UNIVERSITI TEKNOLOGI MARA

PRODUCTION AND CHARACTERIZATION OF BIOCHAR FROM GAHARU RESIDUE VIA PYROLYSIS

SAIFUL HAFFIZI ROSLAN

Thesis submitted in partial fulfillment
of the requirements for the degree of
Bachelor of Engineering (Hons.) Chemical and Bioprocess

FACULTY OF CHEMICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
SHAH ALAM

July 2018

ABSTRACT

A lab-scale high temperature furnace was utilized to study the effect of residence time (30 min – 150 min) on the yield, chemical and physical properties of biochars issued from the pyrolysis process at 800 °C. Afterward, an adsorption capacity analysis was carried out to investigate the amount of Methylene Blue dye adsorbed by the chars. Residence time of 120 minutes was found to be optimal in inducing biochar with improved properties, such as substantial fixed carbon content, enriched functional groups, greater specific surface area and high adsorption capacity. Although the residence time of 150 minutes produced biochar with higher fixed carbon, specific surface area and adsorption capacity, the differences were insignificant. In addition, it was noticed by SEM image that the porous structure of biochar at 150 minutes was blocked by ash content. The pore diameter was also bigger. As a result, biochar at 120 minutes with specific surface area of 152.75 $m^2 g^{-1}$ and Methylene Blue adsorption capacity of 68.5 mg g^{-1} has promising potential towards wide range of applications.

ACKNOWLEDGEMENT

I would like to forward my appreciation to my supervisor, Dr Jefri Jaapar for his guidance and support. I would also very thankful to my academic advisor, Madam Ummi Kalthum binti Ibrahim for her support and believe in me during my studies. Again, very thanks to all of the laboratory's staffs for their guidance and support.

I am very grateful to Universiti Teknologi MARA (UiTM) for providing good facilities in the laboratory and in campus. To all of the stuff in Faculty of Chemical Engineering, a very big thanks you to all.

My sincere appreciation also extends to all of my fellow colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Thank you for the time sacrifices to accompany me. And last but not least, I am grateful to all of my family members for their moral support.

LIST OF CONTENTS

CHAPTER 1
INTRODUCTION

1.1 Research Background

Environmental issues like pollutions, global warming, natural resources depletion and waste disposal have become a controversial topic that have been discussed among public officials and independent researches for both local and global levels. Environmental degradation is one of the largest threats to every country over the world that should be conserved due to its adverse impacts on human livelihood, international relation, biodiversity and economic. Someone can't deny the fact that economic and technological changes, law and political globalization and social mobilization contribute to environmental issues. However, the impacts from those activities could be reduced by implementing or adapting new sustainable solutions.

Biochar, a black solid carbon material has a great solution for that scenario. Hence, interest in biochar for environmental application has become significantly increase day by day due to its unique characteristics to adsorb organic and inorganic materials. 'Black is the New Green' is a relevant analogy to describe that biochar complies the environmental-friendly approaches from the beginning of the feedstock preparation to final use in various fields. However, there are certain criteria for the biochar to be branded as a green material which are type of feedstock used, type of methods implemented, and how its efficiency towards environmental purposes.

On the other hand, biochar also attracts researchers' attention due to its intriguing potential advantages in wide range of disciplines; engineering, biotechnology, agronomy and pedology. Therefore, many researches that related to the biochar have done whether for academic purposes, research and development (R&D) phases, or domestic and industrial applications. Using the varieties of feedstocks or methods in term of creating harmonic studies towards different outcomes can develop a reliable system for the biochar itself. For example, a comparison can be made between two studies of different feedstock used in term of economic, efficiency and complexity.

Biochar is usually produced from biomass as a feedstock and slow pyrolysis as a production method in different types of reactor, furnace or any equipment that provides heating mechanism. Researches are basically conducted based on case-by-