



Weathering of Crude Oil in the Gulf of Mexico

Environmental factors that affect the biological and chemical breakdown of crude oil

WHY Oil spills are a concern due to the increasing activities of extraction and transportation of petroleum. Two of the largest catastrophic oil spills in history occurred in Gulf of Mexico: the Ixtoc 1 in 1979 and the Deepwater Horizon (DWH) in 2010, releasing 140 and 180 million gallons of crude oil, respectively. Oil spills can severely affect ecosystems, such as deep-sea benthos and coastal wetlands, in both short and long time scales. Understanding the degradation processes of crude oil, including both biological and chemical weathering, is important in developing response strategies for oil spills and predicting the fate of oil in the environment.

HOW Weathering of crude oil depends on environmental factors, mainly solar irradiance, temperature and nutrients. Dr. Liu simulates oil degradation in the field and laboratory by conducting incubation experiments using Gulf coastal waters with natural bacterial assemblages. Crucial findings:

- Polycyclic aromatic hydrocarbons, which are toxic, degraded rapidly in the sea surface oil.
- The growth of certain oil-eating bacteria is controlled by environmental factors, such as solar irradiance and temperature.

- Lab experiments suggest that 30-75% of the toxic components of crude oil, in the form of n-alkanes and aromatics, is lost within two months after a spill.

IMPACT

This knowledge is critical to understand the fate of oil following a spill, considering that oil spill in marine waters is often across large environmental gradients. Therefore, a quantitative understanding of how these environmental factors affect oil degradation is key to predicting the fate of oil in Gulf waters. Our eventual goal is to build a model to predict how long the oil can last in Gulf waters, given the environmental conditions including solar irradiance and nutrient levels. This information is critical for policy makers, as well as the public, if there is another oil spill in the Gulf of Mexico in the future.

