AEROBIC BACTERIA ABUNDANCE AND MINERAL ELEMENTS STATUS IN AGED AND NEW CULTURE PONDS OF TIGER SHRIMP (*PENAEUS MONODON*)

By

HAMIDAH BINTI ISMAUN

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

July 2006

DEDICATION

To my

Husband, Ahmad bin Mulot
And Sons, Muhammad Zahid,
Muhammad Zulhelmi,
Muhammad Zulhusni

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

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Chairman : Hishamuddin bin Omar, PhD

Faculty : Science

The shrimp farming in Malaysia is a rapidly developing industry. However, in recent years, the production of cultured shrimp has decreased due to the unsustainable farming practices that lead to outbreaks of diseases. Thus, a comparative study was carried out to analyze the bacterial abundance in aged and new culture ponds of *Penaeus monodon* situated in Merlimau, Malacca.

The water quality parameters of the pond, the bacterial levels and the mineral element status of water and sediment were examined at intervals of 30 days for two crop cycles. Results showed that the water quality parameters remained within the optimum range for shrimp culture. The total bacterial levels (*Vibrio* and aerobic bacteria) ranged from 10^3 to 10^5 $CFUmL^{-1}$ in water and 10^3 to 10^6 $CFUg^{-1}$ in sediment. The ANOVA analysis showed that the *Vibrio* and aerobic bacteria levels in water and sediment samples were significantly higher ($p<0.05$) in new pond compared to aged

pond. The sediment of both aged and new ponds recorded higher values of bacterial level than water and demonstrated a general trend of increase bacterial level with the progress of the culture period. The results also showed that there is no clear pattern of bacterial level between crop cycles. Seven genera of bacteria were identified by using API® 20E, API® 50 CHB and Microgen™ GN-ID identification commercial kits, namely *Vibrio, Bacillus, Moraxella, Acinetobacter, Aeromonas, Pasteurella* and *Staphylococcus*.

Six major elements (Na, Mg, Al, K, Ca, Fe) and 14 trace elements (V, Cr, Co, Cu, Se, As, Pb, Mn, Cd, Sb, Zn, Ti, Ni, Ag) were detected using INAA, ICP-MS methods in both water and sediment from aged and new ponds. Results showed that the major elements concentrations in water and sediment from aged and new ponds were quite similar. The trace element concentrations in water and sediment from aged and new ponds were also quite similar. The results of correlation coefficients showed that water quality parameters and mineral elements concentrations contribute towards the variance of bacterial level. The data collected during this study could provide background information for further research on the mineral elements in penaeid brackish water culture ponds in Malaysia.

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

DENSITI BAKTERIA AEROBIK DAN STATUS UNSUR MINERAL DALAM KOLAM LAMA DAN BARU UDANG HARIMAU (*PENAEUS MONODON*)

Oleh

HAMIDAH BINTI ISMAUN

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Penternakan udang laut di Malaysia merupakan satu industri yang sedang berkembang pesat. Walau pun begitu, kebelakangan ini pengeluaran udang ternakan telah merosot disebabkan oleh amalan pengurusan kolam yang tidak baik yang menyebabkan timbulnya banyak masalah penyakit. Oleh itu, satu kajian bandingan telah dijalankan untuk menganalisa densiti bakteria di dalam kolam yang lama dan baru *Penaeus monodon* yang terletak di Merlimau, Melaka.

Parameter kualiti air kolam, bilangan bakteria dan status unsur mineral di dalam sampel air dan sedimen kolam udang harimau yang baru dan lama ditentukan pada setiap 30 hari selama dua tempoh pengkulturan. Keputusan menunjukkan bahawa semua parameter kualiti air didapati berada di dalam julat yang sesuai untuk pengkulturan udang.

Bilangan mutlak bakteria (*Vibrio* dan bakteria aerobik) di dalam air mempunyai julat di antara 10^3 hingga 10^5 $CFUmL^{-1}$ dan di dalam sedimen di antara 10^3 hingga 10^6 $CFUg^{-1}$. Analisis ANOVA menunjukkan bahawa bilangan *Vibrio* dan bakteria aerobik mempunyai perbezaan bererti yang tinggi ($p<0.05$) di dalam kolam baru berbanding kolam lama. Bilangan bakteria di dalam sedimen bagi kedua-dua kolam mencatatkan nilai yang lebih tinggi berbanding bilangan bakteria di dalam air. Keputusan juga menunjukkan tiada corak yang tertentu pada bilangan bakteria di antara tempoh pengkulturan. Kesimpulannya, jumlah bilangan bakteria di dalam kolam baru lebih banyak berbanding kolam lama. Pengcaman bakteria juga dilakukan dengan menggunakan kit komersil API® 20E, API® 50 CHB dan Microgen™ GN-ID. Tujuh genera bakteria telah dikenalpasti dari sampel air dan sedimen kolam baru dan lama iaitu *Vibrio*, *Bacillus*, *Moraxella*, *Acinetobacter*, *Aeromonas*, *Pasteurella* dan *Staphylococcus*.

Sebanyak enam unsur major (Na, Mg, Al, K, Ca, Fe) dan 14 unsur surih (V, Cr, Co, Cu, Se, As, Pb, Mn, Cd, Sb, Zn, Ti, Ni, Ag) telah dikesan dengan menggunakan kaedah INAA, ICP-MS di dalam air dan sedimen kedua-dua kolam lama dan baru. Keputusan menunjukkan bahawa kepekatan unsur major di dalam air dan sedimen kedua-dua kolam lama dan baru menunjukkan corak yang serupa. Kepekatan unsur surih di dalam air dan sedimen dari kolam lama dan baru juga mempunyai corak yang sama. Keputusan hubungan korelasi menunjukkan terdapat beberapa faktor parameter kualiti air dan unsur mineral yang menyumbang kepada varian paras bakteria. Data yang terkumpul dari kajian ini boleh digunakan sebagai rujukan bandingan bagi kajian yang akan datang kerana masa kini, kurang atau tiada maklumat mengenai status unsur mineral di dalam kolam udang air payau di Malaysia.

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I certify that an Examination Committee has met on 17 July 2006 to conduct the final examination of Hamidah binti Ismaun on her Master of Science thesis entitled "Aerobic Bacteria Abundance and Mineral Elements Status in Aged and New Culture Ponds of Tiger Shrimp (*Penaeus monodon)*" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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Date: 14 DISEMBER 2006

DECLARATION

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

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HAMIDAH BINTI ISMAUN

Date: 31 OCTOBER 2006

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