

Distribution, characterization and origins of Polycyclic Aromatic Hydrocarbons (PAHs) in surficial sediment of Penang, Malaysia: the presence of fresh and toxic substances

Abstract

Petroleum hydrocarbon pollution is one of the most serious problems facing by many developing countries including Malaysia. One class of petroleum hydrocarbon is Polycyclic Aromatic Hydrocarbons (PAHs). PAHs are made up of large group of compounds but semi-volatile comprising of 2 to 7 rings are considered toxic to human health. There are 16 semi-volatile PAHs classified as priority pollutants by USEPA some of which have been shown to disrupt endocrine systems in human. Twenty surface sediments were collected along South and North of Penang Bridge (Prai Straits) covering industrial, urban, shipping lane, tourism attraction and fishing grounds. The samples were dried with anhydrous sodium sulfate and extracted with Soxhlet extraction, treated by activated copper to remove the elemental sulfur, then purified and fractionated with 2-steps column chromatography. PAHs fraction were collected and subsequently injected into Gas Chromatography - Mass Spectrometry (GC-MS) using selected ion monitoring mode. Compound-specific PAHs were qualified by comparing the retention times of native standard previously run in the same machine with identical conditions. PAHs were quantified and recovery-corrected using a known concentration of internal injection standard spiked just before the GC-MS analysis. Total concentration of PAHs in the sediment ranged from 391 to 554204 ng/g dry weight. The ratio of the sum methylphenanthrenes to Phenanthrene (MP/P), an index for sources of PAHs, shows that 16 stations have MP/P values of less than 1 indicating pyrogenic origin. These results indicate that the area receives pyrogenic PAHs from long range atmospheric input. This study found that the trend of previous petrogenic input into the environmental compartment of Peninsular Malaysia is changed possibly due to strict environmental regulations on the release of petroleum products in Penang the source has been moved to the pyrogenic.

Keyword: Penang; PAHs; Surficial Sediment; GC-MS; MP/P ratio