



Convenient Optical pH Measurements

Optical pH sensors based on proprietary sol gel coatings measure pH with high resolution and accuracy. Unlike electrodes, these sensors are less susceptible to changes in ionic strength and turbidity and work well in low salinity environments.

Introduction

Ocean Optics has developed sol gel coating materials that encapsulate colorimetric pH indicator dyes for optical pH sensing. These materials can be applied to substrates such as cuvettes, patches, probes (reflective and transmissive) and even microtiter wells. The sampling devices are easily integrated into optical setups for pH measurements in the biological range (pH 5-9).

An absorbance spectrometer measures the sensor's indicator dye as it changes color in response to the analyte. That color change is related to calibration values via a ratiometric algorithm to determine the pH. Color change occurs as hydrogen ions diffuse in and out silica matrix and interact with the indicator dye. A secondary baseline wavelength is also taken into account in the algorithm to correct any optical shifts caused by the fiber, probe or environment.

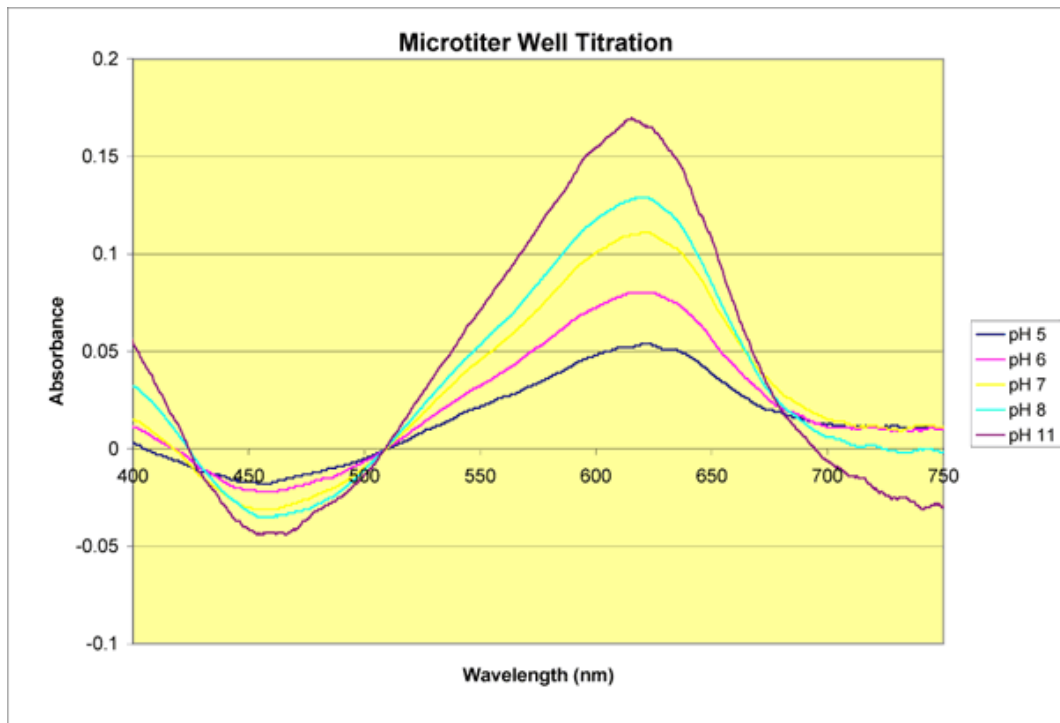
Experimental Conditions

As part of testing for a custom pH application, transparent plastic microtiter wells were affixed with a thin adhesive PMMA material coated with our pH sol-gel formulation. The idea was to allow for transmissive pH sensing of the analyte solutions placed into the wells.

We performed a titration using two buffers only: pH 1 (absorbance reference) and pH 11 (observed). The pH 11 buffer produced a standard absorbance curve very similar to what is seen for our Smart pH Cuvettes - good evidence of feasibility for the wells.

To observe absorbance at the necessary wavelengths, we used a USB2000+ Spectrometer configured for 200-850 nm, with a 200 μ m slit. Generally, most any Visible spectrometer (350-1000 nm) configured with a 25 μ m slit and order-sorting filter is suitable.

Our sample holder was a 10-cm pathlength cuvette holder. Light was fed to the top of the cuvette holder from an LS-1 Tungsten Halogen Light Source with a blue filter via a 200 μ m UV-Vis fiber. The signal was then sent through a 300 μ m UV-Vis fiber to the spectrometer.



The environment will determine your approach to sampling optics. Smart Cuvettes work well for applications that don't require in situ measurements. That's where our transmissive and reflective probes come in. We install patches in our probes, although they can be for through-package or through-container measurements as well.

Results

When our customer carried out its own set of titrations, the data did not adhere to our pH algorithm. We discovered two issues as most probable causes of the poor data: the lack of collimating lenses being used in the customer's testing, and the use of an incorrect baseline correction wavelength. Once we adjusted the setup to the optimum baseline wavelength, we were able to accurately monitor and report pH of the customer's transmissive analyte solutions.

Conclusions

Results demonstrate the viability of our proprietary optical pH sensors for a variety of analytes. Modular spectroscopy and the ability to apply pH indicators to different substrates suggest a wide range of applications is possible.



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