



Analysis and Identification of Biomarkers and Origin of Color in a Bright Blue Crude Oil

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A key step in crude oil production is injection of monoethylene glycol (MEG) to prevent formation of harmful gas hydrates. However, in a particular Gulf of Mexico platform, the recovery of MEG from a bright blue crude oil (see Figure 1) was prevented by formation of unknown deposits.



Figure 1. Strikingly blue crude oil from a Gulf of Mexico drilling platform.

With NHMFL's 9.4 T FT-ICR mass spectrometer and Woods Hole's two-dimensional gas chromatograph and two-dimensional fluorescence spectroscopy, we identified the source of the blue color as perylene, a highly fluorescent polycyclic aromatic hydrocarbon. In addition, we were able to conclusively identify by FT-ICR MS and GC×GC a suite of pentacyclic triterpenoid biomarkers, of which the most abundant species was $17\alpha(\text{H})$, $21\beta(\text{H})$ -25-norhopane.

Finally, FT-ICR MS identified the causative agents in the deposit (Figure 2), enabling the producer to select appropriate additives to prevent deposit formation. The reference below was featured on the cover of *Energy & Fuels*. Ms. Esha Atolia participated in the project as a high school student.

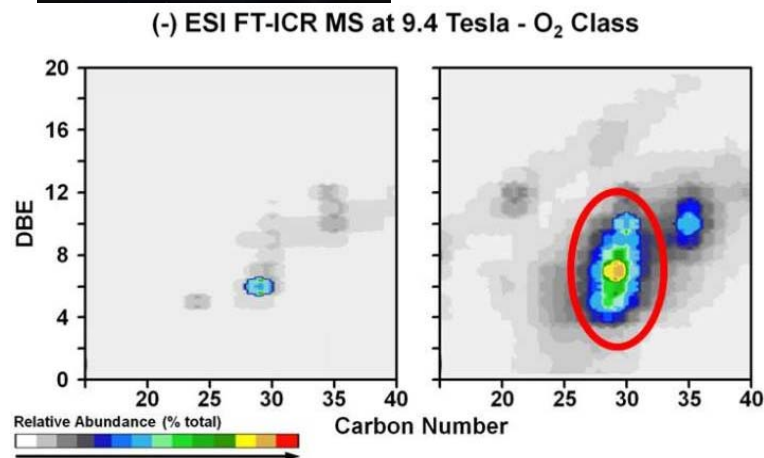


Figure 2. Negative-ion electrospray FT-ICR MS color-coded isoabundance contours of DBE (number of double bonds plus rings in a molecule) versus carbon number for molecules containing carbons, hydrogens, and two oxygen atoms in the blue crude oil (left) and its deposit (right). The compositional image identifies the primary culprit components in the deposit.

Facilities: NHMFL 9.4 tesla widebore FT-ICR mass spectrometer; Woods Hole GC/GC mass spectrometer.

Acknowledgements : G.S. Boebinger (NSF DMR-0654118), DOE DE-FG02-06ER15775.

Citation: Juyal, P.; McKenna, A. M.; Yen, A.; Rodgers, R. P.; Reddy, C. M.; Nelson, R. K.; Andrews, A. B.; Atolia, E.; Allenson, S. J.; Mullins, O. C.; Marshall, A. G. "Analysis and Identification of Biomarkers and Origin of Color in a Bright Blue Crude Oil," *Energy & Fuels* **2011**, *25*, 172-182 .