

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF THE HISTORY OF SCIENCE
AND TECHNOLOGY

PHILOSOPHY OF SCIENCE AND TECHNOLOGY

PHILOSOPHY OF SCIENCE AND TECHNOLOGY
AND THE HISTORY OF SCIENCE AND TECHNOLOGY

**HYDROLOGICAL SURVEY AND HIDROCARBON DISTRIBUTION IN THE
WATER OF PASIR PANJANG, REDANG ISLAND**

By

Raymond Maurice Anak Stephan Bujang

**Research report submitted in partial fulfillment of
the requirement of the degree of
Bachelor of Science (Marine Science)**

**Department of Marine Science
Faculty of Science and Technology**

**KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
2006**

1100042343

This project report should be cited as:

Maurice, R.S. 2006. Hydrological Survey And Hydrocarbon Distribution In The Water Of Pasir Panjang, Redang Island. Undergraduate thesis, Bachelor of Science in Marine Science, Faculty of Science and Technology, Kolej Universiti Sains dan Teknologi Malaysia, Terengganu. 122p.

No part of this project may be reproduced by any mechanical, photographic or electronic process, or in the form of phonographic recording, nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor of the project.



**MARINE SCIENCE DEPARTMENT
FACULTY OF SCIENCE AND TECHNOLOGY
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI
MALAYSIA**

APPROVAL OF RESEARCH PROJECT REPORT I AND II

Whereby this was approved that the research report entitled:

Hydrological Survey And Hydrocarbon Distribution In The Water Of Pasir Panjang, Redang Island by Raymond Maurice Anak Stephan Bujang, Metric No.: UK 7701 have been checked and all the proposed correction have been made. This research report submitted in partial fulfillment of the requirement of the degree of Bachelor of Science (Marine Science), Faculty of Science and Technology, Kolej Universiti Sains dan Teknologi Malaysia.

Approved by:


.....

Main Supervisor: DR. HING LEE SIANG
Pensyarah
Jabatan Sains Samudera
Name: Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
21030 Kuala Terengganu.

Official Stamp:

Date: 2/5/06


.....

Head of Department of Marine Science

Name: PROF. MADYA DR. HJ. ROSNAN HJ. YAACOB
Ketua
Jabatan Sains Samudera
Fakulti Sains dan Teknologi
Official Stamp: Kolej Universiti Sains dan Teknologi Malaysia
21030 Kuala Terengganu

Date: 8/5/06

ACKNOWLEDGEMENTS

Firstly, I would like to thank Dr Hing Lee Siang for this magnificent topic, your vision and mastery drives it all. This research inspire me to know more about my field of study especially regarding chemical oceanography, marine water quality and marine environment. It helps me to realize the field of my interest to further study.

Not forgetting God the Almighty, who bless me with fruitful ideas and guiding me throughout the research project operation. I would also like to dedicate my gratitude to Associate Professor Liew Hock Chark and Dr Hii Yii Siang who is also my mentor during the sampling period and helping me out in this task, your motivation makes everything possible.

Bless to my mom and dad, who have been always supportive and understand the difficulty that I'm facing in completing this thesis. Special thanks to my friends, Chua Chia Miin, Julius, Thirukanthan, Yong See Hong, Asma and Norbee, for your spirits and your hard work in helping me out during the sampling period and laboratory analysis, you all will always in my mind. Not to forget also to my collogues who supports me, gave opinions and advices me regarding this thesis, thanks a lot.

TABLE OF CONTENT

	PAGES
TITLE PAGE	i
APPROVAL FORM	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENT	iv
LIST OF FIGURES	vii
LIST OF TABLES	ix
LIST OF SYMBOL AND ABBREVIATIONS	x
LIST OF APPENDICES	xi
ABSTRACT	xii
ABSTRAK	xiii
CHAPTER 1	
1.0 INTRODUCTION	1
CHAPTER 2	
2.0 LITERATURE REVIEW	5
2.1 Redang Island	5
2.2 Pasir Panjang Beach	6
2.3 Hydrological parameters in the marine environment	7
2.4 Hydrocarbon concentration and the impact of the hydrocarbon pollution in the marine environment	10

