

**PETROLEUM HYDROCARBON DISTRIBUTION IN BOTTOM
SEDIMENT OF KEMAMAN OFFSHORE WATER AND
EFFECT OF DIFFERENT SEASONS**

NAZRAH BT ALIAS

**FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU**

2008

PETROLEUM HYDROCARBON DISTRIBUTION IN BOTTOM
SEDIMENT OF KEMAMAN OFFSHORE WATER AND EFFECT OF
DIFFERENT SEASONS

By
Nazrah bt Alias

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

Department of Marine Science
FACULTY OF MARITIME AND SCIENCE MARINE
UNIVERSITY MALAYSIA TERENGGANU

2008

This project should be cited as:

Nazrah, A.2008. Petroleum Hydrocarbon Distribution in Bottom Sediment of Kemaman Offshore Water and Effect During Different Seasons, 98p.

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 from public/private use, without written permission from the author and the supervisor of the project.

1100061851



**JABATAN SAINS MARIN
FAKULTI PENGAJIAN MARITIM DAN SAINS MARIN
UNIVERSITI MALAYSIA TERENGGANU**

**PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

**THE PETROLEUM HYDROCARBON DISTRIBUTIONS IN SEDIMENT OFF
KEMAMAN OFFSHORE AND EFFECT OF MONSOON** oleh NAZRAH BINTI
ALIAS, No.Matrik UK12256 telah diperiksa dan semua pembedahan yang disarankan
telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Marin sebagai
memenuhi sebahagian daripada keperluan memperoleh Ijazah Sarjana Muda Sains
(Biologi Marin), Fakulti Pengajian Maritim dan Sains Marin, Universiti Malaysia
Terengganu.

Disahkan oleh:

Penyelia Utama

PROF. MADYA DR. MOHAMED KAMIL ABDUL RASHID

Nama:

Timbalan Dekan (Siswazah & Penyelidikan)
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

Cop Rasmi:

Tarikh:

2.5.2008

Penyelia Kedua

Nama:

YONG JAW CHUEN

Cop Rasmi

Pensyarah
Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu.

Tarikh:

2/5/2008

Ketua Jabatan Sains Marin

Nama:

DR. RAZAK ZAKARIYA

Cop Rasmi:

Ketua Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

Tarikh:

12/5/08

ACKNOWLEDGMENT

Praise to God the Almighty and with His bless, I have finished my Final Year Project successfully. Here, I want to thank to the University Malaysia Terengganu (UMT) and individual that involved in helping me to finish this project.

First of all, I would like to dedicate my gratitude to my supervisor, Assoc. Prof. Dr. Mohamed Kamil B. Abdul Rashid, and not forgotten to my former supervisor, Prof. Dr. Law Ah Theem for giving me this project and guide me. I also would like to thank Mr. Yong Jaw Chuen which is my second supervisor for his guide and effort during my theses writing and the laboratory analysis. Besides that, I want to thank to Mr. Yew Wooi Meng for his helped during my sampling.

Bless to my parents who had been always supportive and understand the difficulties I faces in completing this theses. Thanks also to my fellow friend who had helped me a lot during laboratory analysis and writing this thesis. Your good deeds will not be forgotten. Thanks to all of you.

Table of Contents

CONTENTS	PAGES
TITLE PAGE	i
APPROVAL FORM	ii
ACKNOWLEDGMENT	iii
TABLE OF CONTENT	iv
LIST OF FIGURES	vii
LIST OF TABLES	ix
LIST OF ABBREVIATION	x
LIST OF APPENDICES	xi
ABSTRACT	xii
ABSTRAK	xiii
CHAPTER 1 INTRODUCTION	
1.1 Introduction	1
1.2 Objectives	4
CHAPTER 2 LITERATURE REVIEW	
2.1 Hydrological parameters in marine environment	5
2.2 Hydrocarbon	
2.2.1 Alkanes	7
2.2.2 Alkenes	8
2.2.3 Alkynes	8
2.2.4 Benzene and Aromatic Compound	8
2.3 Type of Oil Encountered	10

2.4 Oil Spills at Sea	13
2.5 Behavior of Oil in the Environment	14
2.6 Inputs (Source of oil pollution)	21
2.7 Toxicity of oil and effect to marine environment	25

CHAPTER 3 MATERIALS AND METHOD

3.1 Sampling site	28
3.2 Glassware Cleaning	31
3.3 Sampling Technique	32
3.4 Sediment Sample Analysis	32
3.5 Crude Oil Standard Solution Preparation	32
3.6 Sonication Extraction	34
3.7 Recovery Test	36
3.8 Statistical Analysis	36

