FREQUENTLY ASKED QUESTIONS

Deepwater Horizon Oil Spill and Safety Testing of Marine Environment

Contributions by:

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The Deepwater Horizon oil spill has contaminated parts of the Gulf of Mexico and estuaries in several coastal states in the southern region of the United States. The seafood harvested from these areas may be contaminated by this oil and may need to be so identified. Following is a listing of possible questions you may have on the subject and associated responses.

Q **What types of analysis will be necessary to track the condition of the marine environment following the Deepwater Horizon oil spill?**

A Typically, oil is extracted/dissolved in a solvent such as methylene chloride, and this extract is analyzed by gas chromatography (GC) for total petroleum hydrocarbons (TPH) or GC with mass spectrometry (GC/MS) for quantification of the specific compounds of interest in oil or for oil fingerprinting purposes. Oil has many thousands of individual compounds and, of course, it is not necessary/critical to identify and quantitate all of these. Normally, the compounds of interest are the saturate and branched hydrocarbon chromatographic profiles, the 2, 3, 4 and 5-ringed polycyclic aromatic hydrocarbons (PAH) compounds and their respective C1 to C3 alkyl homologs, as well as the hopane and sterane biomarkers (ions 191 and 217). These compounds are typically detected by single ion monitoring (SIM) GC/MS analyses.

Q **PAHs are an important analyte in determining the condition of the water, sediment, plant and animal life following the oil spill in the Gulf of Mexico. What are some important considerations in preparing samples for PAH determination by chromatographic techniques?**

A Oil primarily contains the alkyl homologs of the PAH compounds. Therefore, in order to identify the residue as being from oil, the C1 to C3 alkyl homologs of each ring structure should also be detected and quantitated (using the response factor of the parent PAH for quantitative calculations). Since these analyses are done using selective ion monitoring (SIM) techniques, special attention should be paid to the correct retention time windows of the SIM plots.

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Q **GC/MS is a typical technique in the determination of PAHs in many different matrices. What are some key aspects needed for an effective GC/MS method?**

A The first, of course, is detection limits that meet the requirement for the analysis. Detection limits should include not only instrument detection limits but method detection limits, typically 0.1 to 1 ppb. Most GC/MS methods use SIM and there is always concern that there are no interfering ions from the sample matrices in the SIM retention time windows for the PAH compounds. Also, if you are trying to identify sources of the PAHs, then their C1 to C3 alkyl homologs should also be detected.

Q **Determination of PAHs is commonly performed with both HPLC (UHPLC) and GC/MS. Can you discuss some advantages and disadvantages of each technology with respect to this application (PAH)?**

A The GC/MS method can readily identify the alkyl homolog patterns associated with petrogenic PAHs, which is not possible in the HPLC method. On the other hand, the HPLC method can detect some oxidized (polar) metabolites not readily amenable to GC/MS analyses.

Q **Beyond PAHs what are other potentially important analytes (V, Ni, alkanes, chemical dispersants) that may be monitored with instrumental techniques (chromatography, mass spectrometry (MS), inductively coupled plasma (ICP and ICP-MS)) during remediation?**

A Ni, V and the sulfur heterocyclic compounds are important components in petroleum. Oil spill analyses should focus primarily on the saturated and branched hydrocarbons (57, 71, 85), the sulfur heterocyclic aromatic compounds (184, 234) and their C1 to C3 alkyl homologs, the PAH compounds (128, 166, 178, 202, 228, 252) and their C1 to C3 alkyl homologs, as well as the hopane and sterane biomarkers (191, 217). Also, the C12/C13 isotopic ratios may sometimes be important.

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