

Application Note: Real-time Determination of Ethanol in Gasoline

Ethanol is now a common biofuel additive for gasoline. The additional oxygen in ethanol provides for a cleaner burning fuel. The data presented demonstrates measurement of the ethanol content of fuel using near-infrared (NIR) spectroscopy. Guided Wave's near-infrared dual beam photometer and near-infrared full scanning dual beam spectrometer make use of fiber optic technology to allow remote process monitoring for a large variety of applications. The determination of ethanol in fuels can be accurately and repeatably verified using both analyzers.

Experimental

A series of samples were prepared by adding known amounts of ethanol to a fuel sample covering the range of 0.1% to 22% added ethanol. Data for these standard samples was collected using a 10mm cuvette cell with both Guided Wave analyzers. The dual beam photometer was equipped with filters at 1140nm, 1300nm, 1410nm and 1445nm. The full near-infrared spectra of the standards are shown in Figure 1, along with an indication of filter locations (wavelengths selected) used in the dual beam photometer. Similar data for the photometer is shown in Figure 2.

Analysis

Simple pre-processing methods were applied to each data set (derivative for spectrometer, baseline correction for photometer). Regression analysis (PLS for spectrometer, MLR for photometer) produced results for ethanol determination as shown in Figure 3 (spectrometer) and figure 4 (photometer). Both methods demonstrate accurate repeatable measurement capability over the entire range of added ethanol.

