

Streamlining Measurement Diagnostics for Point of Care Testing

How Spectroscopy Helps Improve Patient Outcomes



When a leading supplier of diagnostic equipment for healthcare providers sought a compact spectral system for its point of care (POC) blood gas analyzers, Ocean Optics delivered a robust, scalable instrument that's adaptable to the customer's evolving testing requirements. As a result, clinicians can more quickly and accurately monitor changes in critical blood parameters, allowing them to make timelier, more effective treatment decisions.

Applying Spectroscopy to Whole Blood Analysis

POC diagnostics have benefited greatly from the marriage of fiber optic spectroscopy and biofluidics, with photonics technologies playing a major role in addressing healthcare challenges ranging from cancer screening to viral detection.

Absorbance spectroscopy is an especially useful technique for blood testing at the point of care, with readily discernible spectral features providing insight into important blood components including hemoglobin (which transports oxygen in the blood), methemoglobin (a non-oxygen transporting form of hemoglobin) and bilirubin (the substance formed as red blood cells break down

and pass through the liver before being excreted by the body). By correlating the absorbance of these key constituents to their concentration levels in the patient's blood, healthcare providers can spot indicators for conditions including anemia (low hemoglobin) and jaundice (excessive bilirubin buildup).

Compared with other blood testing techniques, spectral analysis is often faster, with real-time results available within seconds versus minutes or even hours; can make continuous measurements throughout the screening process; and is much more readily configured to monitor multiple blood test parameters within a single sample.

For example, UV-visible absorbance spectra for whole blood – especially in the spectral region from about 500-600 nm, where molecular bonding to the heme group in hemoglobin can be detected – reveal a wealth of information within a single measurement, with characteristics that vary for each patient (Figure 1).

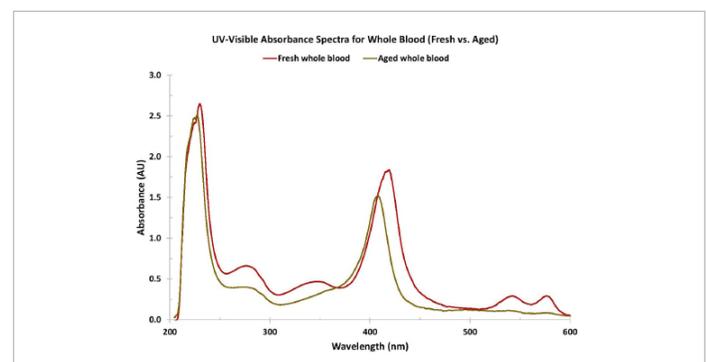


Figure 1

Taking on Diagnostic Equipment Challenges

Successive generations of compact, customized spectrometers have become faster, more accurate and more electronically robust. This has virtually eliminated performance trade-offs inherent to earlier compact spectrometers and made it more feasible to scale these spectrometers for high-volume customers in different industries.

In biomedical and life sciences applications, spectrometers are now routinely integrated into other devices, combined with fiber optic components for use as subassemblies, and designed into fully realized instruments for applications ranging from blood gas analysis to molecular diagnostics. Mass customization adds economies of scale.

In long-term partnership with our POC equipment customer, Ocean Optics has consistently delivered an artfully engineered combination of spectrometer hardware, application know-how and design expertise that meets the customer's blood gas instrument needs. This collaboration highlights Ocean Optics' key capabilities for suppliers of biomedical and life sciences solutions:

- Partnership from prototype to production. We work with customers to design, optimize, scale and supply spectral solutions.
- Copy exact manufacturing. For more than a decade, Ocean Optics has worked with customers in biomedical, pharmaceutical and other industries to ensure both design and production integrity. Our manufacturing facilities are ISO9001:2015 certified and our calibration lab meets ISO/IEC 17025:2017 requirements.
- Experience manufacturing FDA-approved devices. Over many years, Ocean Optics has assembled devices in high volumes for customers that supply FDA-approved instruments.
- Proven success as a spectrometer solutions supplier. Our installed spectrometer base is greater than 500,000, with customers ranging from small colleges and startups to leading research universities and Fortune Global 500 companies.

Adapting for Success

With Ocean Optics' partnership, our medical device customer has sustained high quality in its POC systems without the need for significant spectrometer reengineering of each new instrument generation.

This owes, in part, to the flexibility inherent to compact spectrometers, which allows us to optimize the setup to deliver a targeted answer. Also, we have partnered with the customer to fully understand the application throughout each step of the measurement, including how to manage changes in ambient conditions that affected results. This has allowed us to introduce optoelectronic refinements leading to a nearly 10x reduction in off-specification products.

Flexibility extends beyond design upgrades. Time to market is one of the most important drivers for biomedical and industrial customers. So, we've developed an infrastructure comprising customer and engineering support, supply chain management, and copy exact manufacturing that allows us to respond quickly as the customer's needs change.

For example, when COVID-19 emerged as a worldwide threat, healthcare providers were forced to respond in kind, often turning to technologies like spectroscopy to address a host of issues brought into high relief by the challenges of the pandemic. This directly affected our POC instrument customer, as many COVID-19 patients in respiratory distress required mechanical ventilation, and healthcare providers needed a reliable method to measure oxygenation, total hemoglobin and other critical blood parameters in sedated patients. To best respond to these unique circumstances, Ocean Optics worked closely with the customer to maintain product quality while meeting a dramatic spike in demand.

Whether it's the next pandemic or some other healthcare challenge to tackle, and as the world moves away from "one-size-fits-all" medicine and toward greater personalization, the need for scalable, practical technologies like spectral sensing to analyze results will continue to increase.

Optical sensing technologies have become more powerful and accessible than ever. Yet the ultimate success of each application depends on the supplier-customer partnership. Ocean Optics takes an integrated approach to customer needs that combines optimized spectroscopy hardware, software and data delivery, backed by deep category expertise.

In the case of our POC instrument customer, we've been able to make product improvements to meet their needs, adjusted our processes to conform to copy exact manufacturing requirements, and helped them to deliver a stable, reliable instrument for many years.

Like the best partnerships, each company has benefited. By getting our customer to the right place with their application, we've crafted the building blocks for spectral solutions to help solve a variety of biomedical and life sciences challenges.