



Characterization and source identification of monoaromatic hydrocarbons in the surface sediments offshore the Zonguldak industrial region, Black Sea

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Under great anthropogenic pressure due to the substantial freshwater input from the surrounding industrial and agricultural areas, especially central and middle-Eastern Europe, the Black Sea basin is ranked among the most ecologically threatened water bodies of the world. The Black Sea region of Turkey is not heavily industrialized. Only small-scale textile, food, forest products and metal industries are scattered around the settlement areas. The largest industrial establishments are 600 MW thermal power plant and iron-steel complexes in the Zonguldak region, one of the leading ten provinces of Turkey in terms of industrial production. Together with regional hard coal production since 1848 which caused color changes in sediment, these early industrial facilities, actually composed of many separate plants developed in the 1940s and 1960s along the shores, are responsible for the major coastal hot-spots. The marine areas still suffer from the impacts of water pollution from these industries mostly due to the difficulties involved in enforcing environmental laws on the existing facilities. Beyond land-based sources, trans-boundary pollution sources from Black Sea riparian countries, heavy maritime traffic, particularly involving petroleum transports and fishing boats, and the improper disposal of ballast and bilge waters and solid waste are also important marine sources of pollution.

Sediments are essential components of marine ecosystems. Based on their affinity to sorb to particles and organic carbon in the sediment, contaminants have potential

biological impacts to benthic organisms in many ways and to the overlying water body, as they serve as diffuse sources of contamination. In order to estimate their distribution in sediment and their sources, monoaromatic (Benzene, Toluene and Xylene or BTX) hydrocarbons were monitored from the shelf area seafloor samples staying above the hydrogen-sulfide containing water column offshore the Zonguldak industry region, the most polluted spot along the Turkish Black Sea.

Found in fossil fuels such as PAHs, BTX isomers are generated by incomplete combustion of organic matter. Major sources of aromatics to the urban environment include vehicle exhaust (mobile source), residential heating, waste incineration, petroleum refining processes, coke and aluminum production (stationary sources). Some parametric ratios of BTX compounds can be used to evaluate the gasoline partitioning and have shown gasoline contamination in sediment. Our results show that the Benzene/Toluene ratio is surprisingly high, always greater than one. Its varying concentrations throughout the region have some descriptive characteristics in the estimation of biodegradation and possible pollution sources which were mainly related in this study with high inputs from land-based stationary sources, diffusion of ashes from thermal power plant and coal wastes, and maritime transportation from the regional ports.