UNIVERSITI PUTRA MALAYSIA

BIODEGRADATION OF PETROLEUM SLUDGE BY *METHYLOBACTERIUM* SP.

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BIODEGRADATION OF PETROLEUM SLUDGE BY *METHYLOBACTERIUM* SP.

BY

ZAKUAN AZIZI BIN SHAMSUL HARUMAIN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

BIODEGRADATION OF PETROLEUM SLUDGE BY *METHYLOBACTERIUM* SP.

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ZAKUAN AZIZI BIN SHAMSUL HARUMAIN

Chairman : Associate Professor Dr. Mohd Yunus Abd Shukor, PhD

Faculty : Biotechnology and Biomolecular Sciences

Abstract: A bacterium was isolated from sludge contaminated soil in petroleum refinery centre and tested for its ability to degrade hydrocarbon in petroleum sludge obtained from Shell Refinery Centre, Port Dickson, Negeri Sembilan. The isolate was tentatively identified as *Methylobacterium* sp. strain ZASH based on the partial 16s rRNA molecular phylogeny. The optimum condition for the strain to degrade petroleum sludge was characterized and quantified using GCFID. It was revealed that the bacterium degrade optimally between the temperature of 30°C to 35°C, pH 7 to 7.5, 0.5 to 1.5% (v/v) Tween 80 as surfactant source and at 1 to 2% (w/v) peptone as the nitrogen source. Gas chromatography analysis revealed that after 15 days, the *Methylobacterium* sp. strain ZASH was able to degrade 70% of hydrocarbons component of chain length C12-C36 found in petroleum sludge. It was also found that sawdust can be a good hydrocarbon adsorbent as its addition increase the hydrocarbon removal up to 99% removal.

Keywords: Petroleum Sludge, Sawdust, *Methylobacterium* sp.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

BIOPENGURAIAN ENAPCEMAR PETROLEUM OLEH *METHYLOBACTERIUM* SP.

Oleh

ZAKUAN AZIZI BIN SHAMSUL HARUMAIN

Pengerusi : Profesor Madya Dr. Mohd Yunus Abd Shukor, PhD

Fakulti : Bioteknologi dan Sains Biomolekul

Abstrak: Sejenis bakteria telah dipencilkan daripada bahan enapcemar petroleum yang diperoleh daripada pusat penapisan petroleum dan telah diuji untuk melihat kebolehan bakteria tersebut menguraikan sebatian hidrokarbon dalam bahan enapcemar petroleum yang diperoleh dari Pusat Penapisan Minyak Shell, Port Dickson, Negeri Sembilan. Bakteria itu dikenalpasti sebagai *Methylobacterium* sp. strain ZASH berdasarkan kajian filogeni terhadap sebahagian molekul 16s rRNA. Kondisi optimum bagi penguraian sebatian enapcemar petroleum dikaji dan dianalisis menggunakan GCFID. Kajian mendedahkan bakteria tersebut hidup dan menguraikan sebatian hidrokarbon secara optimum diantara suhu 30°C hingga 35°C, pH 7 hingga 7.5, kepekatan tween 80 sebagai sumber surfaktan pada 0.5 kepada 1.5% (v/v) dan kepekatan pepton sebagai sumber nitrogen pada 1 hingga 2% (w/v). Analisis kromatografi mendedahkan bahawa bakteria ini berupaya menguraikan sebatian hidrokarbon bersaiz C12 hingga C36 sebanyak 70% penyingkiran. Kajian juga mendapati bahawa habuk papan sesuai untuk menjadi bahan penyerap sebatian hidrokarbon dimana penambahan habuk papan telah meningkatkan penyingkiran hidrokarbon sebanyak 99% penyingkiran.

Katakunci: Enapcemar Petroleum, Habuk Papan, *Methylobacterium* sp.

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Specially dedicated to my dedicated parents, my lovely wife, my beautiful family and to my beloved daughter,

'Ilma binti Zakuan Azizi

Rabbi Zidni 'Ilma
"My Lord! Increase me in knowledge."

I certify that an Examination Committee has met on 13 September 2012 to conduct the final examination of Zakuan Azizi Bin Shamsul Harumain on his Master of Science thesis entitled "Biodegradation of petroleum sludge by *Methylobacterium* sp. strain ZASH" in accordance with Universiti Putra Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously or currently submitted for any other degree at UPM or other institutions.

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ZAKUAN AZIZI BIN SHAMSUL HARUMAIN

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TABLE OF CONTENTS