

TITLE: POLYCYCLIC AROMATIC HYDROCARBON (PAHS) AS A MOLECULAR TRACER OF LEACHATE POLLUTION IN LANGAT RIVER.

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Introduction

The important aims of environmental quality studies is to investigate the present of anthropogenic compounds such as organic micropollutants on the ecosystem, in order to minimize or prevent adverse effects. Polycyclic Aromatic Hydrocarbon (PAHs) is made up of large group of compound but semi volatile. There are 16 semi-volatile PAHs classified as priority pollutants by USEPA some of which have been shown to disrupt endocrine system in human. Most of PAHs are come from anthropogenic activities that held by human activities. Besides that, the different intrinsic physicochemical properties of organic contaminants, they tend to interact to different extent with suspended particulate matter (SPM), bed sediments and biota. Direct discharge of leachates to river will enhance the transport of organic contaminants such as PAHs to the coastal environments and open oceans. Leachate is the liquid that drains or 'leaches' from a [landfill](#) it varies widely in composition regarding the age of the landfill and the type of [waste](#) that it contains.

Landfill leachates are generated by excess rainwater percolating through the waste layers in a landfill. The risks from waste leachate are due to its high organic contaminant concentrations and high [ammoniacal nitrogen](#). Leachate streams running directly into the aquatic environment have both an acute and chronic impact on the environment which may be very severe and can severely diminish bio-diversity and greatly reduce populations of sensitive species. Where toxic metals and organics are present this can lead to chronic toxin accumulation in both local and far distant populations. The burial of municipal solid waste in landfills is the most common disposal alternative in most countries. Land filling and depositing of solid wastes in open dumps have been the most common methods for the disposal of municipal solid wastes in Malaysia. Usually, landfill sites in Malaysia are situated near major towns or rivers.

Problem Statement

Most of the leachates from landfill are directly discharged into adjacent rivers and it will cause the quality of water environment decreasing. It is due to the composition of leachate that contains toxic chemicals in sufficient concentration to be potentially cancer causing. One of the concern problems is the distribution of PAHs in water environment. This compound can cause carcinogenic, mutagenic and tumorigenic to mammals. Furthermore, Langat River is selected as area of study because this river flows through the hub commercial, industrial, and residential area (Cheras, Kajang, Bangi, and Banting) and contaminants from all those industries can easily discharged into river.

Significant study

The purpose of this study is to obtain concentration of PAHs in sediment samples of Langat River. This could lead to insight on awareness of the potential hazard of PAHs and minimize the risk to human posed by these carcinogenic. Through the study, background information on PAHs that exist in collected leachates will also be known. It is hope the data would help for the future studies and be as background information.

Research Objective

- 1) To identify the level concentration of Polycyclic Aromatic Hydrocarbons (PAHs) in selected sediments of Langat River.
- 2) To investigate the composition and sources of compound-specific PAHs in the collected leachates.

Literature Review

The PAHs are one of the most important classes of anthropogenic persistent organic contaminants. There are two types of anthropogenic sources, petrogenic and pyrogenic. Petrogenic sources include crude and refined petroleum and pyrogenic PAHs come from the combustion of fossil fuels and biomass, which are released into the environment in the form of exhaust and solid residues (Zakaria et al., 2002). They are introduced to aquatic environments through oil spills; discharge from routine tanker operations, and from municipal and urban runoff. Zhou J.L, and Maskaoui K, 2001 reported that PAHs may enter the water environment from many different sources including river runoff, atmospheric precipitation, sewage outfalls and maritime transport. PAHs are composed of two or more fused aromatic (benzene) rings and ranging in molecular weight from naphthalene ($C_{10}H_8$, M_w : 128.16) to coronene ($C_{24}H_{12}$, M_w : 300.36) (Neff 1979). Within this range is an extremely large number of PAHs differing in the number and positions of aromatic rings and in the number, chemistry and position of substituents on the basic ring system. Furthermore, Clemons et al., 1998 has been reported that PAHs has been a growing concern in recent years regarding possible harmful effect to man and other living organism when it is exposed to environment. It caused carcinogenic, mutagenic and tumorigenic to mammals and it has been reported to disrupt endocrine system.

Municipal solid waste is most commonly disposed in municipal sanitary landfills (MSLs). MSL groundwater leachate is formed by rainwater percolating through waste. Transfer of pollutants often proceeds by transport with the leachate (Gerard et al., 2009). Often the so-formed effluent can reach the environment relatively unhindered and cause pollution of groundwater, surface water recipients and sediments. Leachate can be characterized as an aqueous solution of inorganic macrocomponen, heavy metals, xenobiotic organic pollutant, and dissolved and particulate organic matter quantified as dissolved and particulate organic carbon (DOC and POC, respectively) (Kjeldsen et al., 2002).

Methodology

Study area:

Several samples of sediments and leachates are collect at selected areas at Langat River. This river is 120 km long and originates from the Main Range. It drains westward to the Straits of Malacca. The major tributaries of Langat River are the Semenyih River and Labu River.

Sampling location:

The sediment samples are collect by using Eckman Dredge Sediment Sample from selected stations in the Langat River in the amount of sufficient quantities for the purpose of analytical procedures. The sediment and leachates are then transfer into a stainless steel container with Teflon-lined cap to reduce any contamination. The samples are place in icebox at 4°C to the transportation to the laboratory. Upon reaching the laboratory, the samples are store in the refrigerator (-18°C) until further analysis.

Samples Analysis Procedures:

The weighed samples were extracted with soxhlet extractor using dichloromethane (DCM) for more than 8 hours. The extracted samples were added with surrogate internal standard mixture (SIS) prior to purification and fractionation. The copper treatment was also applied to remove sulphur contents in the samples. The samples were introduced to 5% deactivated silica gel to collect the hydrocarbon contents with 25% DCM in hexane solvent. In the second step column chromatography, 100% fully activated was used to collect the third fraction containing PAHs with similar solvent. Gas Chromatography-Mass Spectrometer was used to analyze PAHs in the samples. Leachates samples can be divided into 2 phase: suspended solid phase and liquid phase. Suspended solid were extracted with soxhlet extractor while liquid phase were extracted by using liquid-liquid extraction.

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