CHAPTER 4 RESULT

4.1 Hydrology Parameter	
4.1.1 Temperature	37
4.1.2 Dissolve oxygen	39
4.1.3 pH	40
4.1.4 Salinity	42
4.2 Standard Curve Crude Oil	44
4.3 Recovery Test	44

4.4 Total Hydrocarbon	
4.4.1 First Sampling in May	45
4.4.2 Second Sampling in September	48
4.4.3 Third Sampling in November	51
4.5 Comparison Between Each Sampling	54
CHAPTER 5	DISCUSSION
5.1 Hydrology Parameter	60
5.2 Hydrocarbon Distribution in Sediment	63
5.2.1 Comparison among sampling periods	64
5.2.2 Comparison with the standard level of unpolluted sediment	69
5.2.3 Rainfall Distribution	73
5.2.4 Comparison with previous study	74
	76
CHAPTER 6	CONCLUSION
REFERENCES	78
APPENDICES	85
CURICULUM VITAE	98

List of Figures

FIGURES	PAGES
2.1 : Shows the structure of some hydrocarbon and a table of refinery cuts of crude oil.	9
2.2 : Totals spills into the seas worldwide.	13
2.3 : It shows how the oil undergoes the environmental process.	19
2.4 : It shows the oil fate model which designed to provide detailed information on the oil concentration distribution in time and space.	20
2.5 : Sources of Oil.	24
2.6 : It shows how much input of petroleum hydrocarbon into the sea.	23
3.1 : Map of sampling site.	29
3.2 : The method of the glassware cleaning	31
3.3 : The standard curve preparation	33
3.4 : Flow chart of sediment analytical method.	35
4.1 : Temperature distribution for first sampling	37
4.2 : Temperature distribution for second sampling	37
4.3 : Temperature distribution for third sampling	38
4.4 : Dissolve oxygen distribution for first sampling.	39
4.5 : Dissolve oxygen distribution for the second sampling	39
4.6 : Dissolve oxygen distribution for the third sampling	39
4.7 : pH distribution for the first sampling	40
4.8 : pH distribution for second sampling	41
4.9 : pH distribution for third sampling	41
4.10: Salinity distribution for the first sampling	42
4.11: Salinity distribution for second sampling	42
4.12: Salinity distribution for the third sampling	43
4.13: Standard Curve of Crude Oil result	44
4.14: Graph of total hydrocarbon for first sampling	45
4.15: Transect 1 for the first sampling	46
4.16: Transect 2 for first sampling	46

4.17:	Transect 3 for first sampling	47
4.18:	Graph of total hydrocarbon for second sampling	48
4.19:	First transect for second sampling.	49
4.20:	Second transect for second sampling	49
4.21:	Third transect for third sampling.	50
4.22 :	Graph of total hydrocarbon for third sampling	51
4.23 :	First transect for third sampling in November	52
4.24 :	Second transect for third sampling in November	52
4.25 :	Third transect for third sampling in November	53
4.26 :	Overall comparison of total hydrocarbon for three times samplings.	54
4.27 :	Transect 1 : Comparison for first, second and third sampling	55
4.28 :	Transect 2 : Comparison for first, second and third sampling	56
4.29 :	Transect 3 : Comparison for first, second and third sampling	57
5.1 :	The hydrocarbon distribution for first sampling in May by using surfer plot	65
5.2 :	The hydrocarbon distribution for second sampling in September by using surfer plot.	66
5.3 :	The hydrocarbon distribution for third sampling in November by using surfer	67
5.4 :	Comparison of mean of hydrocarbon in sediment with the safety level standard or unpolluted level among three times sampling	70
5.5 :	Comparison of mean of hydrocarbon for each station with the safety level standard or unpolluted level.	71
5.6 :	Rainfall distribution throughout the year of 2007(Source: Malaysia Meteorological Department in Sultan Mahmud Airport, Terengganu).	73

List of Tables

TABLES		PAGES
1:	Comparison data from other studies.	4
2:	The thickness of oil and its appearance	12
3:	It shows the level of hydrocarbon in the organism listed.	27
4:	Coordinate for each station.	30
5:	Comparison with previous study.	74

List of Abbreviations

m	-	meter
mm	-	millimeter
g	-	gram
µg	-	microgram
mg/kg	-	milligram/kilogram
mg/kg dw	-	milligram/kilogram dry weight
µL/min	-	microliter/minutes
µg	-	microgram
nm	-	nanometer
µg/L	-	microgram/liter
mL	-	mililiter
gm ⁻¹	-	gram per meter
ppm	-	part per million
ppt	-	part per thousand
ppb	-	part per billion
v/v	-	volume/volume
DCM	-	dichloromethane

