



**UNIVERSITI PUTRA MALAYSIA**

***CONCENTRATION AND DISTRIBUTION OF LINEAR ALKYL BENZENE IN  
SEDIMENTS OF SELECTED MALAYSIAN RIVERS AS MOLECULAR MARKERS  
OF SEWAGE TREATMENT EFFICIENCY***

**SAMI MUHSEN SLEMAN MAGAM**

**FPAS 2012 11**

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By

**SAMI MUHSEN SULEMAN MAGAM**

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**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfillment of the Requirement for the Degree of Master of Science in the Faculty  
of Environmental Studies**

**March 2012**

## DEDICATION

To my dear wife, close friends, my family, and my supervisor who have been the most important reasons of hopefulness during my study.

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Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfillment  
of the requirement of the degree of Master of Science

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**Faculty : Environmental Studies**

The present study investigates the distribution of linear alkylbenzenes (LABs) in sediment samples collected from selected locations in Sarawak, Sembulan, and Kuantan rivers in Peninsular Malaysia. Batch studies were conducted to assess the current status of domestic wastes and synthetic detergent pollution in sediments in these three rivers. Twenty three sampling stations have been selected for sediment collection. Analysis and quantification of LABs was carried out using gas chromatography-mass spectrometry (GC-MS). Concentrations of total LABs in ng/g on a dry weight basis (dw) in the sediment samples of Sarawak River, Sembulan River, and Kuantan River ranged from 156.5 to 7386.2; 643.2 to 5567.1; and 772.8 to 7217.6 ng/g dw, respectively. The *I/E* ratio (ratio of internal to external isomers of LABs) is employed to estimate the degree of degradation of LABs in aquatic environments, making it a powerful, though simple, tool for monitoring biodegradation of LABs in the environment. The *I/E* ratios for Sarawak, Sembulan, and Kuantan rivers fell in the ranges 0.52 to 1.24; 0.81 to 1.79; and 0.50 to 1.28, respectively. The *I/E* ratio at station two in Kuantan River was much lower than those

at the other stations, indicating that the sewage discharged into Kuantan River was poorly treated.

Anthropogenic activities may contribute to high levels of LABs in sediment samples.

In addition to anthropogenic activities, natural features of the sampling location may contribute significant amounts of LAB discharges to the aquatic systems. In sum, the study results demonstrate that the LABs are useful as indicators of pollutants originating from domestic wastes and synthetic detergents.

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

**KEPEKATAN DAN PENGAGIHAN LINEAR ALKYL BENZENE DALAM  
ENAPAN SUNGAI TERPILIH MALAYSIA SEBAGAI PENANDA MOLEKUL  
KECEKAPAN PENGOLAHAN KUMBAHAN**

Oleh

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Mac 2012

**Pengerusi : Profesor Madya Mohamad Pauzi Zakaria, PhD**

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Kajian ini dijalankan bagi menyiasat taburan linear alkil benzen (LAB) di dalam sampel sedimen yang diambil dari beberapa lokasi terpilih di sungai Sarawak, Sembulan dan Kuantan di Semenanjung Malaysia. Kajian secara berkelompok telah dijalankan untuk menilai status terkini bagi pencemaran detergen sintetik dan sisa domestik di dalam sedimen dari tiga sungai tersebut. Dua puluh tiga stesen telah dipilih untuk penyampelan sedimen. Analisis dan kuantifikasi LAB telah dijalankan dengan menggunakan Kromatografi gas-spektrometri jisim (GC-MS). Kepekatan jumlah LAB dalam unit ng/g berasaskan berat kering (dw) di dalam sampel sedimen sungai Sarawak, sungai Sembulan dan sungai Kuantan berjulat dari 156.5 hingga 7386.2; 643.2 hingga 5567.1; dan 772.8 hingga 7517.6 ng/g dw. Nisbah I/E (nisbah isomer LAB dalaman kepada luaran) diaplikasikan untuk menganggarkan darjah degradasi LAB di persekitaran akuatik, menjadikan ia suatu alat yang mudah lagi berkesan dalam pengawasan biodegradasi LAB di dalam alam sekitar. Nisbah I/E

bagi sungai Sarawak, Sembulan dan Kuantan berjulat dari 0.52 hingga 1.24; 0.81 hingga 1.79; dan 0.50 hingga 1.28. Nisbah I/E di stesen dua di sungai Kuantan adalah sangat rendah dari stesen lain, menunjukkan bahawa pembuangan sisa kumbahan ke dalam sungai Kuantan adalah tidak dirawat dengan sempurna. Aktiviti antropogenik mungkin menyumbang kepada tahap kepekatan LAB yang tinggi di dalam sampel sedimen. Merujuk kepada aktiviti antropogenik, ciri-ciri semulajadi yang terdapat di stesen penyampelan mungkin telah menyumbang kepada tahap LAB yang signifikan di dalam sistem akuatik. Kesimpulannya, hasil kajian menunjukkan bahawa LAB adalah berkesan sebagai penunjuk aras bagi bahan pencemar yang berasal dari sisa domestik dan detergen sintetik.



