UNIVERSITI TEKNOLOGI MARA

SLOW PYROLYSIS OF PALM OIL EMPTY FRUIT BUNCH TO PRODUCE BIOCHAR

AHMAD ISMI ZULFADLI BIN ISHAK

Thesis submitted in fulfillment of the requirements
for the degree of

Bachelor Eng. (Hons) Chemical

FACULTY OF CHEMICAL ENGINEERING

JULY 2017

ABSTRACT

As the second biggest producer of palm oil in the world, Malaysia is facing with solid waste management problem due to the abundance of waste generated from palm oil activities. It is estimated that about 80 million metric tonne of wastes were generated from palm oil activities and were project to reach 100 million tonne by the year of 2020. Therefore, it is really necessary to study alternative way so that these wastes can be fully utilized. The objectives of this study were to convert the unwanted empty fruit bunches from palm oil mill into biochar via slow pyrolysis. Then the characteristic of the biochar produced were studied. BET surface area, proximate analysis, Methylene blue adsorption, and XRD were perform to characterize the biochar produced. 50 gram of EFB were pyrolyzed under specific temperature with fix heating rate of 10^{o}C/min. After reaching the desired temperature, the pyrolyzer were left to heat for an hour. Proximately, biochar of 700^{o}C contain the least volatile matter with 7.58% while biochar of 500^{o}C produced the biggest fixed carbon content at 56.02%. For surface area, the biochar that came from 700^{o}C yield the biggest area with 10.354 m^2/g. XRD shows that all of the samples is amorphous. For removal of methylene blue from aqueous solution, biochar that is produced at 500^{o}C has the best adsorption capacity due to the facts that it able to remove up to 91% of the methylene blue.

ACKNOWLEDGEMENT

Assalamualaikum w.b.t,

Firstly in the name of Allah s.w.t, the Most Merciful and the Most Passionate, thankful of Allah for giving me this opportunity to complete my thesis as a part of my journey to complete my studies in Bachelor of Engineering (Hons) Chemical, Universiti Teknologi Mara. I would like to express my gratitude to my supervisor, Dr Rusmi Alias for his unconditional help, support and guidance throughout this research. Acknowledgement to Faculty of Chemical Engineering under the management of Prof Dr. Norazah Abd Rahman, the dean of Faculty, as well as Madam Siti Fatma Abd Karim along with Dr Siti Noor Suzila Maqsood Al-Haque, the coordinators of final year project, for giving me the opportunity to conduct the research.

Special thanks to my parents, Ishak bin Ahmad along with for their concern, guidance, time and sacrifice. A special appreciation to Mr Mohibbah, , Mr Mustafa, Mr Yazid and Mrs Nordiana for their helps through me completing the research. Their guidances and helps were muchly appreciated. I would like to express my gratitude to my course mates from EH220C for their help and contribution for completing my theis.

TABLE OF CONTENTS

CHAPTER ONE

INTRODUCTION

1.1. RESEARCH BACKGROUND

Due to the depletion of non-renewable energy sources such as fossil fuels, the world is desperately in need for alternatives of renewable energy sources. One of the renewable energy sources that have attracted much attention is the utilization of biomass. Biomass can be classified as any hydrocarbon material that made up of carbon, oxygen, hydrogen and nitrogen along with small portion of sulfur. Biomass can be obtained from various sources such as municipal solid waste, wood waste, food processing waste, animal waste, paper waste and many more. The optimizations of biomass as energy sources promote us with the reduction of carbon dioxide emission and climate change effect by decrease greenhouse gases. (Yaman, 2004). Biomass has a great potential as waste to wealth sources as it can be transform to a useful form such as bioenergy. Bioenergy is a process where biomass is converted into energy content form such as electricity, transportation fuel and heat.(Ira, 2015)

Approximately 146 billion metric tons of biomass is produced annually worldwide.(Rozhan, Ani, Salleh, Akiyama, & Purwanto, 2015). As Malaysia is the world's second largest palm oil producer, oil palm wastes have a very high-potential as biomass energy resources. In 2011 itself, about 5 million hectares area of Malaysia is covered for the plantation of palm oil. Along with this, a huge amount of solid wastes