

# HEAVY METAL CONCENTRATION OF SEDIMENT IN SUNGAI TIRAM LAUT AT MATANG MANGROVE FOREST, PERAK

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### HEAVY METAL CONCENTRATION OF SEDIMENT IN SUNGAI TIRAM LAUT AT MATANG MANGROVE FOREST, PERAK.



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A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry Universiti Putra Malaysia

### DEDICATION

### To my beloved family

W. Zainy bin Omar

Zaid bin Mohamad

Narma binti Ramli

Rose Hayati binti Patehkhan

To my fellow friends Nor Haslinda binti Sulaiman Noor Hurriyah binti Abd. Rashid Azlin bin Hassan

To my guider Ahmad Mustapha bin Mohamad Pazi

# To my supervisor

Assoc. Prof. Dr. Seca Gandaseca

Thank you for your encouragements supports

and the helpful

Thank you for everything. May Allah Bless All of us

### ABSTRACT

Mangrove forests thrive near the mouths of large rivers where river deltas provide lots of sediment (sand and mud). Mangrove roots collect sediments and slow the water's flow, helping to protect the coastline and preventing erosion. Over time, the roots can collect enough debris and mud to extend the edge of the coastline further out. The objective of this study was to compare physiochemical properties in Sungai Tiram Laut and compared heavy metal concentration between selected stations and sediment depths. The selected properties in this study were sediment texture using hydrometer method, electrical conductivity using EC meter, sediment pH was identified using pH water and pH KCl, and heavy metal concentration (Fe, Cu, Cd, Pb, Zn) using Aqua Regia method. Data obtained by using statistical analysis system (SAS) version 9.4. Heavy metal contamination was less concentrated except Cu due to maximum permissible addition (MPA) for sediment. The guality standard for Cu was not less than 0.116 cmol/kg. However there was a significant difference concentration by station, but not by depths. The percentage of the sand was higher than silt and clay and had significant difference by stations and depths. Electrical conductivity was higher at location that was nearby to the seawater as caused by the ions in the runoff to the Sungai Tiram Laut. Physiochemical properties concentrated were caused by natural and anthropogenic resources.

### ABSTRAK

Hutan bakau berkembang pesat melalui sungai-sungai besar di mana delta sungai menghasilkan banyak sedimen (pasir dan lumpur). Akar pokok di hutan bakau bertindak untuk mengumpul sedimen dan melambatkan aliran air, membantu melindungi pantai dan menghalang hakisan. Dari masa ke masa, akar dapat mengumpulkan serpihan dan lumpur yang cukup untuk kajian Objektif ini adalah memanjangkan pinggir pantai. untuk membandingkan sifat-sifat fisiokimia di Sungai Tiram Laut dan perbandingan kepekatan logam berat antara stesen yang dipilih dan kedalaman tanah.Ciriciri yang dipilih dalam kajian ini adalah tekstur tanah yang dikaji dengan menggunakan kaedah hidrometer, kekonduksian elektrik menggunakan EC mete, pH tanah dikaji melalui pH air dan pH KCl, dan kepekatan logam berat (Fe, Cu, Cd, Pb, Zn) diuji dengan menggunakan kaedah Aqua Regia. Data diperoleh dengan menggunakan system analisis statistik (SAS) versi 9.4. Pencemaran logam berat dalam kajian ini tidak terlalu tertumpu kecuali Cu kerana mengikut kadar tambahan yang dibenarkan untuk sedimen adalah tidak lebih daripada 0.116 cmol/kg, tetapi terdapat perbezaan yang ketara dalam kepekatan di setiap stesen namun begitu tiada perbezaan dalam setiap kedalaman. Peratusan pasir lebih tinggi daripada lumpur dan tanah liat mengikut perbezaan antara stesen dan kedalaman. Konduktiviti elektrik lebih tinggi disebabkan lokasi stesen berdekatan dengan air laut yang disebabkan oleh ion-ion yang mengalir ke Sungai Tiram Laut

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# **APPROVAL SHEET**

I certify that this research project entitled "Heavy Metal Contamination of sediment in Sungai Tiram Laut at Matang Mangrove Forest, Perak" by Wan Norsuriana Binti W. Zainy has been examined and approved as a fulfillment of the requirements for the degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

