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REAL-TIME OPTICAL ABSORPTION ANALYZERS

APPLICATION NOTE

Real-time Determination of Caustic in Water with Varying Temperatures Using ClearView® db Photometer

Our GUIDED WAVE™ ClearView® db photometer has been used for the measurement of caustic in water over a minimal temperature range described in previous application notes. Measurements in process environments can often present measurement challenges over very wide temperature swings along with the presence of multiple sample matrix interferences. Since the caustic measurement application uses the near-infrared wavelength range, the results can be impacted by large temperature variations of the process stream. The temperature impact can be compensated by either including the sample temperature as an input variable or by making the calibration model itself robust to temperature changes. The impact of sample matrix changes can also be minimized by careful calibration design. This application note will describe the caustic measurements over a wide range of temperatures.

Experimental

A series of samples of known caustic concentration were prepared covering the range of 7% to 21% caustic. Some of these samples also contained chemical constituents that were known to occur in the process stream. Data for these standard samples was collected using our GUIDED WAVE 2 mm Teflon flow cell and a ClearView db photometric analyzer. The ClearView db was equipped with filters at 1064 nm, 1160 nm, 1185 nm and 1210 nm. The full near-infrared spectra of similar samples are shown in Figure 1, along with an indication of filter locations used in the ClearView db. The sample temperature was varied from room temperature of 23 °C up to 40 °C. The sample temperature was measured via thermocouple directly connected to the ClearView db through an analog input. This allows the temperature to be measured and used in both the calibration and future routine analysis. Figure 2 shows the change in absorbance due to temperature of one of the analytical wavelengths that is significant for the caustic measurement. This illustrates the need for temperature compensation.

Analysis

Simple baseline correction pre-processing was applied to the full calibration data set. Multiple linear regression analysis (MLR) produced results for caustic determination as shown in Figure 3. This calibration includes temperature as an input. The data demonstrates accurate caustic measurement capability over the entire range of concentration and temperature.

