Crystal IS
High Performance UVC LEDs

CASE STUDY:

WET Labs

WET Labs is dedicated to developing and manufacturing underwater instrumentation to detect vital biological, chemical and geological parameters and processes of the earth's oceans, lakes and streams.

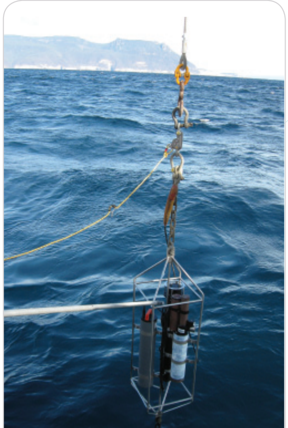
CHALLENGE

Hydrocarbon monitoring in water is of growing importance near oil platforms, marinas and spill-affected waters. Oil can be released into water from many different sources and has the potential to cause significant environmental damage if not remediated. In the case of an oil spill, it is common to use a chemical dispersant to reduce the volume of the surface slick by dispersing the oil into the water column. Oil spill response and remediation efficiency is dependent on monitoring the volume of oil spilled, identifying the oil density and type.

Traditionally, grab sampling and testing by gas chromatography (GC) has been used to characterize and quantify oil in water. Not only is the process slow and expensive, the limit of detection for GC for oil in water is one part-per-million (ppm). Furthermore, the sample must be in a gaseous phase to be analyzed, making portable GC devices unusable during an oil spill-monitoring program to collect real-time concentration data. This has led to the development of alternative, in situ methods of measurement with higher sensitivity. Due to its sensitivity and selectivity, fluorescence spectroscopy is increasingly used in petroleum technology.

The aromatic hydrocarbon proportion of a crude oil is highly fluorescent in the UV so fluorescence is a direct indicator of the aromatic hydrocarbon concentration. Fluorometers are portable and battery-operated instruments that provide instant, on-the-spot measurements with no chemical manipulation. The initial light sources used in these fluorometers for deep UV excitation were Xenon flash or Deuterium lamps. These sources are less stable, have more complex circuitry and a higher cost of ownership in relation to solid state light sources such as LEDs. The adoption of UVC LEDs (250-280nm) has been slow to date, due largely to low light output of some of the earliest commercialized devices which leads to poor sensitivity in the application.

"THE HIGH LIGHT OUTPUT OF CRYSTAL IS DEEP UV LEDS ENABLES THE WETSTAR FLUOROMETER TO DETECT EXTREMELY LOW CONCENTRATIONS OF OIL IN WATER," SAID COREY KOCH, SENIOR SCIENTIST AND PRODUCT MANAGER AT WET LABS. THE TESTS PERFORMED REVEAL THE ABILITY OF THE WETSTAR FLUOROMETER TO DETECT NOT JUST LOW LEVELS OF OIL, BUT ALSO DETERMINE DISPERSANT-TO-OIL RATIO, DETERMINE OIL TYPE BASED ON DENSITY RELATIONSHIPS AND DISCRIMINATE OIL FROM BACKGROUND CDOM.



SOLUTION

The introduction of brighter UVC LEDs from Crystal IS has created new opportunities for the use of LEDs for fluorescent in situ detection of oil in water. WET Labs evaluated the Crystal IS 280 nm UVC LED in their WETStar fluorometer.

The WETStar has multiple channels and utilizes excitation and emission (Ex/Em) pairs for CDOM discrimination, fluorescence index and oil concentration. Various oil types, from refined, fuel and light-heavy crude oils, with and without dispersant and background organic matter, were analyzed with the system.

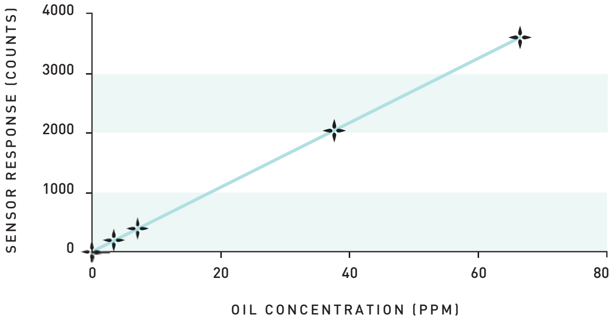
The tests reveal that the WETStar fluorometer has a detection limit of 36 parts-per-billion (ppb) for oil dispersed in water and the response is linear up to oil concentration of 300 ppm. The high light output of the UVC LED leads to trace detection in the part per billion levels. Similarly, the spectral quality of the LED contributes to the linearity of measurement over four orders of magnitude.

Crystal IS ADVANTAGE

LEDs offer light stability, instantaneous response and design freedom over traditional light sources. In addition, Crystal IS deep UV LEDs provide:

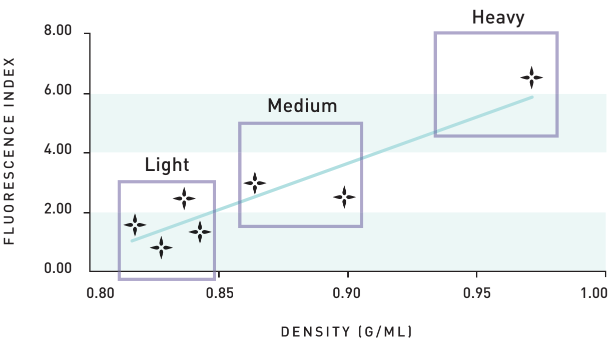
- **High light output for trace detection in the parts per billion levels**
- **High spectral quality for measurement linearity over a wide concentration range**
- **Long lifetime and simple drive electronics that enables maintenance-free, continuous, remote operation**

OIL SENSOR RESPONSE



The sensor responds to various oils and generates positive correlations between the Fluorescence Index and oil densities. This means that the oil type can be detected from the density measurement.

DEPENDENCE OF FLUORESCENCE INDEX ON OIL DENSITY



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