts with water in the food. Foods with different water activity levels will interact with different levels of light producing a unique NIR spectrum for each food at each water activity level. Calibrations curves unique to each food product are used to translate the spectral differences into water activity values. These calibration curves depend on data from a reference method. In the case of NIR water activity determination, the AquaLab Series 3TE is the reference method. The AquaLab DA 7200 measures the sample directly and does not rely on vapor pressure equilibration in the head space above a sample to measure water activity

eliminating the need for equilibration time. Consequently, water activity measurements can be taken almost instantaneously. In addition, water activity can be measured in conjunction with other components such as protein content, oil content, fat content, etc. if calibrations are available.

Experimental

Spectral data was collected on various samples of chocolate syrup, wheat flour, and raisins using an AquaLab DA 7200. Each sample was analyzed with 2 repeats and 2 repacks in a 3" diameter open faced sample dish. Reference analyses were performed using an AquaLab Series 3TE water activity instrument. The collected spectral data was emailed to Perten's Applications Lab for analysis. Calibrations were developed by Perten Instruments using Partial Least Squares (PLS) regression. Multiplicative Scattering Correction (MSC) was used as a data pre-treatment to improve the calibration models.

Results and discussion

The DA 7200 results are very accurate and are similar to those found in good capacitance electric hygrometers. Statistics for the water activities of the 3 products are presented in the table below and graphs are displayed on page 2.

| Product	Range a_w	Samples	R^2	SECV*
Flour	0.43 – 0.85	23	0.981	0.013
Chocolate Syrup	0.67 – 0.88	10	0.984	0.010
Raisins	0.38 – 0.73	10	0.970	0.016

The differences between the DA 7200 and the reference method are of the same magnitude as typical differences between two different reference labs.

In summary it can be concluded that the AquaLab DA 7200 can be used to predict water activity of food products. It should be noted again that no special sample preparation was necessary and the results were generated by the AquaLab DA7200 in just 6 seconds.

DECAGON DEVICES
Water Activity Science

Perten INSTRUMENTS

Flour

Other measurements on flour include Moisture, Protein, Ash

Water Activity in Flour
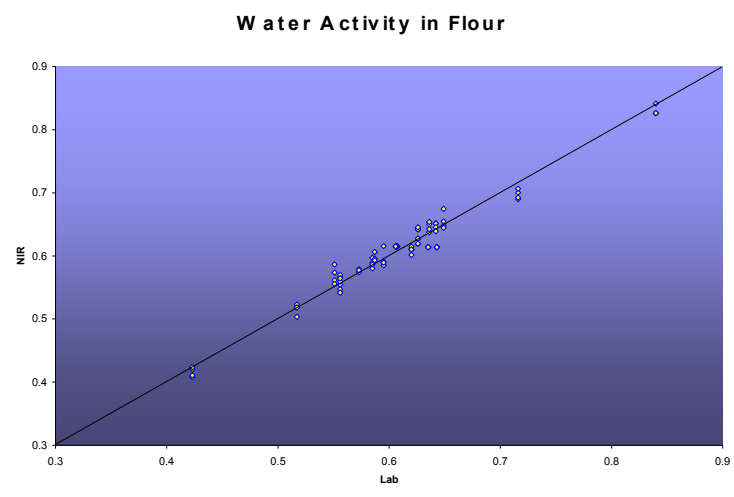
Chocolate Syrup

Disposable dishes can be used for the analysis of this product eliminating cleaning of the sticky substance.

Water Activity in Chocolate Syrup
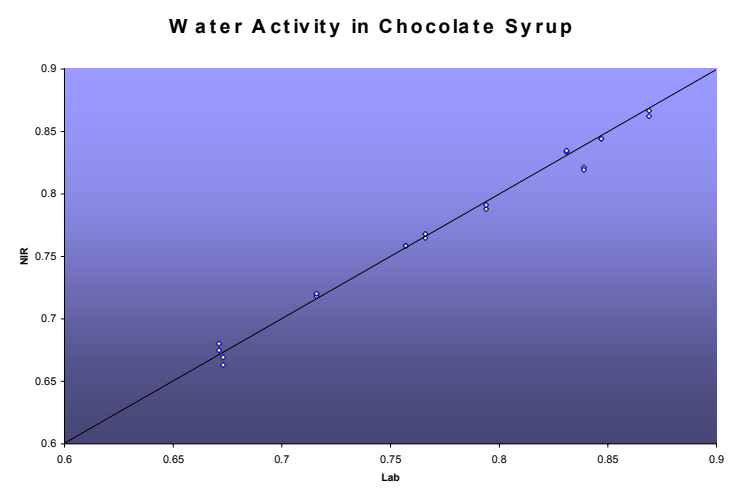
Raisins

The raisins were analyzed whole with no grinding or other sample preparation required.

Water Activity in Raisins
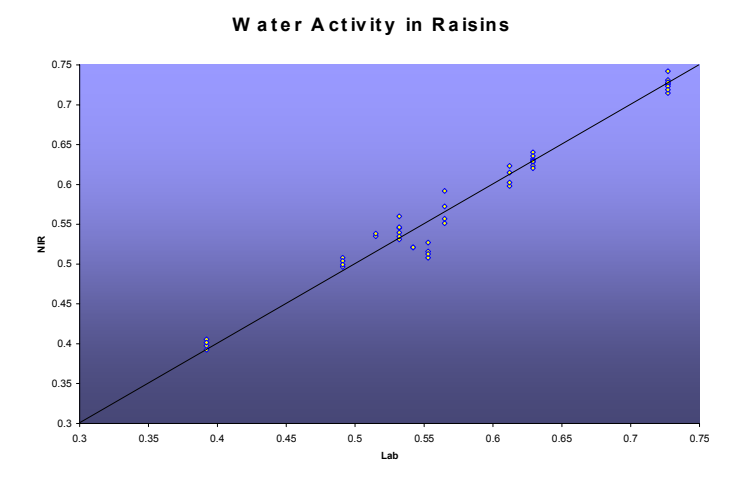
* SECV is the standard deviation between NIR and Lab data calculated in a way that describes the future performance of the calibration.

DECAGON DEVICES
Water Activity Science

Perten
INSTRUMENTS