

Chasing early chemical changes in surface oil slicks

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On a global scale, approximately half of the oil contaminating coastal ocean waters is introduced by natural seepage. One of the world largest seep field's is located just offshore Santa Barbara, California, providing an exceptional natural laboratory for investigating petroleum weathering occurring on the sea-surface (sheens). Here, we tracked a single hydrocarbon plume and collected in total 16 sheen samples downstream, all within varying distances to the surfacing location. The sampling campaign was performed at night, using LED-based slick trackers, to exclude potential photooxidation caused by ultraviolet light emitted from the sun. Our goal was to track the changes in the sheen composition, and explain the corresponding weathering processes, for the oil that underwent these lateral transport processes. Oil sheens were extracted and analyzed on both, conventional one-dimensional gas chromatography (GC) and comprehensive two-dimensional gas chromatography (GCxGC) to detect changes in the molecular diversity and abundance of hydrocarbons. While GC analysis enabled us to decipher hydrocarbon decomposition on a broader scale, GCxGC has the capability to discriminate between isomers of the same compound. This, in particular, has shown to be useful for the analysis of polycyclic aromatic hydrocarbons (PAHs), which have many structural isomers (see Fig. 1). In this study, we examine differences in weathering between structural isomers of PAHs during rapid hydrocarbon degradation at the sea surface.

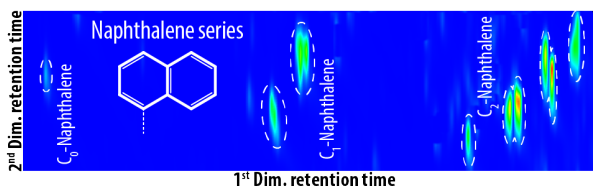


Figure 1: Snapshot of a GCxGC chromatogram showing the first three out of six naphthalene series.