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Anthropogenic waste indicators (AWIs), particularly PAHs and LABs, in Malaysian sediments: Application of aquatic environment for identifying anthropogenic pollution

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ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) and linear alkylbenzenes (LABs) were used as anthropogenic markers of organic chemical pollution of sediments in the Selangor River, Peninsular Malaysia. This study was conducted on sediment samples from the beginning of the estuary to the upstream river during dry and rainy seasons. The concentrations of ΣPAHs and ΣLABs ranged from 203 to 964 and from 23 to 113 ng g^{-1} dry weight (dw), respectively. In particular, the Selangor River was found to have higher sedimentary levels of PAHs and LABs during the wet season than in the dry season, which was primarily associated with the intensity of domestic wastewater discharge and high amounts of urban runoff washing the pollutants from the surrounding area. The concentrations of the toxic contaminants were determined according to the Sediment Quality Guidelines (SQGs). The PAH levels in the Selangor River did not exceed the SQGs, for example, the effects range low (ERL) value, indicating that they cannot exert adverse biological effects.

1. Introduction

Tracing regional anthropogenic influences is significant for evaluating the risk and magnitude of organic contamination and its impact on the environment and human health. Malaysia is a tropical country characterized by continuous rainfall. With an extensive river system as a national water resource, Malaysia is the most developed country in the third millennium. The highest annual rainfall recorded in Malaysia was 3936.2 mm and the lowest 1833.8 mm (DOSM, 2012). Organic pollutants arising from rapid development, urbanization, and industrial and agricultural activities are discharged by the Selangor River into the Straits of Malacca. Estuarine processes play an important role in the distribution and fate of contaminants. During their residence time in estuaries, anthropogenic compounds derived from terrestrial and atmospheric sources are subject to biogeochemical processes, which ultimately determine the distribution and fate of the contaminants of marine environments. In Malaysia, rivers constitute the major source of public water supplies. On analyzing the local precipitation events and monthly rainfall data from 2000 to 2010 of Peninsular Malaysia, two seasons can be deduced: wet (August to December, mean 280 mm) and dry (February to March, mean 150 mm) (Leong et al., 2007; Suhaila et al., 2010). The studied area has several remaining patches of upland forest, swamp forest, and some mangroves.

Some pollutants flow directly from stationary sources such as industries, motor vehicles, open burning activities, and municipal waste dischargers. Other sources of pollutants include urban and agricultural runoff as well as various sources that discharge pollutants into the atmosphere (EPA, 2012). Terrestrially, anthropogenic materials can be transported to the marine environment via fluvial runoff and atmospheric flows, which are then deposited into sediments and redistributed by ocean currents (Hu, 1984; Wu et al., 2001). As a result, investigations into sedimentary records may be able to reveal the input histories of terrestrially derived materials, which in turn would help assess the anthropogenic impact on coastal marine systems objectively (Wei et al., 2014a).

Anthropogenic inputs of pollutants, such as compound-specific hydrocarbon pollution of polycyclic aromatic hydrocarbons (PAHs) and linear alkylbenzenes (LABs), into the marine environment have significantly increased their levels in the past few decades. These pollutants tend to accumulate in the bottom sediments. As a result, ecosystems such as seaports or other industrialized coastal areas with inputs of

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