

Application Note: Safe Operation of your EDC Reactor

Introduction

GUIDED WAVE'S ClearView® db analyzers combined with robust gas sample systems can be used in ethylene dichloride (EDC) plants to monitor the ethylene content in the vent gas. This helps the control systems maintain a constant concentration in the vent gas and also ensures that the concentration is maintained at safe levels during start-up.

Background

In one method of production for EDC, chlorine and ethylene are mixed in the aqueous phase of the EDC reactor using an iron catalyst. When operating and controlling a reactor it is standard practice to maintain an excess of one of the raw material feeds. In an EDC reactor, maintaining a chlorine excess would be costly in terms of the caustic soda usage needed to avoid chlorine emissions and would present a potential emission hazard in the case of upsets. As a result an ethylene excess is typically maintained at 4%.

Guided Wave's photometric analyzers and gas sample systems have been used in a number of EDC plants to monitor the ethylene content in the vent gas to help the plant control systems maintain a constant concentration at safe levels. For installations where this measurement is mission critical, Guided Wave can provide a system that incorporates two independent gas cells on a single ClearView db analyzer. The system sends ethylene concentration data via a 4-20mA signal to the plant DCS system. This configuration allows for a 1 out of 2 voting system if the plant goes into an upset condition. It also allows for routine maintenance on one gas cell while the other continues to supply data and keep the EDC plant operation safe.

ClearView® db Enclosure Options



Zpurge Unit
Class I, Division 2

ExProof Unit
Class I, Division 1

General Purpose Unit



Probes and Gas Flow Cells

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The ClearView db analyzers can provide accurate ethylene concentrations over the range of 0-50%. This allows close monitoring of the reactor condition during start-up to maintain safe conditions.

Results

The ClearView db analyzer utilizes a near-infrared (NIR) spectroscopic method with select NIR filters to measure the chemical composition of the gas stream. Figure 1 shows the full NIR spectral region for EDC and ethylene. This shows that there are spectral regions with sufficient information to distinguish and monitor this combination of gases. Figure 2 shows the ethylene calibration data from a Guided Wave photometric analyzer. This demonstrates good linearity over the full range of concentrations.

Conclusion

Guided Wave's ClearView db filter photometer and gas flow cell(s) can be used to monitor ethylene concentrations in ethylene dichloride (EDC) production. The calibration shows excellent linearity with an $R^2 > .998$. The ClearView db's dual beam design allows for lower photometric drift, accounting for lamp aging affects. The ClearView db also allows for two independent sample points, lowering the overall system cost, or redundant sample points in the same reactor for added safety.

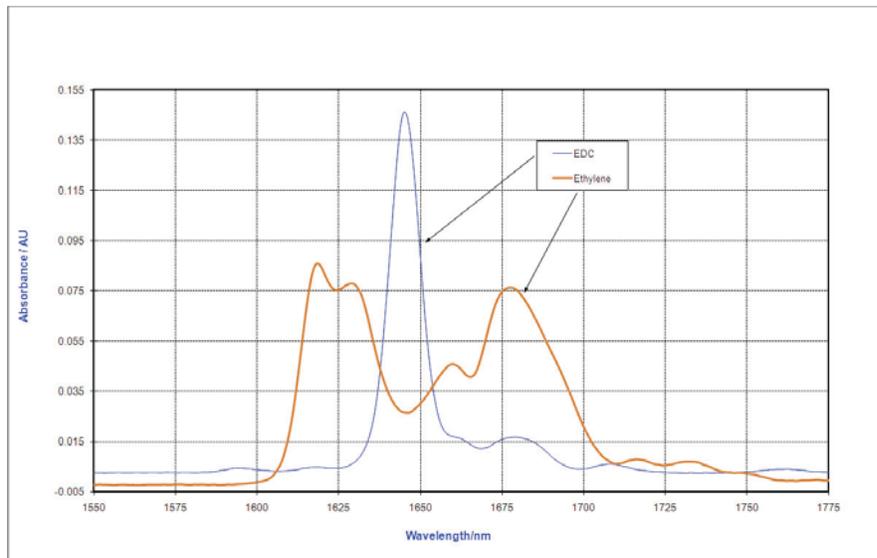


Figure 1: Full Spectral Data Ethylene / EDC

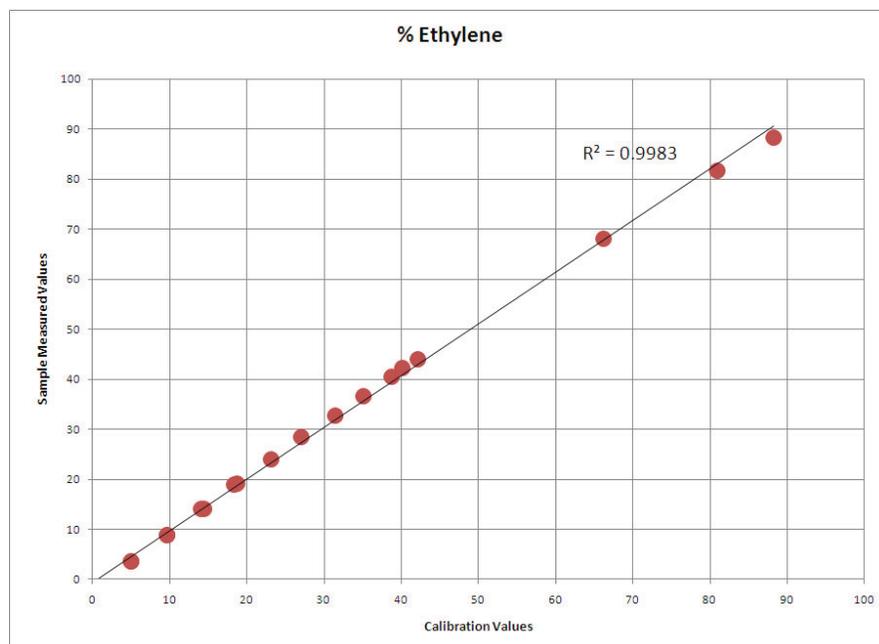


Figure 2: Ethylene Calibration