

**BIOSORPTION PROPERTY OF MODIFIED AND UNMODIFIED
OF HYBRID BIOSORBENT OF MANGROVE BARK AND
LIGNOCELLULOSIC (OIL PALM FIBER)
TOWARD HEAVY METALS**



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"SELAMAT MENJALANKAN PENYELIDIKAN DENGAN JAYANYA"

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TABLE OF CONTENTS

CONTENT	PAGE
Title Page	ii
Letter of Offer (Research Grant)	
Letter of Report Submission	iii
Research Team Members	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	viii
List of Figures	ix
Abstract	x
Chapter 1 – Introduction	1
1.1 Environmental Pollution	1
1.1.1 Biosorbent	2
1.1.2 Biosorption	4
1.1.3 Mangrove Bark	6
1.1.4 Oil Palm Mesocarp Fiber (OPMF)	7
1.2 Problem Statement	7
1.3 Scientific Research	8
1.4 Objectives of Study	8
Chapter 2 – Literature Review	9
2.1 Mangrove Bark	9
2.2 Oil Palm Mesocarp Fiber (OPMF)	12
2.3 Hybrid Biosorbent (HB)	14
Chapter 3 – Methodology	15
3.1 Overall of Methodology	15
3.2 Conducting Experiment	16
3.2.1 Adsorption Treatment	16
3.2.2 Preparation of Biosorbent	17
3.2.2.1 Chemical Pretreatment of Mangrove Bark	17
3.2.2.2 Chemical Pretreatment of Biosorbent (OPMF)	17
3.3 FTIR and AAS	18
3.3.1 FTIR spectroscopy	18
3.3.2 Atomic Absorption Spectroscopy (AAS)	19
Chapter 4 – RESULTS AND DISCUSSIONS	20
4.1 Fourier Transmission Infrared (FTIR) Spectroscopy Analysis	20
4.2 FTIR of the Mangrove Bark (MB), Oil Palm Mesocarp Fiber (OPMF) and Hybrid Biosorbent (HB)	21
4.3 Atomic Absorption Spectroscopy (AAS) Analysis	24
4.4 Effect of Dosage/Ratio	24

ABSTRACT

Chemical water pollution in water bodies has trigger and create awareness among researchers on health effect of heavy metals toward living organisms and how to control chemical pollution from worsening. This pollution mainly comes from the industrial wastewaters that are discharged without being treated. Besides, due to the expensive material of conventional method, it is not suitable to be used to treat heavy metals in long term, however by using biomass as an adsorbent; it is cheaper and eco-environmental due to abundant resources of agricultural wastes. In this research, two types of biomass were used as biosorbent, which were hybridized together to form hybrid biosorbent (HB): oil palm mesocarp fiber (OPMF) (*Elaeis guineensis sp.*) and mangrove bark (MB) (*Rhizophora apiculata sp.*). The similarity between these biomasses is they can absorb multiple heavy metal ions (Cr, Cu, Ni, and Pb) at one time. Thus, by hybridizing these biosorbents, the adsorption capacity can be maximized compared with single biosorbent. The adsorption capacity was also investigated based on four parameters namely contact time, initial concentration, ratio/dosage and pH values. It was found that the adsorption capacity of HB was higher than OPMF and MB; and the results revealed that metals adsorption was in the order: $Pb^{2+} > Cu^{2+} > Ni^{2+} > Cr^{2+}$.

CHAPTER 1

INTRODUCTION

1.1 Environmental Pollution

Pollution is defined as a contamination that can be in the form of chemical, physical or biological substances that are present in the environment (Hogan and Monosson, 2010; Shalaby, 2011). Furthermore, the large growth of human population is a major factor that leads to pollution of environment such as air, water, and noise pollution (Hogan and Monosson, 2010). Water pollution is one of the types of pollutions where the sources are quite similar with the other pollutions however the most significant source is an untreated sewage that can cause the formation of suspended solids and a decrease of dissolved oxygen due to the increase in population of microbes (Hogan and Monosson, 2010).

Besides, water pollutants can be divided into two types which are chemical and physical water pollutants. Hogan and McGinley (2012) stated that chemical water pollutants are produced from two sources which are pollutants that are flowing above and underground storage; and agriculture to intercourses. Meanwhile, physical water pollutant is based on the runoff of the sediment from agriculture, deforestation and discard of the rubbish (Hogan and McGinley, 2012). Moreover, water is also being polluted with heavy metals pollution (Hogan and Monosson, 2010; Volesky, 2001) and biodegradable organic materials with significant amount of inorganic matters (Shalaby, 2011) and if emitted into environment can pose a health hazard or harm and death to living organisms including humans (Naja and Volesky, 2011). The risk of heavy metal that threatens human health even in trace amount of contaminants has led to raise the attention of the researchers (Wang and Chen, 2014; Zhang *et al.*, 2016; Demirbas, 2008; Zouboulis *et al.*, 2004). In the meantime, heavy metal concentration must be minimized to the legalized limit before releasing into water source in order to reduce hazard to living things and ecology (Fuadi *et al.*, 2014). For example one of carcinogenic heavy metal such as nickel can cause crucial damage to lungs and kidneys which lead to cancer and skin dermatitis (Syed-Hassan *et al.*, 2014); while cadmium can cause kidney failure, renal ailment, high blood pressure, bone brittleness, devastation of red blood cells, liver damage and lung failure (Iqbal *et al.*, 2007; Abia and Asuquo, 2007). As for zinc (Zn) and copper (Cu), these heavy metals are very toxic at higher concentration meanwhile lead (Pb), nickel (Ni), mercury (Hg) and cadmium (Cd) are found to have a