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# Fluorescence Monitoring of Total Crude Oil in Water

Custom Sensors & Technology

**The oil content of produced wastewater streams during oil production and/or refining can be monitored using molecular fluorescence whenever aromatic molecular species are present in the oil fraction of the waste stream.**

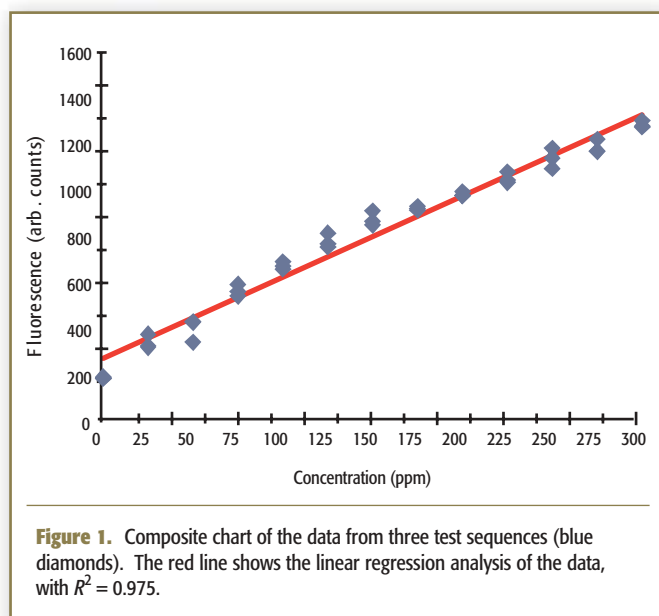
**M**onitoring of the oil content in water streams from oil production and refining facilities is critical for meeting the stringent environmental regulations on waste oil being returned to waterways throughout the world. The current trend in regulation is to further reduce the oil content of produced water streams, which dictates that oil producers and refiners implement improved monitoring methods on the waste water generated in order to stay below regulatory levels and avoid costly fines and cleanup expenses.

In general, only very small quantities (<25 ppm) of crude oil will be completely soluble in produced water. The oil solubility limit is based on the chemical composition of the sample and the temperature and pressure conditions in which the crude oil and water are mixed. Oil concentrations exceeding the solubility limit are entrained in the water stream either as suspended droplets (emulsion) or as a phase-separated oil layer. Due to the low solubility of oil in water and the non-uniform mixing between piping systems, measurement of the total oil content requires that homogenization of the produced water stream occurs.

Custom Sensors & Technology has developed an in-situ monitoring system based on molecular fluorescence to meet current and future monitoring requirements. Fluorescence monitoring was chosen because of high sensitivity and selectivity to specific components found in crude oil (1). Additionally, entrained bubbles and solids should have minimal effect on the measurement due to the proprietary design of the in-situ probe placed in the waste stream (2).

## Experimental Results & Discussion

Figure 1 is a composite from three test solutions composed of ultra high-purity water and EPA #2 oil, a common mimic for crude oil. Linear regression of the composite data, the red line in Figure 1, has an  $R^2$  of 0.975. The solution was generated by standard addition of the EPA #2 oil followed by in-situ homogenization of the sample, which was required to emulsify the sample at all oil concentrations exceeding 25 ppm.



## Conclusion

A new in-situ fluorescence based monitoring system has been developed to monitor the crude oil content of water streams. This system has been shown to have a linear response over a wide oil concentration range with very good reproducibility.

## References

1. I.B. Berlman, *Fluorescence Spectra of Aromatic Molecules* (Academic Press, New York and London, 1971), pp. 67–94.
2. O.S. Wolfbeis, *Fiber Optic Chemical Sensors and Biosensors Vol 1* (CRC Press, Boca Raton, Ann Arbor, Boston, London, 1991), pp. 61–67.

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