

DETERMINATION OF VOLATILE ORGANIC COMPOUNDS (VOC) IN  
WASTEWATER FROM PETROCHEMICAL INDUSTRIAL AREA IN KERTEH,  
TERENGGANU

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FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
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2008



**DETERMINATION OF VOLATILE ORGANIC COMPOUNDS (VOC) IN  
WASTEWATER FROM PETROCHEMICAL INDUSTRIAL AREA IN KERTEH,  
TERENGGANU.**

**By:**

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**Research Report submitted in partial fulfillment of  
the requirements for the degree of  
Bachelor of Science (Marine Science)**

**Department of Marine Science  
Faculty of Maritime Studies and Marine Science  
UNIVERSITI MALAYSIA TERENGGANU**

**2008**

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This project report should be cited as:

Nur Aainaa, M. 2008. Determination of Volatile Organic Compound (VOC) in Wastewater from Petrochemical Industrial Area in Kerteh, Terengganu. Undergraduate thesis, Bachelor of Science (Marine Science), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu. 110p.

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

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: **Determination of VOCs in Wastewater from Petrochemical Industrial Area of Kerteh, Terengganu**, oleh **Nur Aainaa Syafini binti Mohd Radzi**, No.Matrik UK12071 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Marin sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Sains (Sains Samudera), Fakulti Pengajian Maritim dan Sains Marin, Universiti Malaysia Terengganu.

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## ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

Assalammualaikum W.B.T,

Alhamdulillah, thanks to Allah the almighty with His permission I eventually finished this final year project. First of all I would like to thanks Associate Prof. Dr. Mohamed Kamil bin Abd Rashid as my supervisor for his time, support, all the knowledge and his help in finishing this project. Also thanks to Mr. Sainol Aimi for his support and assistance in handling the machine.

Special thanks to Dr Zainuddin Bachok for his time in reviewing and correcting mistakes done, Dr. Nor Antonina, all UMT staffs and all my friends that helps me a lot in finishing this project.

Also special thanks to my best friend and all my family members especially mum and dad for all the material and mental support. Without these people, it is impossible for me to finish this project within time.

Regards,

Nur Aainaa Syafini binti Mohd Radzi (UK12071)

Bachelor of Science (Marine Science)

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## LIST OF ABBREVIATION

VOCs	- Volatile Organic Compounds
PPIC	- PETRONAS Petrochemical Integrated Complex
KIPC	- Kerteh Integrated Petrochemical Complex
WWTP	- Waste Water Treatment Plant
GC	- Gas Chromatography
FID	- Flame Ionization Detector
$\mu\text{g/mL}$	- Microgram per Milliliter
ppm	- Part Per Million
I.S	- Internal Standard

## ABSTRACT

This study was conducted in 12 sampling stations within PETRONAS Petrochemical Integrated Complex (PPIC), Kerteh, and Kerteh River during Northeast monsoon. The type of samples used to detect Volatile organic compounds (VOC) in this research is water. The samples were collected by using modified water sampler and preserved with 30 drops of 6N/300mL HCl before being placed in ice chest to maintain the temperature between 0 to 4<sup>0</sup>C. Samples were brought back to the laboratory for further analysis and identification by using GC- FID. Twelve species of VOC were detected and their concentrations were measured. The most dominant species identified was 1, 4-dichlorobenzene that appeared in eight stations during pre monsoon, eleven stations during intermediate monsoon and in all stations during post monsoon. Averagely, 3 species were presents in each sampling station. From the research, it was known that the species and concentrations of VOCs were unevenly distributed and cannot be predicted. Total VOCs concentrations detected in Station 1 to Station 12 from pre to post monsoon were ranged between 0.0193 $\mu$ g/mL to 9.7535 $\mu$ g/mL. Exposure to the water at sampling areas (except for water with VOCs concentrations lower than 0.20 $\mu$ g/mL) can cause acute effects such as irritation, discomfort, exposure effects, headache and neurotoxic effects. Concentrations of VOCs along KIPC and GPP drainage reduced with increased distance towards the outflow of the drainage in Kerteh River except for GPP drainage during intermediate and post monsoon. Open pond which usually used to reduce organic containing wastewater present between Station 7 and 8 of KIPC drainage. The pond was not functioning well during this monsoon season except in intermediate monsoon. Concentration of VOC has found to be dependable on temperature and salinity.

Other parameters that might influence the distribution of VOC in the study areas were the stream flow rates, pressure and characteristics of the individual pollutant at the origin.

## ABSTRAK

Kajian mengenai spesies, kepekatan dan taburan sebatian organik mudah meruap (VOC) ini telah dijalankan di 12 stesen sekitar kawasan perindustrian PETRONAS, Kerteh dan di Sungai Kerteh. Sampel air telah diambil menggunakan alat persampelan yang telah diubahsuai dan diawet dengan memasukkan 30 titis 6N/300mL HCl sebelum diletakkan di dalam peti sejuk untuk mengekalkan suhu sampel diantara 0 hingga 4<sup>0</sup>C. Sampel dibawa pulang ke makmal untuk dianalisis dengan lebih lanjut menggunakan GG- FID. Spesies VOC yang paling dominan sepanjang monsoon adalah 1,4- dichlorobenzene yang hadir di lapan stesen kajian pada awal monsun, sebelas stesen di pertengahan monsoon dan di semua stesen pada hujung monsoon. Puratanya, tiga spesies VOC hadir di setiap stesen. Jenis dan kepekatan VOC yang hadir adalah tidak sama rata dan tidak boleh diramal. Julat keseluruhan kepekatan VOC yang dikenalpasti dari Stesen 1 ke Stesen 12 pada awal, pertengahan dan akhir monsun adalah diantara 0.0193 $\mu$ g/mL ke 9.7535 $\mu$ g/mL. Pendedahan kepada air di kawasan kajian (kecuali bagi air yang mempunyai kepekatan VOC kurang dari 0.20 $\mu$ g/mL) boleh menyebabkan radang, ketidakselesaan, kesan pendedahan, sakit kepala dan kesan toksik kepada saraf. Kepekatan VOC di sepanjang saluran air kumbahan terawat KIPC dan GPP menurun dengan pertambahan jarak mwnghampiri Sungai Kerteh kecuali di saluran GPP pada pertengahan dan hujung monsun. Kolam terbuka yang terdapat diantara stesen 7 dan 8 di saluran KIPC telah dibina untuk tujuan mengurangkan bahan organik yang hadir dalam air kumbahan terawat. Walaubagaimanapun, kolam ini telah didapati tidak berfungsi dengan baik dalam mengurangkan kandungan VOC dalam air di kawasan kajian kecuali pada pertengahan monsoon. Kepekatan VOC telah didapati bergantung kepada suhu dan

kemasinan air. Faktor lain yang mungkin mempengaruhi bacaan kepekatan VOC di kawasan kajian adalah seperti kelajuan arus, tekanan, dan ciri- ciri semulajadi bahan pencemar terlibat.