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## APPROVAL

I certify that a Thesis Examination Committee has met on 1st April 2012 to conduct the final examination of Sami Muhsen Sleman Magam on his thesis entitled 'Concentration And Distribution Of Linear Alkylbenzene In Sediments Of Selected Malaysian Rivers as Molecular Markers of Sewage Treatment Efficiency' in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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SAMI MUBSEN SLEMAN MAGAM

Date

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## TABLE OF CONTENTS

	Page
<b>DEDICATION</b>	i
<b>ABSTRACT</b>	ii
<b>ABSTRAK</b>	iv
<b>ACKNOWLEDGEMENTS</b>	vi
<b>APPROVAL</b>	viii
<b>DECLARATION</b>	x
<b>LIST OF TABLES</b>	xii
<b>LIST OF FIGURES</b>	xvi
<b>LIST OF ABBREVIATIONS</b>	xix
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	1
1.1 Background of Study	1
1.2 Problem Statement	6
1.3 Significance of Study	7
1.4 The Objectives of the Study	7
<b>2 LITERATURE REVIEW</b>	8
2.1 The Concept of Molecular Markers Analysis	8
2.1.1 Biogenic Marker	8
2.1.2 Fossil biomarkers	9
2.1.3 Anthropogenic Molecular Markers	10
2.2 Linear Alkylbenzenes (LABs)	14
2.3 Nomenclature	17
2.4 Production of LABs	17
2.5 Physico-chemical Properties of LABs	18
2.5.1 Physical and Chemical Properties	19
2.5.2 Aqueous Solubility and Log Octanol-Water Partitioning Coefficient	19
2.5.3 Forms and Persistence	20
2.5.4 Biodegradability of Detergent Products	21
2.6 Sources of LABs	23
2.6.1 Incomplete Sulfonation of LABs	24
2.6.2 Fluid Drilling	24
2.7 Transport and Distribution of LABs	25
2.7.1 Distribution of LABs in Sediments	25
2.7.2 Distribution of LABs in Sewage	27
2.7.3 Distribution of LABs in Water	27
2.8 Toxic of LABs	28
2.9 Biodegradation of LABs	28
2.10 Ratios of Internal to External LAB Isomers ( <i>I/E</i> Ratio)	30
2.11 Effectiveness of Sewage Treatment Plants	33
2.12 Gas Chromatography-Mass Spectrometry (GC-MS)	34

<b>3</b>	<b>METHODOLOGY</b>	36
3.1	Sampling Locations and Sample Collection	36
3.2	Sediment Sample Collection	40
3.3	Chemicals and Materials	41
3.3.1	Surrogate Internal Standard (SIS), Internal Injection Standard (IIS) and Native Standard Mixture of LABs	41
3.3.2	Organic Solvents	44
3.3.3	Preparation of 5% Deactivated Silica Gel	44
3.3.4	Anhydrous Sodium Sulphate (Na <sub>2</sub> SO <sub>4</sub> )	45
3.4	Cleaning of Glassware and Apparatus	45
3.5	Analytical Procedure	45
3.5.1	Extraction and Fractionation	46
3.5.1.1	Activated Copper Treatment	46
3.5.1.2	Vacuum Rotary Evaporation	47
3.5.2	Purification - First Step Silica Gel Column Chromatography	47
3.5.3	Fractionation - Second Step Silica Gel Column Chromatography	48
3.5.4	Nitrogen Blow-down	49
3.5.5	Preparation for GC-MS	49
3.5.6	Gas Chromatography-Mass Spectrometry (GC-MS) Analysis	51
3.6	Identification of Sample Peaks	55
3.7	Calibration Curves and Linearity of the Response Factor	56
3.8	Quality Control and Quality Assurance	57
3.9	LAB Concentration in the Samples	59
3.10	Analysis of Variance (ANOVA) for the LAB Concentrations in the Three Rivers	60
<b>4</b>	<b>RESULTS AND DISCUSSION</b>	63
4.1	Levels of LABs in the Sediments of the Studied Rivers	63
4.1.1	The Concentrations of LABs in Sediments of Sarawak River	64
4.1.2	The Concentrations of LABs in Sediments of Sembulan River	68
4.1.3	The Concentrations of LABs in Sediments of Kuantan River	71
4.2	Biodegradation of LABs and the Internal to External LAB Congener Ratios ( <i>I/E</i> ) in the Three Rivers	74
4.2.1	Biodegradation of LABs and the <i>I/E</i> Ratios for Sarawak River	75
4.2.2	Biodegradation of LABs and the <i>I/E</i> Ratios for Sembulan River	78
4.2.3	Biodegradation of LABs and the <i>I/E</i> Ratios for Kuantan River	80
4.2.4	Comparison of Total LABs Concentrations in Sediments from Different Countries	83
4.2.5	Comparison of <i>I/E</i> Ratios in Sediments from Different Countries	83

4.3	Spatial Distribution of LABs in the Three Rivers	84
4.4	Statistical Analysis	87
4.4.1	Analysis of Variance (ANOVA) for the LAB Concentrations in the Three Rivers	88
4.4.2	Cluster Analysis	91
<b>5</b>	<b>CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH</b>	<b>95</b>
	<b>REFERENCES</b>	<b>97</b>
	<b>APPENDICES</b>	<b>105</b>
	<b>BIODATA OF STUDENT</b>	<b>125</b>
	<b>LIST OF PUBLICATIONS</b>	<b>126</b>

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