
UNIVERSITI PUTRA MALAYSIA

# HEAVY METAL CONTENT IN MANGROVE SEDIMENT OF SUNGAI SEPETANG AND SUNGAI TIRAM LAUT IN MATANG MANGROVES FOREST, PERAK, MALAYSIA

AHMAD HANAFI HAMZAH

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By

**AHMAD HANAFI BIN HAMZAH**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science**

**February 2019**

**DEDICATION**

**For my beloved Parents:**
HAMZAH BIN PUNIMAN
SITI AISHAH BINTI BABA

**My Wife**
NUR IZZATI BINTI UMAR

**My siblings:**
AHMAD NAJMY BIN HAMZAH
AHMAD SHAFIQ BIN HAMZAH
AISHQIN HAIZA BINTI HAMZAH

To my supervisor Assc.Prof. Dr Seca Gandaseca
To all my friends,
Thank you for your encouragements supports
And the helpful

Thank you for everything. May Allah Bless All of us

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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**February 2019**

**Chairman : Associate Professor Seca Gandaseca, PhD**
**Faculty : Forestry**

Woody plants that capable to grow in extreme conditions such as in anaerobic muddy soil, high salinity, rough winds, hot and humid weather are commonly called mangrove plants. These mangrove creatures usually can be found in tropical and subtropical area; between land and sea.Elevated concentration of heavy metals in sediment have detrimental consequences on enviromental.This study was conducted to response to environmental problems of Malaysia. Thus, the objectives of this study were: (1) to detemine status of heavy metals contents in sediment at Sungai Sepetang and Sungai Tiram laut, Perak; (2) the specific objective to assess and compare of heavy metal contents in sediment at Sungai Sepetang and Sungai Tiram laut; (3) Comparison of the data analysis according to different national and international standards. For this research, the samples were collected during the wet season. A total of 150 sediment samples were collected with different depth (of 0-15 cm, 15-30 cm, 30-50 cm, 50-100 cm, and >100 cm) from upstream, middle stream, and downstream of river at each study area.To determination and level of five heavy metals (Zn, Fe, Cd, Pb, and Cu) from Sungai Sepetang and Sungai Tiram laut, and for the portion of sediment which passing through the 2mm sieve were determined the study.The metal contamination in sediment are also evaluated by applying Geo-accumulation Index (I-geo). The results showed that the sediment at Sungai Sepetang was sandy loam clay at all depths and the sediment at Sungai Tiram Laut was sandy loam. The sediment pH of this area was acidic, where the soil at the deepest level showed a low pH. As for electrical conductivity (EC) at Sungai Sepetang and Sungai Tiram Laut, the range was from 17.239 to 17.871 dS/m. Furthermore, both rivers showed concentration of the heavy metals Cu, Pb, and Fe; however, Cd and Zn were not detected. The results also revealed that Sungai Sepetang had a higher concentration of heavy metal than Sungai

Sepetang , Where the contamination of sediment was higher (Fe) in zones and depth. Based on result , the comparison the concentration of heavy metal in sediment with different zones and depth at Sungai Sepetang and Sungai Tiram Laut was found that Copper (Cu), Lead (Pb),and Iron (Fe) are not dangerous in sediment from other studies .I-geo index demonstrated that most of the embraced metal have index value below zero.This shows the river sediment is unpolluted.The present study on heavy metal concentration in the sediment of Sungai Sepetang and Sungai Tiram Laut, Matang Mangrove Forest Reserve, will be useful for rational planning of contamination control strategies and their prioritization.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**KANDUNGAN LOGAM BERAT DI DALAM TANAH HUTAN BAKAU PADA SUNGAI SEPETANG DAN SUNGAI TIRAM LAUT DI HUTAN BAKAU MATANG PERAK, MALAYSIA**

Oleh

**AHMAD HANAFI BIN HAMZAH**

**Februari 2019**

**Pengerusi : Profesor Madya Seca Gandaseca, PhD**
**Fakulti : Perhutanan**

Tumbuhan kayu yang mampu bertumbuh dalam keadaan yang melampau seperti di tanah berlumpur anaerob, saliniti yang tinggi, angin kasar, cuaca panas dan lembab yang biasa dipanggil tumbuhan bakau. Makhluk-makhluk bakau ini biasanya boleh didapati di kawasan tropika dan subtropika; antara tanah dan laut. Penumpuan logam berat dalam sedimen mempunyai kesan buruk terhadap alam sekitar. Kajian ini dijalankan untuk menanggapi masalah alam sekitar di Malaysia. Oleh itu, objektif kajian ini adalah: (1) untuk mengesan status kandungan logam berat di sedimen di Sungai Sepetang dan Sungai Tiram laut, Perak; (2) objektif khusus untuk menilai dan membandingkan kandungan logam berat di sedimen di Sungai Sepetang dan Sungai Tiram laut; (3) Perbandingan analisis data mengikut piawaian kebangsaan dan antarabangsa yang berlainan. Bagi kajian ini, sampel dikumpulkan semasa musim basah. Sejumlah 150 sampel sedimen dikumpulkan dengan kedalaman yang berbeza (0-15 cm, 15-30 cm, 30-50 cm, 50-100 cm, dan> 100 cm) dari hulu, aliran tengah, dan hilir sungai di setiap kawasan kajian. Untuk penentuan dan tahap lima logam berat (Zn, Fe, Cd, Pb, dan Cu) dari Sungai Sepetang dan Sungai Tiram laut, dan untuk bahagian sedimen yang melalui penapis 2mm telah ditentukan kajian tersebut. Pencemaran logam di sedimen juga dinilai dengan menggunakan Geo-accumulation Index (I-geo) Umumnya, kerja ini adalah untuk menyelidik dan menilai pencemaran logam berat di sedimen di Sungai Sepetang dan Sungai Tiram Laut, Perak. Keputusan menunjukkan bahawa sedimen di Sungai Sepetang adalah tanah liat berpasir pasir di semua kedalaman dan sedimen di Sungai Tiram Laut adalah loji berpasir. PH sedimen di kawasan ini berasid, dimana tanah pada tahap terdalam menunjukkan pH yang rendah. Bagi kekonduksian elektrik (EC) di Sungai Sepetang dan Sungai Tiram Laut, jarak dari 17.239 hingga 17.871 dS / m. Tambahan pula, kedua-dua sungai

