

THE EFFECTIVENESS OF GARBAGE ENZYME TO TREAT  
WATER CONTAMINATED WITH HYDROCARBONS

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**DECLARATION AND VERIFICATION REPORT  
RESEARCH PROJECT I AND II**

It is hereby declared and verified that this research report entitled:

The effectiveness of garbage enzyme to treat water contaminated with hydrocarbons  
by Choo Jing Ying, Matric No. UK16934 have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree of Bachelor of Science (Marine Science), Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

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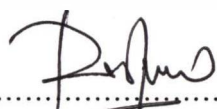
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## LIST OF ABBREVIATIONS

%	- Percentage
°C	- Degree Celsius
2FO	- No.2 Fuel Oil
Abs	- Absorbance
BaP	- Benzo(a)pyrene
BFT	- Baffled Flask Test
BTEX	- Acronym that stands for benzene, toluene, ethylbenzene and xylenes
C9500	- Corexit9500
CO <sub>2</sub>	- Carbon Dioxide
cSt	- CentiStokes
DCM	- Dichloromethane
g	- Gram
g/l	- Gram per liter
GE	- Garbage enzyme
IFO 180	- Intermediate Fuel Oil 180
IFO 380	- Intermediate Fuel Oil 380
L	- Liter
LC <sub>50</sub>	- Lethal Concentration 50
mg/L	- Milligram per liter
ml	- Milliliter

n	- Sample size
NCP	- National Contingency Plan
nm	- Nanometer
PAHs	- Polycyclic aromatic hydrocarbons
PBC	- Prudhoe Bay crude oil
ppt	- Part per thousand
rpm	- Revolutions per minute
RSD	- Relative standard deviation
SD	- Standard Deviation
SD25	- Superdispersant-25
SFT	- Swirling flask test
SLC	- South Louisiana crude oil
SPC1000	- Dispersit SPC1000
TPH	- Total petroleum hydrocarbons
USEPA	- United States Environmental Protection Agency
UV	- Ultraviolet
UZKC	- Upper Zakum crude oil
V	- Volume
$\mu$ l	- Microliter
$\rho_{oil}$	- Oil density

## ABSTRACT

Oil spill has created a lot of environmental related problems, especially to the marine wild lives. So, a good and easy method to clean up oil spill has to be developed too apart from preventing the occurrence of oil spill. Among the methods, the chemical dispersants face the greatest controversy. They could disperse the oil spill in a short time but they would increase the toxicity in the aquatic environment. Garbage enzyme (GE) is commonly used in household as a cleaning liquid to remove oil and grease in the kitchen. So it is believed to have the ability to disperse oil spill as it can breakdown the oil particles. This study is to test on the effectiveness of GE as oil dispersant. The experiment was carried out based on Baffled Flask Test (BFT) which is developed by US Environmental Protection Agency (EPA) to determine the dispersant effectiveness. Dispersant-to-oil ratio (DOR) of 1:10 of GE is the optimum DOR to treat water contaminated by Malaysia Tapis crude oil with GE 30, GE 60 and GE 90 performed the highest effectiveness DOR of 83.4% ( $\pm 9.8$ ), 40.5% ( $\pm 4.6$ ) and 31.1% ( $\pm 2.3$ ) respectively. The result showed that the effectiveness of GE decreases with regards to its fermentation period. However, this result may be the influence of temperature as low temperature usually decreases the dispersability of oil or it may be the ability of GE to transform oils and greases into non-oils-and-greases. The ANOVA analysis shows that the effectiveness for both of the independent variables, DOR and fermentation period have significant differences, which is  $p=0.00 < 0.05$  for both and there is significant interaction between the independent variables (DOR\*Month) with  $F(18, 90) = 12.270$ ,  $p=0.00 < 0.05$ . DOR of 1:10 is the most

effective for the DOR variables and GE A is the most effective for fermentation period variables according to Turkey Test. As a conclusion, it is believed that GE certainly has some effect on dispersing the oil. However, further studies have to be done on various variables such as crude oil type, salinity, temperature, etc as well as the toxicity test and bioremediation agent test before we can firmly conclude that GE can be used as commercial oil dispersant that would not bring harm to environment.

## KEBERKESANAN ENZIM SAMPAH DALAM MENGATASI AIR YANG TERCEMAR DENGAN MINYAK

### ABSTRAK

Tumpahan minyak telah mengakibatkan banyak masalah persekitaran terutamanya kepada hidupan marin. Oleh itu, kaedah yang bagus dan mudah untuk membersihkan tumpahan minyak harus dikembangkan di samping mencegah terjadinya tumpahan minyak. Antara kaedah yang sedia ada, '*dispersant*' kimia menghadapi kontroversi yang hebat kerana ia boleh membubarkan tumpahan minyak dalam masa yang singkat tetapi juga akan meningkatkan toksisiti di dalam air. Enzim Sampah (GE) digunakan di rumah tangga sebagai cecair pencuci untuk menghilangkan minyak di dapur. Jadi, adalah dipercayai ia berkemampuan untuk membubarkan tumpahan minyak kerana ia boleh membubarkan zarah minyak. Kajian ini adalah untuk menguji keberkesanan GE sebagai '*dispersant*' minyak dengan berdasarkan '*Baffle Flask Test (BFT)*' yang dibangunkan oleh '*US Environmental Protection Agency (EPA)*'. Keputusan menunjukkan 1:10 nisbah '*dispersant*'-minyak (DOR) adalah DOR optimum untuk mengatasi air yang tercemar oleh minyak mentah Tapis Malaysia. GE 30, GE 60 dan GE 90 telah membubarkan sebanyak 83.4% ( $\pm 9.8$ ), 40.5% ( $\pm 4.6$ ) dan 31.1% ( $\pm 2.3$ ) minyak masing-masing pada 1:10 DOR. Keputusan kajian menunjukkan bahawa keberkesanan GE menurun apabila tempoh fermentasinya meningkat. Namun, keputusan ini mungkin disebabkan oleh suhu rendah yang kebiasaannya mengurangkan '*dispersability*' minyak atau berkemungkinannya GE mampu untuk

menukar hidrokarbon menjadi non-hidrokarbon. Analisis ANOVA menunjukkan bahawa keberkesanan untuk kedua pembolehubah bebas, DOR dan tempoh fermentasi mempunyai perbezaan yang signifikan, iaitu  $p = 0.00 < 0.05$  untuk kedua-duanya, dan ada interaksi yang signifikan antara pembolehubah bebas (DOR\*Tempoh fermentasi) dengan  $F(18, 90)=12,270$ ,  $p=0.00 < 0.05$ . 1:10 DOR adalah DOR yang paling berkesan dan GE A (Tempoh fermentasi untuk satu bulan) adalah tempoh fermentasi yang paling berkesan jika dibandingkan dengan pembolehubahnya, menurut *Turkey Test*. Sebagai kesimpulannya, adalah diyakini bahawa GE mempunyai kesan terhadap pembubaran minyak. Namun, kajian yang lebih lanjut perlu dilakukan untuk mengkaji faktor pembolehubah yang lain seperti jenis minyak mentah, saliniti, suhu, dll serta kajian toksisiti dan kajian agen bioremediasi sebelum kita dapat simpulkan bahawa GE boleh digunakan sebagai '*dispersant*' minyak komersial yang tidak akan memudaratkan alam sekitar.