CHAPTER 3

3.0	METHODOLOGY	12
3.1	Study site	12
3.2	Hydrological data	13
3.3	Hydrocarbon Distribution Data	13
3.4	Sampling technique	14
3.5	Analytical technique	15
3.6	Special apparatus and equipment	16
3.7	Special chemical	16
3.8	Standard curve determination for hydrocarbon analysis	16
3.9	Hydrocarbon analysis	17
3.10	Hydrocarbon Data Analysis	18
3.11	Statistical analysis	20

CHAPTER 4

4.0	RESULTS	21
4.1	Temperature	21
4.2	Ph	24
4.3	Turbidity	27
4.4	Dissolved oxygen	30
4.5	Salinity	34
4.6	Hydrocarbon distribution	37

CHAPTER 5

5.0	DISCUSSION	43
-----	------------	----

CHAPTER 6

6.0	CONCLUSION	66
	REFERENCES	68
	APPENDICES	71
	CURRICULUM VITAE	97

LIST OF FIGURES

FIGURE		PAGES
3.1:	Sampling Site	12
3.2:	Analytical Techniques Flow Chart	15
3.3:	Hydrocarbon Data Analysis Flow Chart	19
3.4:	Crude oil standard curve	20
4.1:	Temperature distribution for sampling 1	22
4.2:	Temperature distribution for sampling 2	22
4.3:	Temperature distribution for sampling 3	22
4.4:	pH distribution for sampling 1	25
4.5:	pH distribution for sampling 2	25
4.6:	pH distribution for sampling 3	25
4.7:	Turbidity distribution for sampling 1	28
4.8:	Turbidity distribution for sampling 2	28
4.9:	Turbidity distribution for sampling 3	28
4.10:	Dissolved oxygen distribution for sampling 1	31
4.11:	Dissolved oxygen distribution for sampling 2	31
4.12:	Dissolved oxygen distribution for sampling 3	31
4.13:	Salinity distribution for sampling 1	35
4.14:	Salinity distribution for sampling 2	35
4.15:	Salinity distribution for sampling 3	35
4.16:	Hydrocarbon distribution for first sampling	38

4.17:	Hydrocarbon distribution for second sampling	39
4.18:	Hydrocarbon distribution for third sampling	40
5.1:	July temperature distribution	44
5.2:	September temperature distribution	45
5.3:	October water temperature distribution	45
5.4:	July water pH distribution	51
5.5:	September pH distribution	51
5.6:	October water pH distribution	52
5.7:	July turbidity distribution	55
5.8:	September turbidity distribution	56
5.9:	October turbidity distribution	56
5.10:	July dissolved oxygen distribution	60
5.11:	September dissolved oxygen distribution	61
5.12:	October dissolved oxygen distribution	61
5.13:	July salinity distribution	66
5.14:	September salinity distribution	67
5.15:	October salinity distribution	67
5.16:	July hydrocarbon distribution	71
5.17:	September hydrocarbon distribution	72
5.18:	October hydrocarbon distribution	73

LIST OF TABLES

TABLE		PAGES
3.1:	The position of sampling stations determined by Global Positioning System	12
3.2:	Crude oil Standard Curve	20

LIST OF SYMBOL AND ABBREVIATIONS

°C	degree celcius
%	percentage
o/oo	part per thousand
o/ooo	part per million
DCM	dichloromethane
Na ₂ SO ₄	natrium sulphate
DO	dissolved oxygen
DO%	dissolved oxygen percentage saturation
GPS	global positioning system
mg/l	milligram per liter
NTU	natural turbidity unit
pH	- log [H ⁺]
ppb	part per billion
ppm	part per million
ppt	part per thousand

LIST OF APPENDICES

APPENDIX		PAGES
Appendix 1	Hydrological parameters of Temperature in the water of Pasir Panjang	86
Appendix 2	Hydrological parameters of pH in the water of Pasir Panjang	87
Appendix 3	Hydrological parameters of turbidity in the water of Pasir Panjang.	88
Appendix 4	Hydrological parameters of dissolved oxygen in the water of Pasir Panjang	89
Appendix 5	Hydrological parameters of salinity in the water of Pasir Panjang	90
Appendix 6	Crude oil standard curve	91
Appendix 7	Hydrocarbon distribution results for first sampling	92
Appendix 8	Hydrocarbon distribution results for second sampling	94
Appendix 9	Hydrocarbon distribution results for third sampling	96
Appendix 10	Two Way ANOVA analysis of Pasir Panjang water	98
Appendix 11	Interim National Water Quality Standard for Malaysia	110

