LI-5700A Spectrophotometric Seawater pH Analyzer

Specifications

- **Precision:** better than ± 0.001 pH units
- **Wavelengths for pH analysis:** 434 nm, 578 nm, and 705 nm (user-definable and expandable)
- **Indicator for pH:** m-cresol purple
- **Spectrophotometer:** Agilent Cary 60
- **Spectrophotometric cell:** 10 cm with thermostatic water jacket
- **Precision of temperate-control system:** < 0.1°C
- **Automated:** run 9 samples sequentially
- **Typical sample volume:** ~ 40 mL per analysis
- **Time-consumption:** ~ 5 minutes per analysis
- **Working environment:** both land and shipboard laboratories

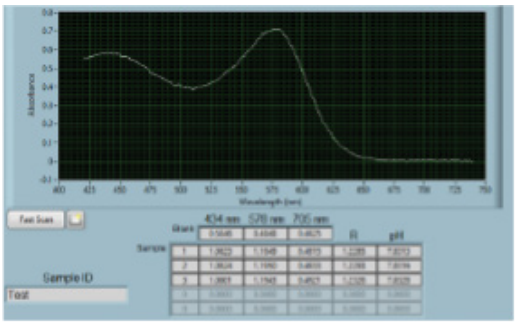

Figure 1. Spectrophotometric determination of seawater pH based on absorbance at three wavelengths. A final pH value is returned as an average of 3 measurements. The full wavelength absorbance curve is based on the difference between sample with and without mCP.

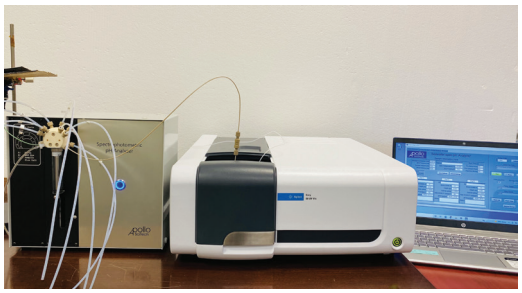

Figure 2. A whole unit for the spectrophotometric pH analysis at sea or in land-based lab.

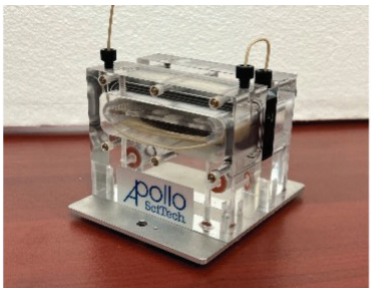

Figure 3. Water-jacketed flow cell (Inside Cary60)

Description

The LI-5700A Spec-pH Analyzer (formerly Apollo AS-spec-pH2T) has been developed for high precision and accuracy, automated determination of seawater pH. It is based on the principle of colorimetric determination of the relative color intensity using a pH indicator (m-cresol purple) at three wavelengths (434 nm, 578 nm, and 705 nm) with the first two absorptions as a known function of pH and the third one serves as a baseline correction (Clayton and Byrne 1993; Liu et al. 2011). The automated analyzer is designed according to Carter et al. (2013) with improvements.

A high-quality Agilent spectrophotometer (model Cary 60) is used for the colorimetric determination and a high precision. An innovative thermostated spectrophotometric flow cell is built in-house which effectively controls all sample temperatures to a describable constant temperature in the analytical cell. To ensure high quality data, a water bath should be used to help maintain a constant temperature throughout the sample analysis.

Sample Analysis Results

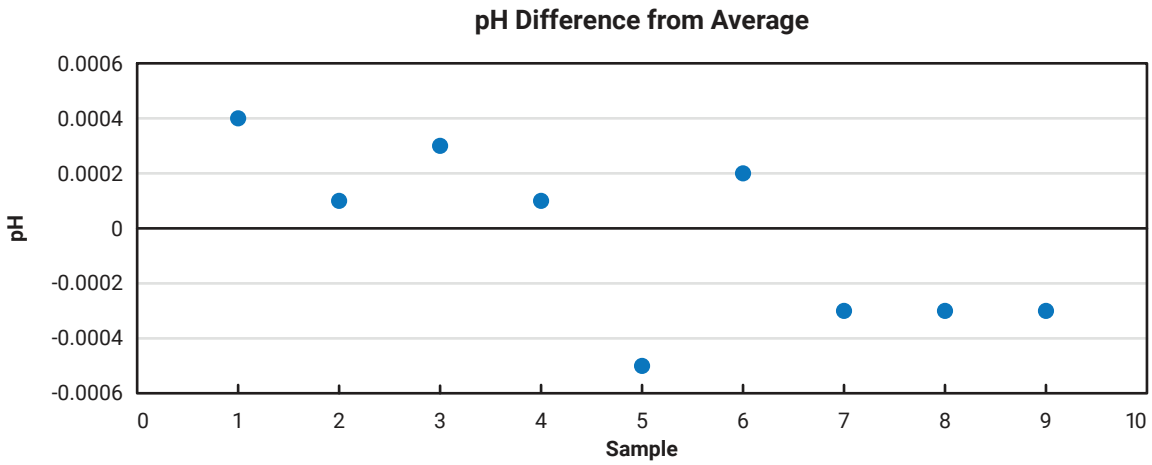

Figure 4. Differences in pH of replicate samples from average pH, sampled from the same Cali-5-Bond bag. Water sample was taken from Delaware coast. No HgCl2 was added to the bag. The average and standard deviation of the replicated pH measurements are 8.0598 ± 0.0003.

References

Carter, B. R., J. A. Radich, H. L. Doyle, and A. G. Dickson. 2013. An automated system for spectrophotometric seawater pH measurements. *Limnol. Ocean. Methods*, **11**: 16–27.

Clayton, T. D., and R. H. Byrne. 1993. Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of m-cresol purple and at-sea results. *Dee-Sea Res.*, **40**: 2315–2329.

Liu, X., M. C. Patsavas, and R. H. Byrne. 2011. Purification and Characterization of meta-Cresol Purple for Spectrophotometric Seawater pH Measurements. *Environ. Sci. Technol.*, **45**: 4862–4868. doi:10.1021/es200665d