

EFFECT OF DIFFERENT ENRICHMENT PERIOD, INITIAL DENSITY AND
INITIAL RATIO OF MARINE MICROALGAE (*Pavlova* sp. AND
Nannochloropsis sp.) ON INGESTION RATE IN *Artemia* NAUPLII

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MASTER OF SCIENCE
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**Thesis Submitted in Fulfillment of the Requirement for the
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BY COURSEWORK

DEDICATION

I dedicate this dissertation to most important people in my life,
especially...

To my father, Zakaria Husin who always believe in me;
To my mother, Zainab Yunus for her patience and understanding;
Brothers and sisters, thanks you for supporting my visions and
aspiration with love and encouragement, regardless and distance.

To grandma, late grandpa, who thought me to become somebody;

To my treasure and lasting friends;

Nurul Nadiah Abu Hasan, Nik Nur Husna Nik Sin and Nur Hidayah
Asgnari

To always giving the hands and put the smile in my face

Finally, this thesis is dedicated to all those who believe in the richness of
learning.

The most important is to installing the importance of hard work
and higher education.

Abstract of thesis presented to the Senate of Universiti Malaysia
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**EFFECT OF DIFFERENT ENRICHMENT PERIOD, INITIAL
DENSITY AND INITIAL RATIO OF MICROALGAE ON INGESTION
RATE IN *Artemia* FED WITH MARINE MICROALGAE (*Pavlova* sp.
AND *Nannochloropsis* sp.)**

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July 2012

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Maximum and optimum ingestion rate of *Artemia* nauplii enriched with marine microalgae (*Pavlova* sp. and *Nannochloropsis*) has been determined to develop the method for efficient enrichment protocol. Three strategies involved included manipulation of enrichment period, initial microalgae density and the mixed ratio of microalgae. The maximum ingestion rate achieved after 3 hours of enrichment period instead of 6 and 9 hours which were 9.7 and 31.6 cells mL⁻¹/hr/1000 for *Pavlova* sp. and *Nannochloropsis* sp. respectively. Experiment involved manipulation of initial microalgae density resulted in ingestion rate for *Pavlova* sp. were between 3 to 6 cells mL⁻¹/hr/1000 with the highest and the lowest was from 3 million and 1 million initial *Pavlova* sp. density respectively. The *Nannochloropsis* sp., the highest ingestion rate was 39 cells mL⁻¹/hr/1000 achieved from 20 million initial density given. The rest were between 13 to 28 cells mL⁻¹/hr/1000 came from 4 to 16 million initial density. The optimum mixed ratio of microalgae also has been determined. For *Nannochloropsis* sp. the highest ingestion rate considered for the present density was in ratio 75:25 which is 37 cells mL⁻¹/hr/1000 followed by 50:50 and 25:75, each by 4 cells mL⁻¹/hr/1000. For *Pavlova* sp., the ingestion rate ratio was between 0.2 to 5 cells mL⁻¹/hr/1000, considered only the present density in the ratios. From this, each parameter can be combined and efficient enrichment protocol can be developed to satisfied nutrient requirement of fish larvae.

Abstrak thesis yang telah dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Master Sains.

KESAN TEMPOH PENGKAYAAN BERLAINAN, KETUMPATAN AWAL DAN NISBAH KETUMPATAN AWAL MIKROALGA MARIN (*Pavlova* sp. DAN *Nannochloropsis* sp.) KEPADA KADAR PENCERNAAN BAGI NAUPLII *Artemia*

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Kadar pencernaan yang maksimum dan optimum nauplii *Artemia* yang diperkaya dengan mikroalga marin (*Pavlova* sp. dan *Nannochloropsis*) telah ditentukan untuk membangunkan protokol pengkayaan yang cekap. Tiga strategi yang terlibat termasuklah manipulasi tempoh pengayaan, ketumpatan awal mikroalga dan nisbah campuran ketumpatan mikroalga. Kadar pencernaan maksimum yang dicapai ialah selepas 3 jam tempoh pengayaan selain 6 dan 9 jam, iaitu 9.7 dan 31.6 sel mL⁻¹/jam/1000 untuk *Pavlova* sp. dan *Nannochloropsis* sp. masing-masing. Manipulasi eksperimen yang melibatkan ketumpatan awal mikroalga menunjukkan kadar pencernaan untuk *Pavlova* sp. ialah antara 3 hingga 6 sel mL⁻¹/jam/1000 dengan yang tertinggi dan yang terendah adalah dari 3 juta dan 1 juta ketumpatan awal *Pavlova* sp. masing-masing. *Nannochloropsis* sp., kadar pencernaan tertinggi adalah 39 sel mL⁻¹/jam/1000 yang dicapai dari 20 juta ketumpatan awal yang diberikan. Selebihnya adalah di antara 13-28 sel mL⁻¹/jam/1000 datang dari 4-16 juta ketumpatan awal. Nisbah optimum campuran mikroalga juga telah ditentukan. Untuk *Nannochloropsis* sp. kadar pencernaan tertinggi mengambil kira wujudnya bahagian dalam nisbah tersebut adalah dalam nisbah 75:25 iaitu 37 sel mL⁻¹/jam/1000 diikuti oleh 50:50 dan 25:75, masing-masing 4 sel mL⁻¹/hr/1000. Bagi *Pavlova* sp., Nisbah kadar pencernaan adalah antara 0.2-5 sel mL⁻¹/hr/1000, mengambil kira wujudnya bahagian dalam nisbah tersebut. Bagi setiap parameter yang menunjukkan maximum dan optimum kadar pencernaan boleh digabungkan dan protokol pengkayaan yang cekap boleh dibangunkan selaras dengan keperluan nutrien larva ikan.