ABSTRACT

The pass-by commercial boat and recreational resort activities effect on the hydrological parameters and hydrocarbon distribution in the water of Pasir Panjang, Redang Island was studied. Three sampling periods were conducted during July, September and October. For all three sampling periods during July, September and October, out of five hydrological parameters which are temperature, pH, turbidity, dissolved oxygen and salinity, three were relatively affected by the recreational tourism activities which were pH, dissolved oxygen and salinity. The temperature range from 28.54 °C to 31.65 °C, pH range from 8.05 to 8.30, turbidity range from 0.1 NTU to 13.0 NTU, dissolved oxygen range from 3.51 mg/l to 11.54 mg/l and salinity range from 31.08 ppt to 33.25 ppt. However, the level for pH and dissolved oxygen in the water of Pasir Panjang, Redang Island were still between the safety level of pH and dissolved oxygen which are 5.00 and 9.00 for pH and 3 – 5 mg/l for dissolved oxygen respectively. As for the salinity distribution, the salinity distribution for most of the stations and different water column were less than the normal 35 ppt. While as for the hydrocarbon distribution, the results shows that the water of Pasir Panjang was polluted as the hydrocarbon concentration for most of different sampling stations and sampling periods for surface, middle and bottom water were exceeding the hydrocarbon pollution in water level which is 0.1 mg/l or 100 ppb. The hydrocarbon distribution range from 0.18917 mg/l or 189.17 ppb to 1.97582 mg/l or 1975.82 ppb. Anova analysis showed that there were significant differences in between parameters values for pH, dissolved oxygen, salinity and hydrocarbon distribution in the three sampling periods ($p < 0.05$).

ABSTRAK

Kajian mengenai pengaruh laluan bot-bot komersial dan aktiviti rekreasi resort ke atas parameter hidrologi air serta taburan hidrokarbon di kawasan perairan Pasir Panjang, Pulau Redang telah dilakukan. Tiga penyempelan telah dijalankan pada bulan Julai, September dan Oktober. Untuk kesemua tempoh penyempelan pada Julai, September dan Oktober, daripada lima hidrologi iaitu suhu, pH, kekeruhan, oksigen terlarut dan kemasinan, tiga daripadanya adalah dipengaruhi oleh aktiviti rekreasi resort iaitu pH, oksigen terlarut dan kemasinan. Suhu berjulat dari 28.54 °C kepada 31.65 °C, pH berjulat dari 8.05 kepada 8.30, kekeruhan berjulat dari 0.1 NTU kepada 13.0 NTU, oksigen terlarut berjulat dari 3.51 mg/l kepada 11.54 mg/l dan kemasinan berjulat dari 31.08 ppt kepada 33.25 ppt. Walaubagaimanapun, nilai pH dan oksigen terlarut bagi kawasan perairan Pasir Panjang, Pulau Redang adalah masih berada dalam julat paras normal iaitu 5.00 hingga 9.00 untuk pH dan 3 – 5 mg/l untuk oksigen terlarut. Bagi taburan kemasinan, taburan kemasinan untuk kebanyakan stesen dalam kesemua lapisan air adalah di bawah aras normal 35 ppt. Untuk taburan hydrocarbon pula, keputusan menunjukkan bahawa perairan Pasir Panjang untuk kebanyakan stesen dan tempoh penyempelan, bagi air permukaan, tengah dan dasar, adalah melebihi tahap pencemaran hidrokarbon dalam air iaitu 100 ppb atau 0.01 mg/l. Taburan hidrokarbon berjulat dari 0.18917 mg/l atau 189.17 ppb kepada 1.97582 mg/l atau 1975.82 ppb. Analisis Anova telah menunjukkan bahawa terdapat perbezaan yang nyata di antara parameter-parameter hidrologi iaitu pH, oksigen terlarut dan kemasinan serta taburan hidrokarbon bagi ketiga-tiga tempoh penyempelan ($p < 0.05$).