

Application Note: On-Line Control of a Styrene Tower with a ClearView® db Photometer

Purpose

GUIDED WAVE'S ClearView db photometer can replace on-line GCs for rapid control of a styrene purification column by measuring styrene at two points.

Background

The first sample point is from the overhead with 0 to 80% styrene in ethylbenzene, but also containing up to 6% toluene and 2% benzene. The second is at a middle tray with 60 to 100% styrene in ethylbenzene with toluene and benzene stripped out.

Approach

Samples at 40 °C in a 10mm cuvette were run on our diode array spectrophotometer to identify the relevant wavelengths. See Figure 1. Two NIR wavelengths (down arrows) were required for the more complicated mixture in the overhead line, and only one for the middle tray product stream. The samples were then re-run in the photometer, absorbances were recorded and the regression analyses were performed.

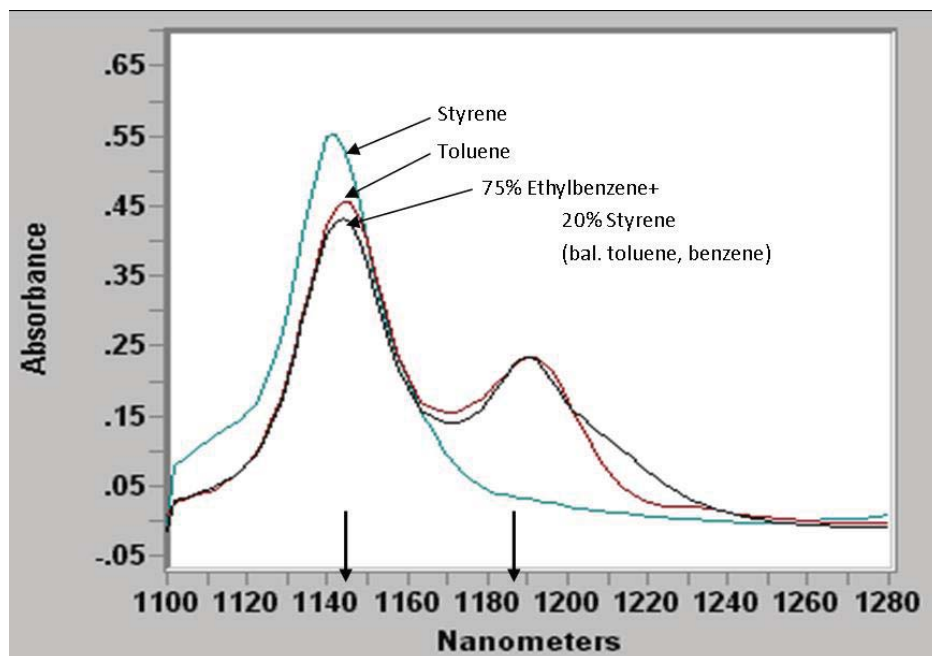


Figure 1

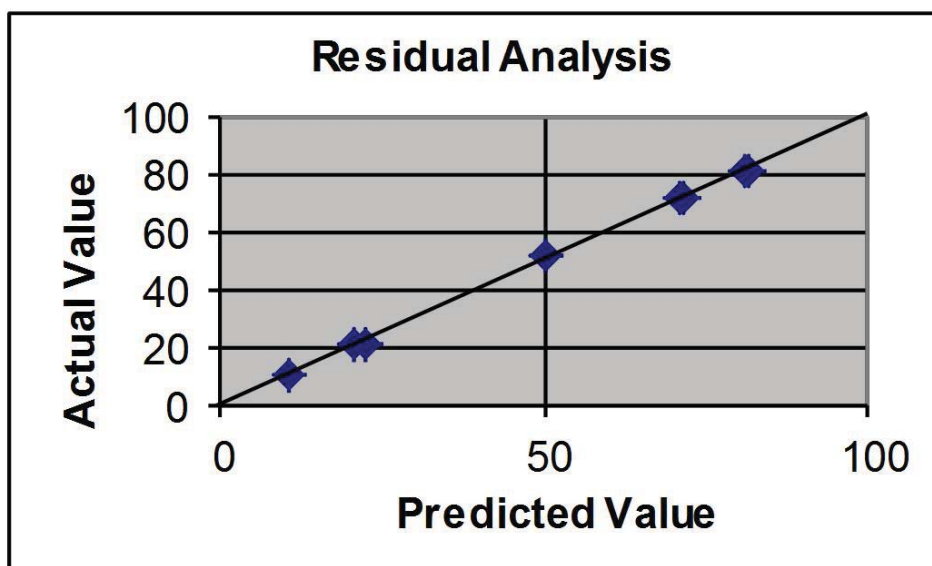


Figure 2

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Results

The MLR calibration for styrene in 10 overhead samples resulted in an R^2 of 0.999 with a standard error of 0.84% styrene. The predicted vs. actual plot for this model is shown in Figure 2. The styrene calibration for the simpler stream resulted in the same R^2 and a standard error of 0.37%. The photometer was installed on line with two side stream flow probes using fiber optic cables and the factory calibrations. The results of over three months of data for the overhead stream is shown in Figure 3 compared with laboratory values for grab samples using a gas chromatograph. The average difference is 0.6 with a standard deviation of 1.2. The simpler stream was sampled infrequently because the analyzer's styrene values matched the GC values within experimental error.

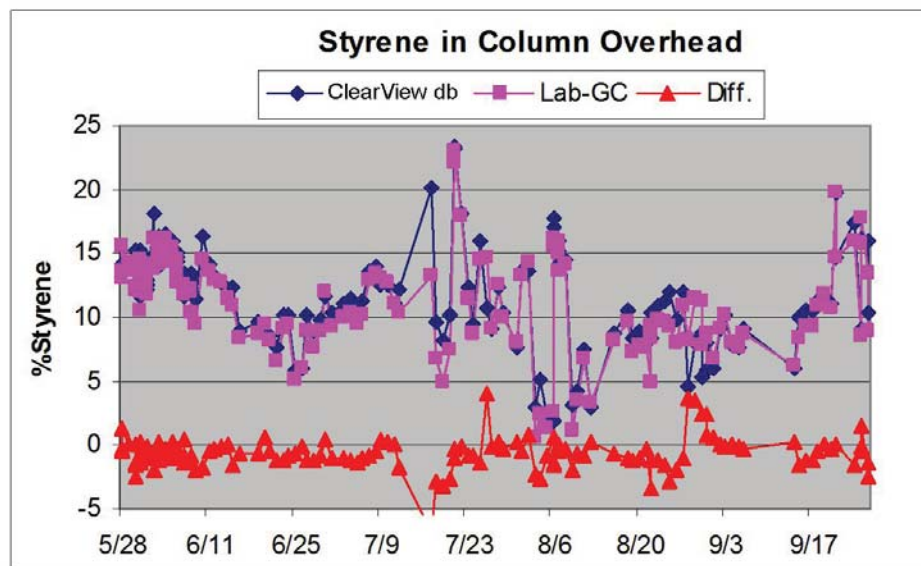


Figure 3

Conclusions

A ClearView db can provide real-time, on-line measurements of both streams with no system down-time, permitting greater column efficiency. For the example above ROI was achieved in less than 6 months.

ClearView® db Enclosure Options



Zpurge Unit
Class I, Division 2

ExProof Unit
Class I, Division 1

General
Purpose Unit