

Application Note — On-Line Monitoring of Ethylene:Diethylene Glycols with a ClearView® Photometer

Purpose:

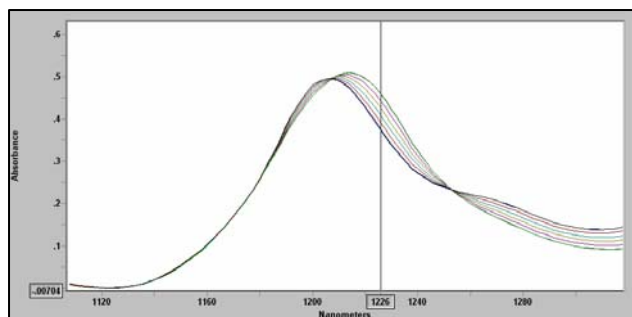
To replace a gas chromatograph (GC) by continuously measuring the amount of ethylene glycol in diethylene glycol using a near-infrared (NIR) ClearView® fiber optic filter photometer.

Background:

It is not obvious, even to many NIR practitioners, that NIR can make more subtle distinctions among closely related compounds. As a result, it is often thought that a process GC is required.

Experimental:

Our PS-2E diode array spectrometer was used to measure the NIR spectra of ethylene:diethylene glycol (EG:DEG) mixtures. Two meters of low-OH fiber optic cables were used and the samples were measured in a 10 mm glass cuvette at room temperature.

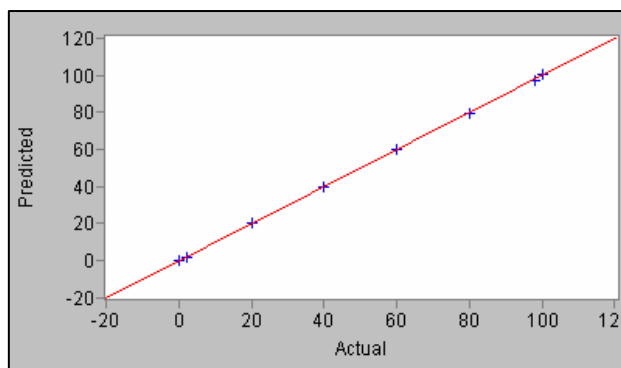


Results:

The resulting PS-2E spectra are shown above for 0, 2, 20, 40, 60, 80, 98 and 100 wt% EG in DEG. Our OS-MLR program for our GRAMS operating system in the PS-2E indicated that 1226 nm (shown by the vertical line) provided the best single wavelength solution for the ClearView Process Photometer. This is the 2nd C-H overtone region, which shows the different C-H vibrational character of the two compounds. It was chosen outside the water regions to minimize interferences. Excellent linearity is achieved, as shown in the observed vs. predicted EG plot. A standard error for the regression of 0.46% EG was achieved for the 10 mm optical path.

The goal in NIR spectroscopy is to maximize precision by increasing the optical path in the sample probe, while keeping the absorbance near or below 1 AU at the wavelength of interest. For this application, we would use a 20 mm fiber optic process probe. The

long-term photometric drift of ClearView® is 1-2 mAU (0.001-0.002 Absorbance Units). A 1 mAU change leads to a 0.58% (the slope) change in EG at 20 mm. Therefore, the on-line precision is expected to be between 0.6 and 1.2% full-scale; comparable to a GC.



Slope at 1226 nm (mAU - 10 mm path)	-1.16
Intercept	534.4
Correlation Coefficient	0.99996
Standard Error	0.41
F for Regression	67780
On-line precision for 20 mm path	0.6-1.2% FS

Conclusions:

These results show that a NIR ClearView® can match the typical 1% FS performance of a process GC at about 2/3 the price with lower maintenance costs. Compared to a GC, ClearView's 0.2 s data update is virtually continuous. With its small size (8" cube), its installation costs are 1/5 of typical GC installation costs and due to its no-moving parts design, the only maintenance required is changing the lamp every 4-6 months, and perhaps re-zeroing once a month.



ClearView®
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 (Ex/d IIB) Enclosure