UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF BIO-CHAR USING NON-DIRECT FIRING SYSTEM FROM OIL PALM FROND AND ITS CHEMICAL PROPERTIES

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ABSTRACT

One of the vital research in this area is to locate another biomass feedstock for bio-char production since an investigation on this issue is basic in light of the fact that each country has different biomass that can used an alternative energy. There was copious measure of wastes generated from the oil palm plantation like oil palm frond (OPF) in Malaysia which greatly increased over the years were mostly left on the fields. This waste particularly can be utilizing as the feedstock in the context of the bio-char via non direct firing system and therefore help in reducing the number of waste management problem. The aim of this research was to analyze the characteristics OPF as a feedstock for slow pyrolysis for production of bio-char via non-direct firing system using a laboratory-scale under various temperature 400, 500 and 600^{o}C and also to analyze the chemical properties of OPF bio-char based on thermo-gravimetric analysis (TGA) for proximate analysis, CHNS/O analyzer for ultimate analysis and functional group using Fourier-Transform Infrared Spectroscopy (FTIR). The proximate analysis of raw material oil palm frond (OPF) have more volatile matter (VM) but less ash content (AC) and moisture content (MC) compared with bio-char produced at 400-600^{o}C. The data of fixed carbon (FC) for OPF was lower than bio-char at 400^{o}C but higher compared to bio-char at 500 and 600^{o}C. The carbon content in OPF was less than the carbon content in bio-char produce at all three different temperatures. Meanwhile, the hydrogen, nitrogen, sulphur were high in OPF but less in bio-char produced. Furthermore, the oxygen content in OPF was less than bio-char produced at 500^{o}C but the oxygen content in OPF was high than the bio-char produced at 400 and 600^{o}C. For FTIR analysis, the spectra began to disappear with the increasing pyrolysis temperature. This result was due to functional group have rupture and progressive carbonization. It can be concluded that the objectives for this research was successfully achieved since OPF have good characteristics of biomass feedstock for pyrolysis process and OPF bio-char produced shows a different trend of chemical properties depending on the temperature.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

At this rate, we live in a world where the source of supply is diminished as a result of its uncontrollable usage. The call for maintainable improvement both earth and financially is spelt so anyone can hear and clear. Henceforth, the current and future ages must guarantee that all assets could be saved, completely used and all around oversaw. Squander ages has been an integral part of humankind's interest for improvement, be it in social or monetary exercises. The developing interest and supply of fuel oil and new synthetic substances by the industrialized society of the twenty-first century has put progressively higher weight on the indigenous habitat.

One of the centre parts in human day by day life is vitality or energy. Nature manageability, financial improvement and human progress identified with this energy. The nature of energy is needed in order to fulfil the essential needs, for example, nourishment, farming and cultivating, instruction wellbeing data and other establishment organizations.

There are two types of resources that can produce the energy which are renewable and non-renewable resources. Today, non-renewable resources are commonly used by the human as the main energy resources such as fossil fuels. Fossil fuels are predicted be phased out after a year 2042, while the coal available that are reserves until at least 2112. (Shafiee & Topal, 2009). With the increasing number of population, this fossil fuel cannot satisfy the demand of energy. (Demirbaş & Arin, 2002).

The product from consumption of fossil fuel causes a considerable measure of issues in term of natural manageability, this incorporate step by step expanding in carbon dioxide (CO_2) concentration, one of ozone depleting substance (GHG) in the air and affect worldwide environmental. The consequences from anthropogenic emissions of greenhouse is desertification. It is a level of ocean is rising and the numbers of hurricanes show a large increment. (Lehmann, 2006) In addition, to urgently needed