menunjukkan kepekatan logam berat Cu, Pb, dan Fe; Walau bagaimanapun, Cd dan Zn tidak dikesan. Keputusan juga menunjukkan bahawa Sungai Sepetang mempunyai kepekatan logam berat yang lebih tinggi daripada Sungai Sepetang, di mana pencemaran sedimen adalah lebih tinggi (Fe) di zon dan kedalaman. Berdasarkan hasilnya, perbandingan kepekatan logam berat di sedimen dengan zon dan kedalaman yang berlainan di Sungai Sepetang dan Sungai Tiram Laut didapati bahawa Tembaga (Cu), Lead (Pb), dan Besi (Fe) tidak berbahaya pada sedimen dari lain kajian I-geo menunjukkan bahawa sebahagian besar logam yang memeluk mempunyai nilai indeks di bawah sifar. Ini menunjukkan sedimen sungai tidak cemar. Kajian terkini mengenai kepekatan logam berat di sedimen Sungai Sepetang dan Sungai Tiram Laut, Hutan Simpan Mangrove Matang, akan berguna untuk perancangan rasional strategi kawalan pencemaran dan keutamaan mereka

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement of the degree of Master of Science. The members of the Supervisory Committee were as follow:

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| | |
|---|---|
| Cd | Cadmium |
| Pb | Lead |
| Zn | Zinc |
| Cu | Copper |
| Fe | Iron |
| Sand | Sand |
| Silt | Silt |
| Clay | Clay |
| Ec | Electrical conductivity |
| AAS | Atomic Absorption Spectrometer |
| ICP | Inductively Coupled Plasma |
| SAS | Statistical Analysis System |
| mg/kg | milligram of medication per kilogram |
| EC | Electrical conductivity |
| dS/m | deciSiemens per meter |

# CHAPTER 1

# INTRODUCTION

## 1.1 Mangrove Forests

Mangrove forests are of utmost importance to estuarine systems as a major primary producer of unique organisms. Tropical and subtropical coastal and river mouths areas are usually occupied with these mangrove forest. One vital role these forests play is to reduce erosion and stabilize adjacent coastal landforms (Harty,1997). Soil composition, water salinity and pattern of tides are known to mould the mangrove forests. Apart from being established as one of wetlands' element, mangrove areas are also known to be the most condusive ecosystems for various exotic living organisms (Gandaseca *et al*., 2011).

In Peninsular Malaysia, mangrove forests are located primarly in Perak, Selangor and Johor. Whereas for Borneo, they are existing in the east coastline of Sabah, and at the north and south parts of Sarawak. These mangrove forests are being unique as they capable to support exotic wildlife such as estuarine crocodiles and proboscis monkeys. Are sadly, these special-types of species are becaming extinct as the mangrove forests are endangered due to anthropogenic activity. A healthy ecosystem of mangrove areas is very vital as a conducive estuary for these species to survive.

## 1.2 Matang Mangrove

Matang mangrove forest area are suspected to receive a lot of domestic waste and industrial waste due to human activities from the nearby town area. Matang mangrove forest was chosen for the study because the mangrove forest is the third mangrove in the world gazzeted as world heritage. There is a lack of data for the mangrove forest. The data obtained from the study can be used as baseline value in developing the mangrove forest.

A study by Zakaria *et al*. (2002), stated that the contaminated in the west Cost of Peninsular Malaysia and the straits of Malacca are mainly from antropogenic source; oil spill, crankcase, and industrial waste routed to the river system. However, much of the physicochemical processes in the tropical aquatic system, such as in Malaysia are still unknown to enable the prediction of the behavior, fate and transpot of land-derived pollutant behavior, transport and environmental significance in tropical conditions must be addressed.

## 1.3 Problem Statement

The matang mangrove forest has economic significance to the local community and perak state Government through eco- tourism, fishery resoursce, logging of bakau wood and many other coastal.Mangrove forests also known for most productive breeding ground for marine fish ecosystem, producing organic carbon as well as contributing significantly to global carbon cycle (Alongi *et al.,* 1998)

A natural process affects the water quality through rainfall, corrosian, erosion and sediment transport.Several anthropogenic activities have continued to degrade the natural enviroment. Some of the rivers in the area being developed by the industry are heavily contaminated and have lost their natural ecosystem due to rapid urbanization and development activities around the area.

In this study due to time and resource constraints we selected a few sections on the Matang mangrove to evaluate the heavy metal contamination and sediment quality of the river which gives a representative value of the entire river.The findings of this study could provide information on the source, and cause of the pollution on its sediment quality and represent as baseline data in order to achieve sustainable as well as environmental concern.

## 1.4 Objectives

The objectives of this study were to determine heavy metal contents in sediment.Hence this research has been undertaken with the following objectives summarized as follows;

i. to detemine status of heavy metals contents in sediment at Sungai Sepetang and Sungai Tiram laut, Perak.
ii. the specific objective to assess and compare of heavy metal contents in sediment at Sungai Sepetang and Sungai Tiram laut.
iii. Comparison of the data analysis according to different national and international standards.

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