A Method for Identifying the Photoproducts, Mechanisms, and Toxicity of Petroleum from the Deepwater Horizon by High-Performance Liquid Chromatography and DNPHi Derivatization

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The BP Deepwater Horizon oil spill was detrimental to the prosperity of marine and wildlife habitats, as well as the fishing and tourism industry in the surrounding region. Oil spills can also indirectly affect the economies of countries outside the region, specifically through the spread of toxins harmful to aquatic life. Octanal, hexanal, and propionaldehyde are the three waste products targeted in this study. These aldehydes and ketones have specific negative impacts on marine wildlife, such as long term cardiotoxicity in fish and liver dysfunction in mammals. Because aldehydes and ketones are considered a waste product in aquatic environments, this long-term study was conducted to identify and quantify the formation of aldehydes in emulsified crude oil and seawater by high-performance liquid chromatography (HPLC) and solar simulation. Oil samples collected from BP's Surrogate Macondo Well were irradiated by solar simulator over six, twelve, and eighteen hour periods. The aqueous solution from beneath the oil was then pulled, derivatized with dinitrophenylhydrazine (DNPH), and analyzed by HPLC with UV detection to be compared to the standard chromatograms generated for propionaldehyde, octanal, and hexanal. Chromatogram results from the eighteen hour irradiated BP Surrogate oil indicated that aldehydes were present after exposure to sunlight, and within the range of the aldehyde standards used based on their carbon chains. The procedure developed in this research will allow EPA and bioremediation organizations to identify toxins forming as photoproducts in an oil spill, and treat affected marine ecosystems accordingly.

Awards Won:

Second Award of $2,000

Consortium for Ocean Leadership: First Award of $3,000