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Hot Spots for Poly Aromatic Hydrocarbons (PAHs) in Sediments and Benthic Organisms in the Coastal Water of Qatar

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The state of Qatar has a strategic location within the heart of the Arabian Gulf, the richest oil area in the world. Its extensive coastline (700 km) is experiencing some of the most radical environmental conditions in the world's oceans including extreme temperature, high UV irradiance as well as high evaporations. These extreme conditions are pushing many marine biota to function close to their physiological limits. On the top of the extreme natural hydrographic conditions, there are tremendous stress exerted by oil exploration, production and transportation and probably any remnants from the largest oil spills in history, during the Gulf war in 1991. The present study is the first comprehensive study in the Gulf that is designed to assess the spatial and temporal variability of levels of Poly Aromatic Hydrocarbons (PAHs) in sediments of the Qatari coastal water and their bioaccumulation by dominant benthic invertebrates. Sediments and dominants benthic organisms samples were collected seasonally from thirteen locations in the coastal water of Qatar starting in the winter of 2014 and for four consequent seasons. Ten abundant benthic invertebrate species representing different trophic levels were selected to assess the spatial and temporal variability of PAHs in the Qatar costal water. These species have limited or no mobility, a major criteria for selecting benthic organisms in bio-monitoring programs. These species included gastropods, bivalves, and crustaceans with different trophic positions including carnivores, omnivores, herbivores and detritivores. Samples were analyzed for 16 parent PAHs including low molecular weight parent PAHs (LPAHS) and high molecular weight parent PAHs (HPAHs), 18 alkyl homologs and dibenzothiophenes. The results of the present study will be used for ecological risks assessment.

Levels of PAHs in sediments and tissue residues are found to be significantly variable with species, locations, seasons and also with distance from shore ($P<0.05$). PAHs concentrations in sediments is negatively correlated with the water temperature ($r = -0.65$) indicating the impact of temperature and probably levels of UV radiations on the fate of

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PAHs. Levels of PAHs in sediments indicated the presence of few moderately contaminated sites near point sources. Concentrations of PAHs in sediments showed wide spatial and temporal range (5 8.5%) presenting a range of trophic levels including carnivores and filter feeders. Significant correlations ($P<0.05$) were found between PAHs tissue residues concentrations and signatures of carbon and nitrogen stable isotopes emphasizing the roles of trophic pathways on the uptake and bioaccumulation levels of individual PAHs in marine invertebrates. The present results are to be supported by more samples from two more seasons. The knowledge from this study intended to assist PAHs monitoring and identification of potential sources to guide management decisions. The outcome of the study is expected to help the regulatory agency (Qatar Ministry of Environment) as well as Gulf organizations such as ROPME to improve environmental laws and set standards based on these studies.

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