Analysis of Syrup Using a Perten DA 7250 Diode Array Based High Speed Analysis System

Introduction
Ethanol production is a fast growing segment of grain processing. To make the ventures profitable, fast and accurate analyses are required to move as much product through the process while optimizing use of raw materials and enzymes. One critical control point is monitoring the syrup.

The Near Infrared Reflectance (NIR) technique is particularly suited for measurement of syrup, but past instrument limitations have not permitted users to reap the full benefits of NIR. Sample preparation requirements, special cups, and a small analysis area made analyses laborious, time consuming and error-prone.

DA 7250 NIR Analyzer
The DA 7250 is a new full-spectrum NIR instrument designed for use in the ethanol industry. Using novel diode array technology it performs a multi-component analysis in only 6 seconds with no sample prep or clean-up required.

During this time many full spectra are collected and averaged. As the sample is analyzed in an open disposable cup, the problems associated with sample cups are avoided and operator influence on results is minimal.

Experimental
Spectral data was collected on over 600 syrup samples (including de-oiled syrups) using multiple DA 7250 Analysis systems. A primary advantage of the DA 7250 is its use of non-contact sampling. Each sample was poured into a disposable sample cup, analyzed, and discarded. The disposable cup removes the need for time consuming cell cleaning, possibilities of cross contamination, and significantly speeds up the analysis process. The reference analyses used for calibration development were supplied by the processors. Perten Instruments developed calibrations using Honigs regression (HR). Harmonization was used as a pre-treatment to improve the calibration model.

Results and discussion
The DA 7250 results are very accurate when compared to the results from the reference methods. Statistics for the respective parameters are presented in the table below and graphs are displayed on page 2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Samples</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids</td>
<td>5.59 - 40.58</td>
<td>680+</td>
<td>0.993</td>
</tr>
<tr>
<td>Protein</td>
<td>5.33 - 7.78</td>
<td>165+</td>
<td>0.866</td>
</tr>
<tr>
<td>Fat</td>
<td>1.19 - 7.90</td>
<td>220+</td>
<td>0.941</td>
</tr>
</tbody>
</table>

The differences between the DA 7250 and the reference results are of the same magnitude as typical differences between two different reference labs. The DA 7250 is a rapid way to monitor results without the need to wait for lengthy lab results. Replicate analyses are generally more precise than the reference methods.

In summary it is concluded that the Diode Array 7250 can analyze liquid syrups for the aforementioned constituents. The disposable sample cups allow users to quickly and accurately analyze samples without any sample prep or subsequent cleaning requirements. The overall sampling speed and analysis speed produce results in nearly real-time allowing for rapid feedback to monitor syrup at an Ethanol facility.

Perten Instruments Application Note
DA Fermentation Syrups (Ethanol Production)
**Solids**
Rapid measurement of solids helps for back addition of syrups.

**Protein**
Protein measurement provides important nutritional information when added back to DDGs.

**Fat**
Fat is measured with very good accuracy across a wide range of concentrations.