

ASSESSMENT OF HEAVY METALS IN SUNGAI JEMPUL

CHE MOHAMAD FAKHRUL HAFIZ BIN CHE MOHD SHAMSHUDIN

**Final Year Project Report Submitted in
Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science (Hons) Chemistry
In the Faculty of Applied Sciences
Universiti Teknologi MARA**

JULY 2019

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENT	iii
TABLE OF CONTENT	iv
LIST OF ABBREVIATIONS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
ABSTRACT	x
ABSTRAK	xi
CHAPTER 1 INTRODUCTION	
1.1 Background of the study	1
1.2 Problem statement	2
1.3 Significance of study	2
1.4 Objectives of study	3
1.5 Limitation and scope of study	3
CHAPTER 2 LITERATURE REVIEW	
2.1 Heavy metal	4
2.2 Sources of heavy metals	5
2.2.1 Agriculture	6
2.2.2 Domestic and industrial wastewater	6
2.2.3 Animal manures	6
2.3 Malaysia river	7
2.4 River pollution	7
2.5 Point sources	8
2.5.1 Industrial discharges	9
2.5.2 Combined sewer discharges	9
2.5.3 Domestic wastewater discharges	9
2.3.4 Spills	10
2.6 Non-point sources	10
2.6.1 Landfills	11
2.6.2 Storm water discharges	11
2.7 Suspended solid (SS)	11
2.8 Toxicity of heavy metals and effects to living organisms	12
CHAPTER 3 METHODOLOGY	
3.1 Materials	13
3.1.1 Chemical and reagent	13
3.1.2 Glassware and apparatus	13
3.1.3 Equipment and analytical instrument	13
3.2 Sampling area	13

3.3	Water sampling, sample preparation & analysis	14
3.4	Health risk assessment (HRA)	15
3.4.1	Non-cancer risk assessment on human via dermal and ingestion	15
3.4.2	Cancer risk assessment on human via dermal inhalation and dermal contact pathways	16
3.5	Statistical analyses	18
CHAPTER 4 RESULTS AND DISCUSSION		
4.1	Heavy metal analysis in river water samples	19
4.2	Health risk assessment (HRA)	20
4.2.1	Non-cancer risk assessment	20
4.2.2	Cancer risk assessment	25
4.3	Correlation analysis	28
4.4	Comparison with other studies	29
CHAPTER 5 CONCLUSION AND RECOMMENDATIONS		31
CITED REFERENCES		32
<i>CURRICULUM VITAE</i>		38

LIST OF TABLES

Table	Caption	Page
3.1	Parameters used for estimation of ADD via dermal contact and ingestion exposure pathways and some toxicological characteristics of the investigated heavy metals used for health risk assessments.	17
3.2	Reference dose (RfD) values for Pb, Mn and Fe	17
4.1	Hazard quotient (HQ) of dermal and ingestion values for Pb, Fe and Mn	23
4.2	Hazard index(HI) values for Pb, Mn and Fe	24
4.3	Cancer risk of dermal and ingestion values for Pb and Fe	26
4.4	Lifetime cancer risk (LCR) values for Pb and Fe	27
4.5	Correlation analyses of metal at Sungai Jempul (moderate correlation 0.36-0.67 was shown in bold)	28
4.6	Concentration of heavy metals in river water in $\mu\text{g/L}$ (high concentration shown in bold)	30

ABSTRACT

ASSESSMENT OF HEAVY METALS IN SUNGAI JEMPUL

This study was conducted to assess the concentration of heavy metals such as Pb, Mn and Fe in Sungai Jempul, Jengka, Pahang. The heavy metals were analyzed by using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). Fe showed the highest concentration while Pb presented the lowest concentration in this river. The concentration of studied metals were in the increasing order $Pb < Mn < Fe$. The health risk associated with Pb, Mn and Fe were assessed based on the parameters used for dermal contact and ingestion exposure. The results indicated that the parameters for targeted heavy metals were below the non-carcinogenic and carcinogenic limits as suggested by United State Environmental Protection Agency (USEPA). The results indicated that Sungai Jempul were safe to be used for drinking water and recreational activities by nearby inhabitants.