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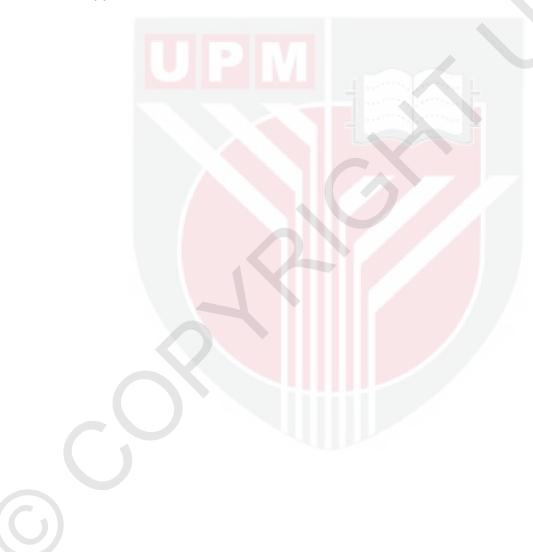
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# LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AAS	Atomic Absorption Spectrometer
Cd	Cadmium
cm	Centimeter
CL	Clay
Cu	Copper
Cmol/Kg	Centimol Per Kilogram
Cr	Chromium
CSIRO	Commonwealth Scientific and Industrial Research Organization
D	Depth
E	East
EC	Electrical conductivity
EPA	Environmental Protection Agency
Fe	Iron
FAO	Food Agriculture Organization
g	Gram
GWRTAC	Ground-Water Remediation Technologies Analysis Center
h	hour
ha	Hectar
HNO₃	Nitrate acid
HCI	Hydrochloric acid
HM. Concent.	Heavy metal concentration
IAEA	International Atomic Energy Agency
ΙΤΤΟ	International Tropical Timber Organization
KCI	Potasium Chloride



L	Litre
Mg	Magnesium
Mn	Manganese
Мо	Molybdenum
mL	Mililitre
М	Molar
mcg	Microgram
mg	miligram
MPA	Maximum Permissible Addition
N	North
Ni	Nickel
ppm	Part per million
Pb	Lead
Se	Selenium
Si	Silt
S	second
SD	Sand
SAS	Statistical Analysis System
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
WHO	World Health Organization
Zn	Zinc

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#### **CHAPTER 1**

### INTRODUCTION

### 1.1 Background

Mangroves are among the most productive ecosystem on earth and occupy brackish water zones along tropical and subtropical coasts (ITTO, 2006). Mangrove systems had the capacity to act as a sink or buffer and remove or restrain heavy metals before they reach nearby aquatic ecosystem. Because Mangrove sediments had a large proportion of fine particles, high organic anaerobic sediments either by adsorption on ion exchange sites on the surface of sediments particles, incorporation into mesh structures of the clay particles, or precipitation as insoluble sulfides (Harbison, 1986).

Mangrove forest is also distributed in the inter-tidal region between the sea and the land in the tropical and subtropical regions of the world (Alongi, 2009). Mangrove representatives such as *Rhizophora* spp. also function as a physical barrier against tidal and ocean influences by means of their large above-ground aerial root systems and standing crop. (Alongi, 2002).

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In Malaysia, Mangrove forests form one of the major wetland types in Peninsular Malaysia, which had been identified as one of the life support systems on earth. The importance of mangrove forests goes beyond their status as the habitat of many endangered flora and fauna species. Mangrove forest is a valuable natural resource with distinctive diversity, high intrinsic natural productivity and unique habitat value. Mangrove forests provide invaluable goods and services both in economics and environmental terms. Apart from the production of poles, charcoal and fuelwood, the mangrove ecosystem supports a wide range of functions such as coastline production, assimilation of waste, source of food, shelter and sanctuary for fauna, spawning and breeding ground for marine life and also recently proven as a barrier to significantly reduce the height and force of the waves of the tsunami (Kamaruzaman, 2008).

Heavy metals are defined as metallic elements that had a relatively high density compared to water (Fergusson, 1990). Heavy metals basically come from environment include geologic, industrial, agricultural, pharmaceutical, domestic effluents and atmospheric sources (He *et al.*, 2005). Heavy metals concentration can also occur through metals corrosion, atmospheric deposition, soil erosion of metal ions and leaching of heavy metals, sediment resuspension, and metal evaporation from water resources to soil and groundwater (Nriagu, 1989).

