UNIVERSITI TEKNOLOGI MARA

CHEMICAL MODIFICATION OF BROWN MACRO ALGAE *PADINA* sp. AS A POTENTIAL BIOSORBENT FOR THE REMOVAL OF HEAVY METALS IN AQUEOUS SOLUTION

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 15th March 2016 to conduct the final examination of Anies Suhaida Mohd Naspu on her Master of Science thesis entitled "Chemical modification of brown macro algae *Padina* sp. as a potential biosorbent for the removal of heavy metals in aqueous solution" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

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ABSTRACT

Chemical modification on brown macro algae *Padina* sp. as biosorbent was carried out in order to enhance the performance due to the inefficient in removing metal ion from the water bodies. Brown macro algae *Padina* sp. was undergoing NaCl pre-treatment process before applying it with citric acid and PAA/HCl. After modifications, characterization of biosorbent was observed using FTIR and SEM-EDX analysis. FTIR analysis shows that the modified *Padina* sp. was enhanced the intensity and functional groups presence on the biosorbent. However, *Padina*-PAA shows the greatest reduction in it intensity due to the binding of metal ions on active sites compared to *Padina*-CA and pre-treated *Padina*. The surface morphology of *Padina* sp. slightly change after pre-treatment but there are no significant changes observed between *Padina*-CA and *Padina*-PAA. The presence of metal ions on biosorbent after adsorption process was confirmed using SEM-EDX. Batch of experiments were conducted to determine the optimum removal of metal ions by considering few parameters such as contact time, pH, initial metal ions concentration and biosorbent dosage. It found that 75 minutes is the best exposure time for pre-treated *Padina* and *Padina*-CA and 60 minutes for *Padina*-PAA. pH of 6, 100 ppb of initial concentration and 0.5 g of biosorbent dosage resulting the optimum removal metal ion by all the biosorbents. Meanwhile, Pb ion is dominant in removal followed by Cd, Cu, Ni and Cr. Adsorption-desorption study was performed using HNO_3 as desorbing agent and the result shows that the regeneration of biosorbent is up to 5 cycles with 80% recovery. Equilibrium isotherm model was good fit to the Freundlich isotherm model which describes the heterogeneity metal binding and pseudo-second order is the best kinetic model to describe the biosorption on the rate limiting step. Among of three biosorbent tested, chemical modification of *Padina* sp. with PAA/HCl shows the best performance in removing metal ions from water system.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Environmental pollution can be simplified as the presence of substances in the environment which is potentially damaging the environment as well as human health. Unfortunately, environmental pollution continues to be major causes of health problem to humans.

The question is where do the pollutants come from? Actually, most of the pollutants presence on this earth is originated from human. They are derived from human activities such as industries, energy production and use, transportation, agriculture activities, waste disposal and recreation. However, in some cases, the pollutants may occurred naturally such as radon is released through the decaying of radioactive in the earth's crust, the accumulation of heavy metal in soils and sediments is derived from ore-bearing rocks and volcanic activity which releases sulphur dioxides into the environment [1]. The various sources of pollutants releases into the environment may be transported via different pathways and processes such as soil, water and air. When the exposure of pollutant is exceeds it will contribute to soil, air and water pollution.

Among the pollutions that exist in the environment, water pollution is one of the serious problems and it occurs when there is any changes in the physical, biological, chemical and radiological of water which have potential to disrupts the balance of the ecosystem [2]. Sources of water pollution can be from either point or non-point source. The point source occurs when unwanted substances is emitted directly into the water system, while non-points source occurs when all the waste materials that cannot be naturally broken down by water.

This common knowledge that water is the most important source for living things to survive. Unfortunately, nowadays, water quality has become worst day by day and it is believed that most countries are facing a high degree of water pollution and therefore, this crisis has become a serious topic in conversations among the