A Comparison: Full Scanning Dual Beam Spectrometer vs. Dual Beam Photometer

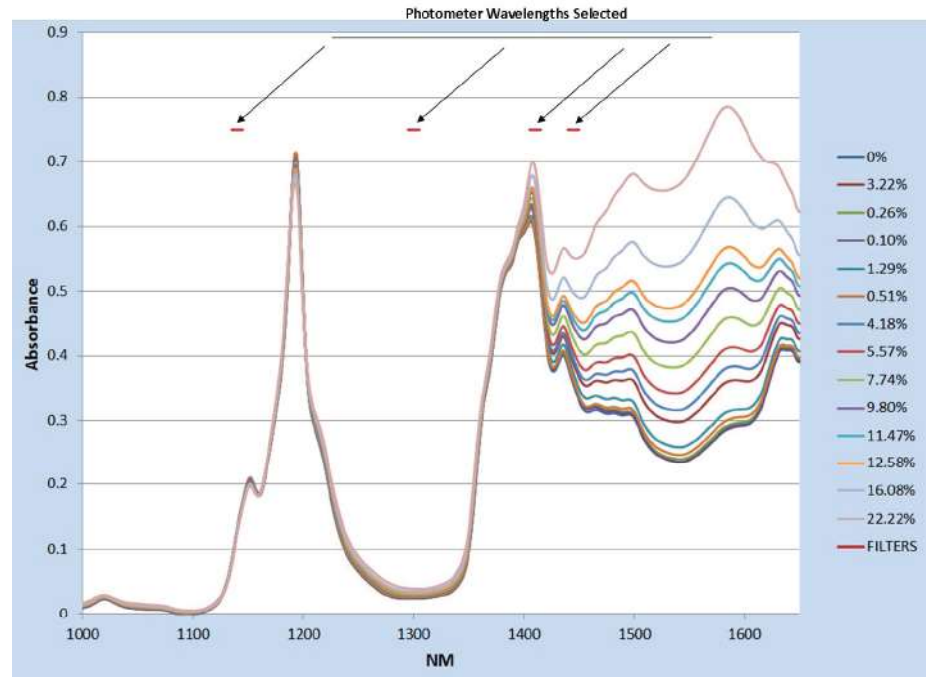


Figure 1: Ethanol in Gasoline - Full Scanning Dual Beam Spectrometer

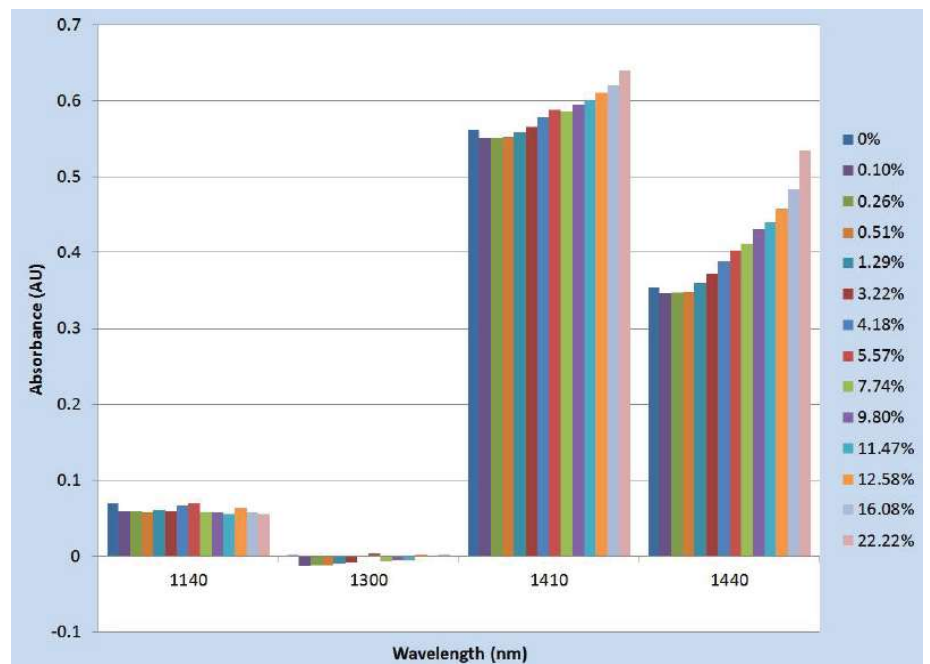


Figure 2: Ethanol in Gasoline - Dual Beam Photometer

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Discussion - Choosing the Analyzer

Both analyzer technologies demonstrate successful measurement of ethanol. The differentiating factor for choosing one unit over the other is typically the measurement environment and other measurement parameters that are of interest. For example, if a measurement of the Octane rating or some other physical property of the fuel were also desired then the full spectrum dual beam spectrometer can provide that functionality. The dual beam photometer is better suited for single component or single property applications.

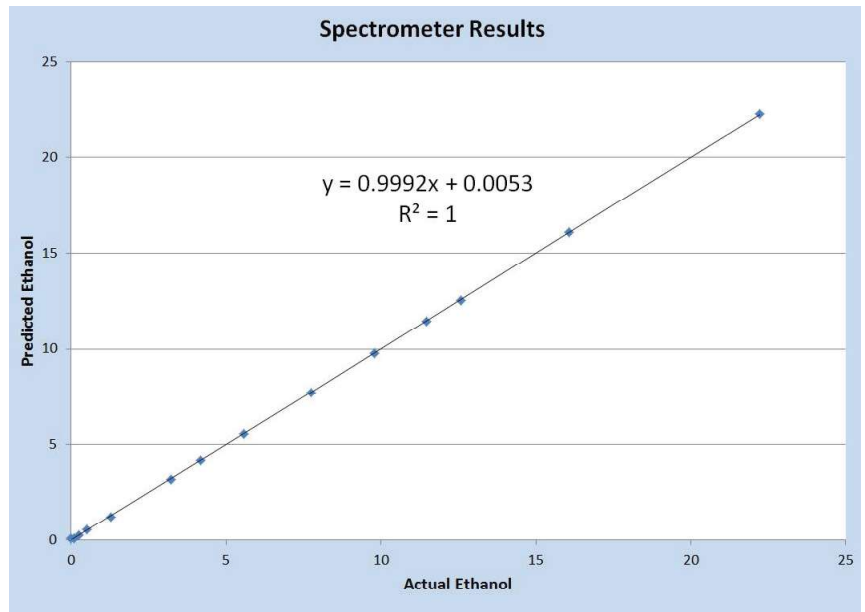


Figure 3: Regression Results - Full Scanning Dual Beam Spectrometer

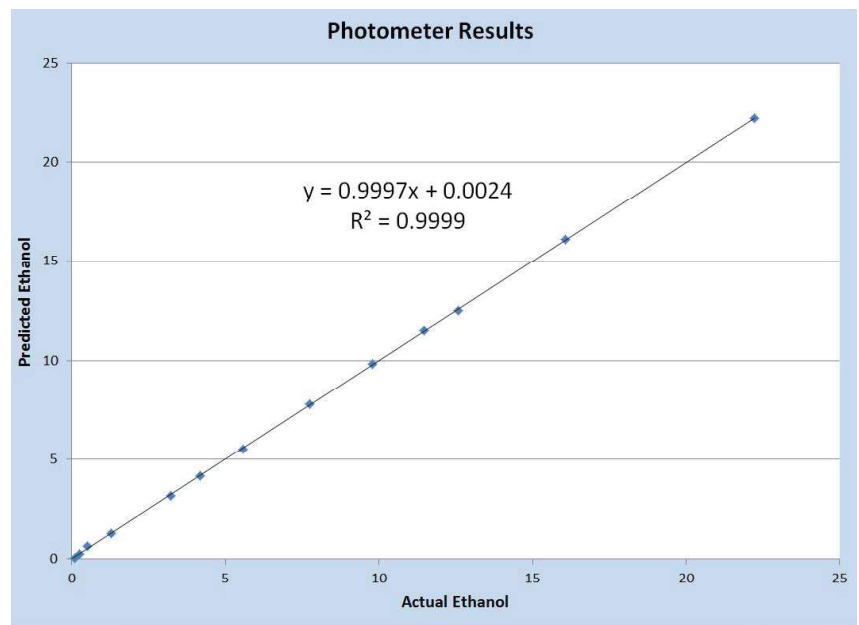


Figure 4: Regression Results - Dual Beam Photometer