

Application Note — On-Line Control of a Styrene Tower with a Simulplex™ ChemView® Photometer

Purpose: Replace on-line GCs for rapid control of a styrene purification column by measuring styrene at two points using a Simulplex™ ChemView®.

Background: The first 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: A 10 mm cuvette was used in our HeaterCell fiber optic accessory at 40 °C. Our PS-2 NIR diode array spectrophotometer was used to identify the wavelengths. 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. A Simulplex™ ChemView® was built using a reference wavelength and these peak wavelengths for each probe. The samples were re-run in the photometer, absorbances were recorded and the regression analyses were performed.

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 at right. The styrene calibration for the simpler stream resulted in same R^2 and a standard error of 0.37%. The Simulplex™ was installed on line with two side stream flow probes using 3 m fiber optic cables and the factory calibrations. The results of over three months of data for the overhead stream is shown below and 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.

Conclusions: Our Simulplex™ ChemView® provides real-time, on-line measurements of both streams with no analyzer down-time, permitting greater column efficiency. Analyzer payback was achieved in less than 6 months.