List of Appendices

APPENDIX	PAGES
1 :	Depth of the stations. 86
2 :	Hydrological parameter of temperature (°C) in water of Kemaman offshore. 86
3 :	Hydrological parameter of dissolve oxygen (mg/l) in water of Kemaman Offshore. 87
4 :	Hydrological parameter of pH in water of Kemaman Offshore. 87
5 :	Hydrological parameter of salinity (ppt) in water of Kemaman Offshore. 88
6 :	Hydrology parameter of current in water of Kemaman Ofsshore. 88
7 :	Result for Standard Curve Crude Oil. 89
8 :	Hydrocarbon distribution results for first sampling in May. 89
9 :	Hydrocarbon distribution results for first sampling in September. 90
10:	Hydrocarbon distribution results for first sampling in November. 91
11:	The recovery test. 92
12:	Anderson-Darling Test. 93
13:	Friedman Test: HYDROCARBON versus STATION blocked by SAMPLING 94
14:	Friedman Test: hydrocarbon versus sampling blocked by station 95
15(a):	Machinery that were used to release Smith McIntyre Grab to ocean bottom. 96
15(b):	Hauled up the Smith McIntyre Grab that carry the sediment sample. 96
16:	Current movement during the first sampling in May. 97
17:	Current movement during the second sampling in September. 97
18:	Current movement during the third sampling in November. 98

ABSTRACT

A study has been carried out to determine the concentration and distribution of hydrocarbons in bottom sediments of Kemaman Offshore water, Terengganu. Three sampling periods were conducted during May, September and November 2007 for the sediment samples. There are 24 study stations overall which comprised three transect that layered from coastal area to offshore, where each transect comprises eight stations. From the result, total hydrocarbon for the first sampling was ranged from 45.18 mg/kg to 432.74 mg/kg dry sediment. For the second sampling, the total hydrocarbon concentration was 13.96 mg/kg to 778.17 mg/kg dry weight, while for the third sampling in November, the concentration of total hydrocarbon was 20.4 mg/kg to 506.09 mg/kg dry sediment. The mean value for first, second and third sampling are 177.315 mg/kg dry sediment, 184.324 mg/kg dry sediment and 95.127 mg/kg dry sediment respectively. The mean value shows the second sampling in the month of September has the highest hydrocarbon concentration. From this study, it showed that the study area had been polluted with hydrocarbon pollution. In this present study, the petroleum hydrocarbon ranges from 35.7 mg/kg dry sediment to 487.82 mg/kg dry sediment. The hydrocarbon content in study areas are increased from previous study that has been done in South China Sea and most of the stations are polluted with hydrocarbon as the mean value is more than unpolluted level which is 100 mg/kg.

ABSTRAK

Kajian ini dilakukan bagi menentukan taburan dan kandungan hidrokarbon didalam sedimen perairan Kemaman, Terengganu. Tiga persampelan telah dilakukan iaitu pada May, September dan November 2007 bagi mendapatkan sampel sedimen. Terdapat 24 stesen keseluruhannya dimana terdapat tiga transek yang mengunjur dari kawasan pantai ke laut. Daripada keputusan, jumlah hidrokarbon bagi persampelan pertama adalah 45.18 mg/kg to 432.74 mg/kg sedimen kering. Bagi persampelan kedua, jumlah kepekatan hidrokarbon adalah 13.96 mg/kg to 778.17 mg/kg sedimen kering. Bagi persampelan ketiga pada bulan November, kepekatan hidrokarbon adalah 20.4 mg/kg to 506.09 mg/kg sedimen kering. Nilai min bagi May, September dan November adalah 177.315 mg/kg sedimen kering, 184.324 mg/kg sedimen kering and 95.127 mg/kg sedimen kering. Nilai min bagi persampelan kedua di bulan September mempunyai kepekatan hidrokarbon yang paling tinggi. Berdasarkan kajian ini, didapati kawasan kajian telah dicemari dengan pencemaran hidrokarbon. Di dalam kajian ini, petroleum hidrokarbon berjulat daripada 35.7 mg/kg sedimen kering hingga 487.82 mg/kg sedimen kering. Kandungan hidrokarbon dikawasan kajian meningkat daripada kajian sebelum ini yang dijalankan di Laut China Selatan dan kebanyakan stesen tercemar dengan hidrokarbon dengan nilai min yang melebihi tahap tidak tercemar iaitu 100 mg/kg.