

Evaluation of Polycyclic Aromatic Hydrocarbons Contamination in the Sediments of the Johor Strait, Peninsular Malaysia

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ABSTRACT

In May 2013, sediment samples were collected from five stations in the Straits of Johor, near the southern tip of Peninsular Malaysia, in order to evaluate the distribution and sources of polycyclic aromatic hydrocarbons (PAHs). The concentrations of 16 United States Environmental Protection Agency PAHs varied from 650.5 to 1441.2 ng g⁻¹ dry weight (dw) with a mean value of 985.5 ng g⁻¹ dw. PAHs can be classified as moderate level pollution in the collected samples. When comparing PAHs in this study with that of the sediment quality guidelines (SQGs), it was found that the total PAHs, low molecular weight (LMW), and high molecular weight (HMW) PAHs might incur minimal adverse biological effects. The diagnostic ratios of individual PAHs indicated both petrogenic and pyrogenic origins with predominantly pyrogenic sources, the findings of which are further supported by the results from principal component analysis (PCA). The PCA results reveal contributions of 44.44%, 32.3%, and 18.96% for traffic-related, coal combustion, and petroleum-related products, respectively. These findings indicate that the effective monitoring and significant improvement resulting from the implementation of environmental regulations in Malaysia might have caused a shift in the source of petroleum hydrocarbons in the Straits of Johor's aquatic ecosystems from petrogenic to pyrogenic origins.

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KEYWORDS

Malaysia; polycyclic aromatic hydrocarbons (PAHs); origin; sediment; sources; Straits of Johor

Introduction

The Straits of Johor or Selat Tebrau is a shallow and narrow waterway (<25 m depth and <6 km across), which connects the southern tip of Malaysia and Singapore Island. The Straits of Johor is an important zone due to the existence of mangroves, sea grasses, and coral ecosystems. It is also a commercial shipping way (1). There are major ports along the Straits, including Tanjung Pelepas, Johor Port, Tanjung Langsat (a new petrochemical port), and also Iskandar Malaysia, the latest, large economic zone, which make it a crowded strait. The high population of Johor State (around 3.35 million people) (2) and the rapid development and thriving marine transportation along the coast of the Johor Strait could be the cause of organic pollutant input into the Strait's aquatic ecosystems. Petroleum hydrocarbons contain polycyclic aromatic hydrocarbons (PAHs) that are ubiquitous and widely distributed in all

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