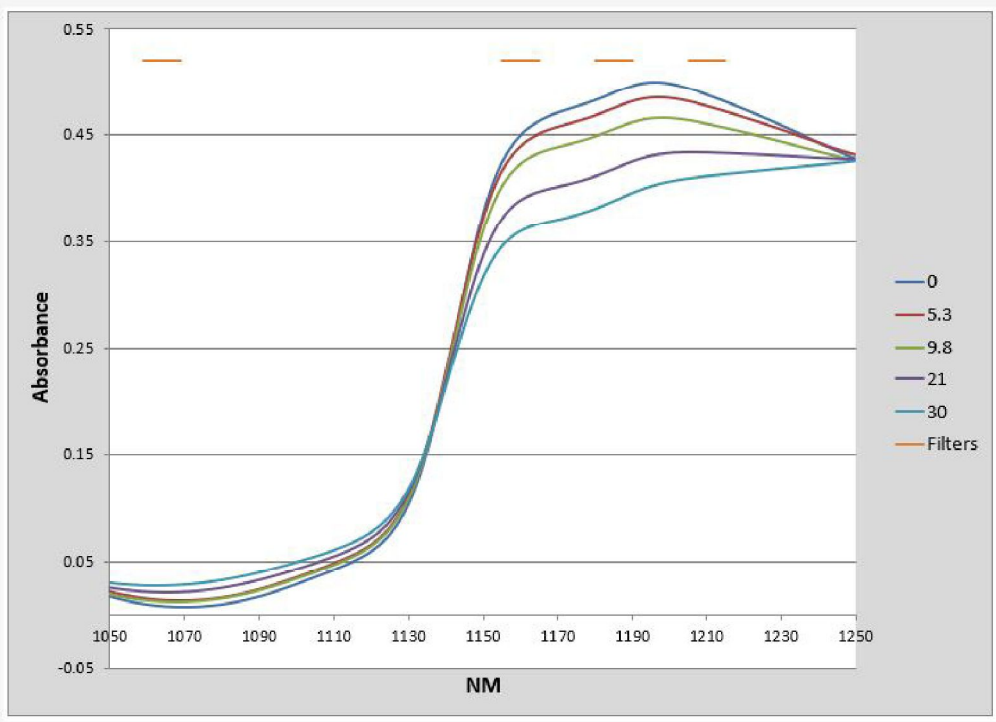

Figure 1: Caustic in Water - full sepctrum comparison

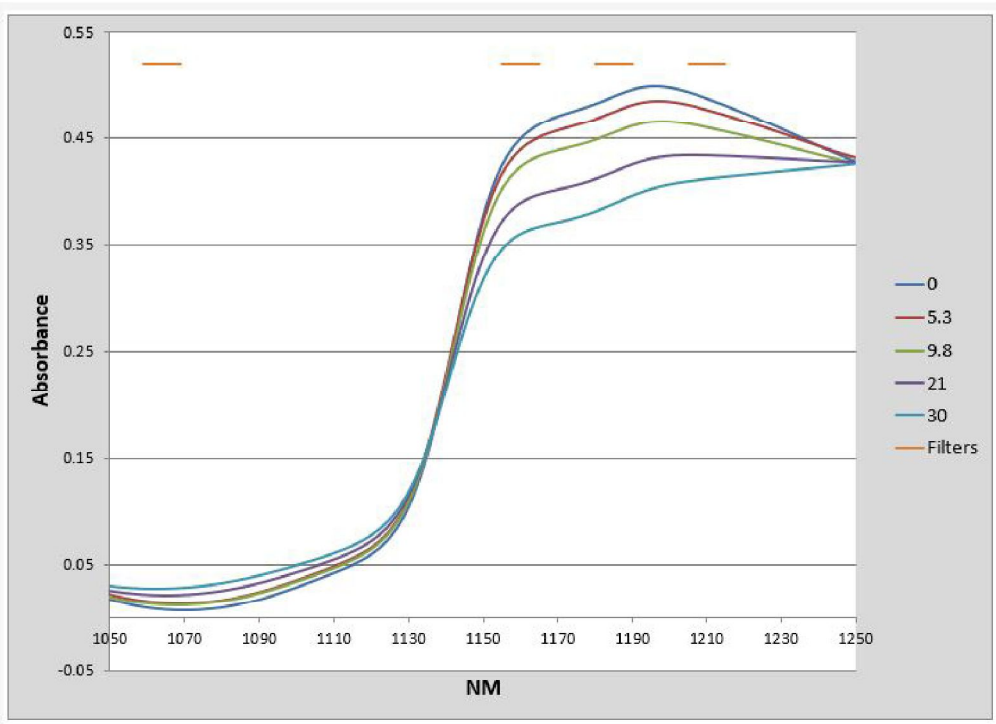

Figure 2: Temperature Infulence

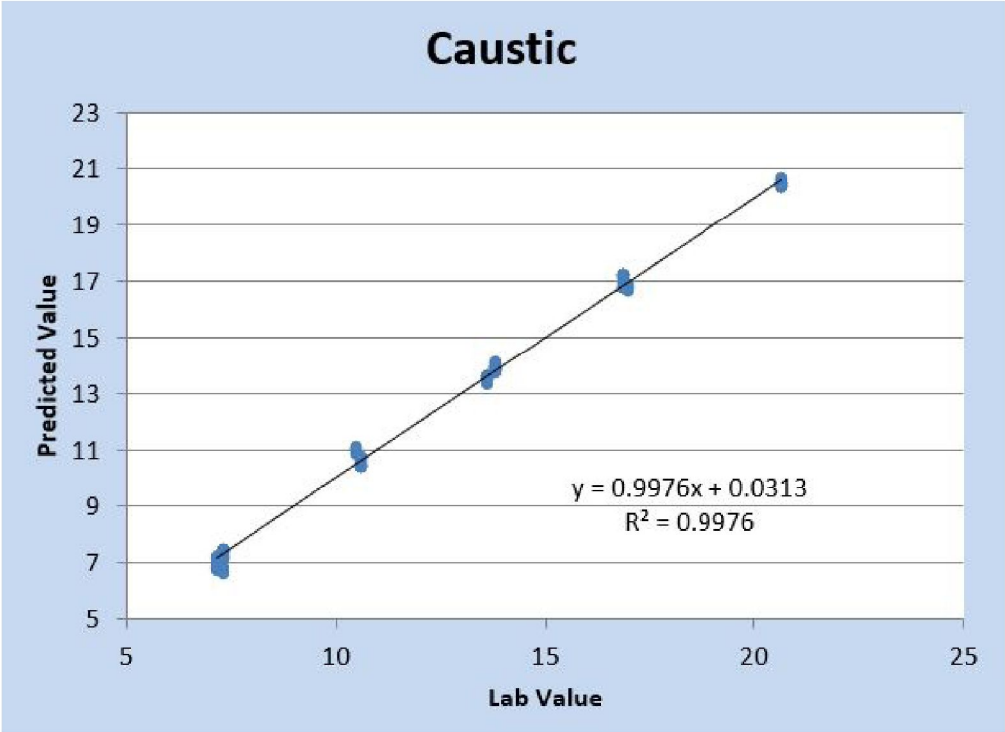

Figure 3: Caustic Results

Summary

This data has shown the determination of caustic concentration in water in the presence of normal process interferents over a typical measurement temperature range. The impact of temperature is minimized, and measurement accuracy preserved. The ClearView db photometer can accept temperature as an input as described here. Process Insights also offers a GUIDED WAVE SST™ insertion probe with a built in RTD to make temperature measurement straightforward while maintaining overall system performance. For more detailed information regarding system specifications please contact a Process Insights sales or technical specialist.

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