WHO/FAO/IAEA, 1996 reported that metals such as cobalt (Co), copper (Cu), chromium (Cr), iron (Fe), magnesium (Mg), manganese (Mn), molybdenum (Mo), nickel (Ni) selenium (Se), and Zinc (Zn) are essential nutrients that are required for various biochemical and physiological function. Heavy metals are efficient generators of active oxygen species and thus an important factor in these heavy metal, toxicities are the generation of oxidative stress (Aust *et al.*, 1985).

Soil consists of weathered minerals and organic matter. They are product of interaction among parent material, climate, and biological activity. It is well known that soils differ from place to place on the earth's surface, and beneath a given site the soil profile consists of horizontal layers that change in characteristics with depth below and the land surface (Munsiri *et al.,* 1995)

The differences in sediment composition such as its grain-size distribution and mineralogy would affect the natural heavy metal concentration (Loring, 1991). Their geological material shows a high heavy metal concentration rather than concentration (White and Tittlebaum, 1985; Murray 1996).

### 1.2 Problem Statement

Heavy metals are toxic to the living organisms and also considered as essential can be toxic if present in excess. The heavy metals can impair important biochemical processes posing a threat to human health, plant growth and animal life (Khan R *et. al.*, 2005).Soils may become contaminated by the accretion of heavy metals and metalloids through emissions from the quickly expanding industrial areas, harvesting areas, disposal of high metal waste, leaded gasoline, animal manures, sewage sludge, wastewater irrigation, coal combustion residues, spillage of petrochemicals, and atmospheric deposition (Khan *et al.*, 2008).

3

In recent years, Sungai Tiram Laut was exposed to human activities but less disturbed area (Nursyafiqah, 2016). Some of the villagers used to fishing and harvesting in a few compartments but this area was considered as fewer disturbances rather than another site. This study needs to investigate the source of heavy metals concentration in Sungai Tiram Laut and to protect living organisms such as aquatic life and residents in the vicinity. Individuals in the vicinity will carry out with the activities related with the sediment. Other than that, this study needs to ensure the level of heavy metals concentration in the region is below than maximum permissible addition (MPA) in sediment and does not affect the health of people and aquatic habitat. As the area is Forest Reserve, it monitoring whether the heavy metals content is still control based on the comparison with other areas nearby.

This result can be made as baseline data for future research to compare with another site that gives more impact on heavy metals concentration. In addition, these results can be used as documentation in the Forest Reserve to improve their management towards a much better.

### 1.3 Hypothesis

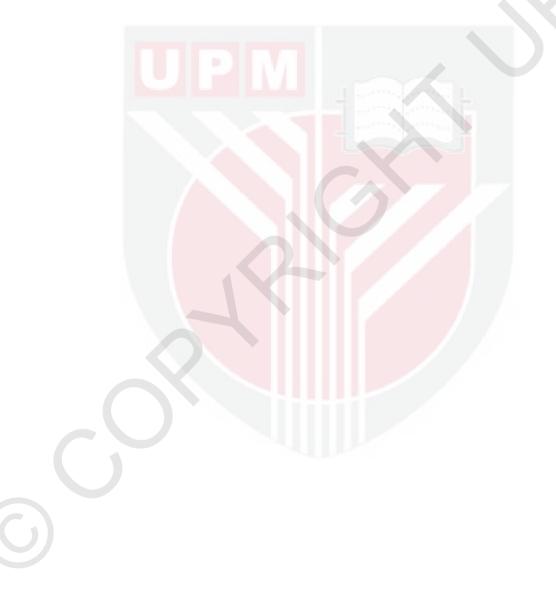
The hypothesis of this study can determine by;

- Ho: There are no significant difference physiochemical properties at three stations by soil depths along Sungai Tiram Laut.
- H<sub>1</sub>: There are significant difference physiochemical properties at three stations by soil depths along Sungai Tiram Laut.

# 1.4 Objective

The objectives of this study were;

- To determine of sediment physiochemical properties at three stations by soil depths along Sungai Tiram Laut.
- 2. To compare of sediment physiochemical properties between three stations and five different depths along Sungai Tiram Laut.



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