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**DOCTOR OF PHILOSOPHY**

**2016**

**STUDY OF BIOFLOC TECHNOLOGY ON  
CARBON SEQUESTRATION AND EMISSION,  
WATER QUALITY AND HEALTH OF PACIFIC  
WHITELEG SHRIMP, *Penaeus vannamei***

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SEQUESTRATION AND EMISSION, WATER QUALITY AND HEALTH OF  
PACIFIC WHITELEG SHRIMP, *Penaeus vannamei***

**NORHIDAYAH BINTI ABDUL MANAN**

**Thesis Submitted in Fulfilment of the Requirement for the Doctor of Philosophy  
of Science in the Institute Of Tropical Aquaculture  
Universiti Malaysia Terengganu**

**October 2016**

## DEDICATION

*I dedicate this thesis to my beloved husband, father and mother; for all their support and encouragement throughout my studies and also to all my beloved friends for all of their help and support.  
Thank you.*

## ABSTRACT

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirement for Doctor of Philosophy in Science Aquaculture

### **STUDY OF BIOFLOC TECHNOLOGY ON CARBON SEQUESTRATION AND EMISSION, WATER QUALITY AND HEALTH OF PACIFIC WHITELEG SHRIMP, *Penaeus vannamei***

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The application of biofloc technology in aquaculture sector has increased worldwide due to its effectiveness in controlling the water quality in aquaculture system. Nonetheless, the effect from the biofloc application towards environment effect such as Greenhouse Gases emission and toward shrimp health is still dearth. Therefore, study on biofloc technology was carried out to investigate the effect of biofloc application towards carbon sequestration and emission, water quality and health of Pacific Whiteleg shrimp, *Penaeus vannamei* from the shrimp farm and also from hatchery. Through the effect of carbon sequestration, the highest value of carbon sink using biovolume analysis was 14923.39  $\mu\text{gC}^{-1}$  by the *Chroococcus* sp. and 3778.20  $\mu\text{gC}^{-1}$  by *Oocystis* sp. Through the chlorophyll analysis, the highest carbon sink come from Chl-a which the highest value is 881.33  $\text{mg/m}^3$  from DOC91 pond. Through the effect of carbon emission, from 52 ponds studied, 27 ponds acted as the carbon sink  $p\text{CO}_2 < 400 \mu\text{atm}$ , 12 ponds as the potential carbon sources and 13 ponds acted as carbon sources to the atmospheres. The ponds act as carbon sources  $p\text{CO}_2$

>1000 $\mu$ atm mostly come from DOC higher than 70 days. Through the analysis of shrimp health using histopathology, the hepatopancreas (HP) of shrimp DOC32 and DOC102 was observed under unhealthy condition with sloughing of HP cell, enlargement of the HP nuclei and the degeneration of the tubule lumen (TL). When linked with the water quality parameter, the result showed extremely low salinity in the unhealthy shrimp pond. The pathogenic bacteria from *Vibrio* spp. also with the appearance of heterotrophic bacterial, *Aeromonas* sp., *Pseudomonas* sp., *Staphylococcus* sp. and *Bacillus* sp. were identified from the biofloc water column. Through the effect of water quality, ammonia, nitrite and nitrate concentrations started decreased in biofloc treatment when reached 60 days of culture period until the end of culture period (105 days). Organic carbon was also identified in low concentration between 0.52- 4.55 mgL<sup>-1</sup> in biofloc shrimp ponds.

Pond and shrimp tanks that contain high nutrients level, high density of heterotrophic bacterial and organic carbon loaded are more potential as carbon sources. It was also identified the appearance of pathogenic bacteria in the water column such as *Vibrio* spp. inhabited the unhealthy shrimp pond. As a conclusion, the application of the biofloc system under proper management is effective as carbon sink, maintaining the water quality and also helps improve the bio security in the pond and hatchery culture.