

BIODEGRADATION RATE OF ESSO CRUDE OIL (TAPIS A)
AND GROWTH ON SOME SELECTED HYDROCARBONS
BY BACTERIA ISOLATED FROM PORT DICKSON COASTAL WATERS

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UNIVERSITI PERTANIAN MALAYSIA
SERDANG, SELANGOR
1993

Lp
224

TERENGGANU

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A report submitted as partial fulfilment
to the Faculty of Fisheries and Marine Science
for the degree of B.Sc.(Fisheries).

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1100023714

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ACKNOWLEDGEMENTS

I would like to express my greatest appreciation and gratitude to Dr. Law Ah Theem, my supervisor whom without his supervision and guidance this project might not have been possible.

My appreciation is also extended to Puan Norzaidah Mawi and Encik Azahar Othman for their technical and moral support through this past eight months or so when I was conducting this research project.

My heartfelt thanks to Dr. Rohana P. Subasinghe for his comments and criticism in my work on the identification of the bacteria.

I would also like to thank my family for their moral support through my years in Universiti Pertanian Malaysia.

Last but not least to all my coursemates, housemates especially Tan Geok Ting (for the use of her Computer) and Yow Geok Yong (transportation -nocturnal data collection) and friends who have supported me through the running of my project, I say a big THANK YOU.

This project was done with the support from the IRPA Research Grant 04-07-05-006.

ABSTRACT

Two bacteria isolated from Port Dickson coastal waters were identified and their petroleum degrading activities were determined. They were identified as *Flavobacterium* sp. and *Micrococcus* sp. Both species were capable to grow on selected alkanes but they were unable to grow on alkenes or aromatic petroleum hydrocarbons. Biodegradation of ESSO Crude oil was measured by weight loss technique. The oil biodegradation rates for *Flavobacterium* sp. and *Micrococcus* sp. were 1.45 mg/l/hr and 1.13 mg/l/hr respectively with 20 day of incubation at 30° C in basal salt medium. The initial cell population of the above studies were 2.1×10^5 cells/ml and 3.3×10^6 cells/ml respectively.

The effects of nutrients (NH_4^+ and PO_4^{3-}) on the biodegradation of ESSO Crude oil by the natural population of microorganisms in Port Dickson coastal waters were also conducted by using the weight loss technique. The number of oil degrading microorganisms in the seawater sample used for the study was 320 cells/ml. The highest oil biodegradation rate was found in NH_4^+ enriched seawater; a value of 76.8 mg/l/day was detected at a concentration of 100 $\mu\text{g-at N/L}$. Phosphate at 25 and 50 $\mu\text{g-at P/L}$ showed no significant difference in the degrading rate i.e. 69.4 mg/l/day and 70.6

mg/l/day respectively. In combination of both nutrients at a level of 100 µg-at N/L and 50 µg-at P/L, 89.2 mg/l/day biodegradation rate was recorded.

The results indicated that the natural hydrocarbon oxidizing bacteria in the coastal waters off Port Dickson possessed the ability to degrade 6 mg/l/day petroleum hydrocarbons. Under conditions when the seawater was enriched with NH_4^+ and PO_4^{3-} a degradation rate of 89.2 mg/l/day was recorded. The nutrient depletion studies recorded that nitrogen was the limiting factor in the coastal waters off Port Dickson. Attempts to clean up oil spills with the aid of microorganisms should take into consideration of the nutrient deficiencies in the seawater.

ABSTRAK

Dua bakteria dari perairan Port Dickson telah dikenalpasti serta kecekapan mereka untuk mendegradasi petroleum telah ditentukan. Kedua bakteria diidentifikasi sebagai *Flavobacterium* sp. dan *Micrococcus* sp.. Kedua bakteria ini berupaya untuk tumbuh pada beberapa bahan hidrokarbon iaitu dari rangkaian kumpulan alkana dan tiada pertumbuhan diperhatikan pada kumpulan alkena dan kumpulan aromatik. Kajian biodegradasi minyak mentah ESSO (Tapis A) telah dijalankan dengan kaedah kehilangan berat minyak. Kajian mendapati kadar biodegradasi minyak bagi *Flavobacterium* sp. adalah 1.45 mg/l/jam manakala *Micrococcus* sp. pula adalah 1.13 mg/l/jam di dalam tempoh 20 hari di dalam media garam asas. Populasi awalan sel adalah 2.1×10^5 sel/ml dan 3.3×10^6 sel/ml masing-masing.

Kajian mengenai kesan nutrien (NH_4^+ dan PO_4) ke atas biodegradasi minyak mentah ESSO (Tapis A) oleh populasi semulajadi perairan Port Dickson juga telah dijalankan dengan kaedah kehilangan berat minyak. Bilangan mikroorganisma dari segi kebolehan untuk mendegradasi minyak mentah petroleum adalah 320 sel/ml bagi perairan Port Dickson. Kajian mendapati pada kepekatan ammonium paling tinggi iaitu 100 $\mu\text{g-at N/L}$,

kadar degradasi adalah paling tinggi antara nutrien ammonia iaitu 76.8 mg/l/hari. Bagi fosfat pula pada kepekatan 25 dan 50 µg-at P/L tidak menunjukkan perbezaan yang bererti dalam kadar deradasi iaitu 69.4 mg/l/hari dan 70.6 mg/l/hari masing-masing.

LIST OF DIAGRAMS

Di dalam kombinasi kedua-dua kepekatan nutrien iaitu 50 µg-at P/l fosfat dan 100 µg-at N/L ammonium pula, kadar degradasi yang paling tinggi iaitu 89.2 mg/l/hari diperolehi.

Di dalam keadaan tiada nutrien iaitu kawalan, kadar biodegradasi minyak mentah ESSO (Tapis A) adalah 6 mg/l/hari. Ini menunjukkan keadaan semulajadi di perairan Port Dickson berupaya mendegradasikan minyak tetapi pada kadar yang amat lambat. Kajian pengaruh nutrien menunjukkan sumber nitrogen adalah faktor penghad di perairan Port Dickson di dalam aktiviti mengdegradasikan minyak.

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