A Laboratory Microcosm Study of Macondo Oil Degradation in a Coastal Salt Marsh

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ABSTRACT

Although Alabama shores were impacted by the Deepwater Horizon oil spill, few data are available for a reliable assessment of the fate of Macondo oil-derived pollutants in Alabama's coastal environments. Laboratory microcosm incubations were conducted to evaluate the degradation of hydrocarbons from Macondo oil in salt marsh sediments collected from Bayou La Batre, Alabama. Each microcosm containing salt marsh sediment and in situ seawater was spiked with Macondo oil and then incubated for 14 d in the dark. Total alkanes in the sediment decreased rapidly within the first 12 hr and thereafter remained relatively stable. At the end of the experiment, total alkanes in sediments decreased by 71.4 ± 32.3%. The high degradation rate of alkanes in the first 12 hr of the incubations was attributed to aerobic microbial degradation, and the subsequent decrease in the degradation rate was likely due to oxygen depletion in the microcosms. The concentrations of dissolved inorganic nutrients (nitrate, nitrite, and phosphate) did not show evident patterns over the course of the incubation, indicating that nutrient availability was not the factor responsible for the decrease in the alkane degradation rate. No preferential degradation was observed between normal versus branched alkanes or between short-chain versus long-chain alkanes. Presumably, this may be due to adaptation of in situ microbes to degrade various types of alkane compounds because of their previous exposure to oil pollutants from the Deepwater Horizon oil spill as well as from prevalent natural oil seeps and oil drilling activities in the study area. Polycyclic aromatic hydrocarbons (PAHs) detected in microcosm sediment included naphthalene, acenaphthylene, fluorene, fluoranthene, and pyrene. The PAHs showed variable concentrations and demonstrated no consistent loss over time, indicating the resistance of these compounds to short-term biodegradation.