NURFARAHANA BINTI MOHD NASIR MASTER OF SCIENCE 2017

PHYCOREMEDIATION OF AQUACULTURE WASTEWATER BY *Chlorella* sp. AND BIOMASS RECOVERY USING *Aspergillus niger*

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MASTER OF SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

2017

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Thesis Submitted in Fulfillment of the Requirement for the Degree of Master of Science in the School of Ocean Engineering, Universiti Malaysia Terengganu

September 2017

To Allah who gave me the strength throughout this journey. To my parents who always showered me with unconditional love. To my friends who words can never explained the gratitude that I have for their continuous encouragement and advice.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

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SEPTEMBER 2017

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Aquaculture is deemed one of the most important industry around the world. However, the continued growth of global aquaculture development has presented the industry with large production of organic waste and toxic compound that affect water bodies. Therefore, proper treatment is required to control the contaminant as the aquaculture waste can negatively impact the aquatic ecosystems. Microalgae, *Chlorella* sp. was selected because it is known as a very effective bio-absorbents aquatic microorganism in treating inorganic nutrients present in the wastewater. Thus, this study was initiated with evaluation of *Chlorella* sp. for its nutrient removal performance in aquaculture wastewater with its correlation with the kinetic growth of *Chlorella* sp.. Phycoremediation was then performed with various *Chlorella* sp. inoculation dosage of 10 – 60 % (v/v) of wastewater for a treatment period of 14 days. The results revealed that *Chlorella* sp. is promising for use in aquaculture wastewater treatment. The best inoculation dosage was recorded

at 30 % (v/v) with an effluent concentration of ammonia and orthophosphate of 0.012 mg L^{-1} and 0.647 mg L^{-1}, respectively on Day 11. However, the utilization of phycoremediation would require appropriate control of the biomass density of *Chlorella* sp.. A regular biomass harvesting is required for maintaining suitable biomass density and effective nutrient recycling. Therefore, this study proposed the use of a novel bio-flocculant from filamentous fungus, *Aspergillus niger*, as a sustainable bio-flocculant for microalgae biomass harvesting. This bio-flocculant achieved the best dosage at 30 mg L^{-1} with 97.4 % harvesting efficiency. In addition, this bio-flocculant was also proven to be well-adapted to different pH with a harvesting efficiency greater than 90 % for cell density, cell mL^{-1} and greater than 85 % for chlorophyll-a, mg m^{-3}. On the other hand, 100 to 150 rpm were considered to be the best mixing rate, recording a harvesting efficiency greater than 90% for both cell density, cell mL^{-1} and chlorophyll-a, mg m^{-3}. Finally, the harvested product from the harvesting process potentially valuable for feed production, pharmaceutical and biodiesel. The development of phycoremediation with continuous bio-harvesting could be a promising green technology for effective aquaculture wastewater treatment.