UNIVERSITI TEKNOLOGI MARA

THE EFFECT OF COMBINING ELECTRON BEAM IRRADIATION AND IONIC LIQUID SOAKED (ILS) PRETREATMENT ON LIGNOCELLULOSIC OF OIL PALM FROND (OPF)

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ABSTRACT

This research was conducted to study the effect of combining electron beam irradiation and ionic liquid soaked (ILS) pretreatment on lignocellulosic of Oil Palm Frond (OPF). OPF was used as potential lignocellulosic biomass (LCB) for the production of bioethanol. OPF was pretreated by using physical (electron beam irradiation) and chemical (ionic liquid) pretreatments. In this research project, LCB were soaked with 50% (v/v) of 1-ethyl-3-methylimidazolium acetate, [EMIM]Ac for ionic liquid pretreatment and then irradiated with different doses which was 100-1000 kGy using electron beam under cooperation with *Agensi Nuklear Malaysia*. The characterization of treated OPF was conducted by using Fourier Transform Infrared Spectroscopy (FTIR) and X-Ray Diffraction (XRD). The combination of ionic liquid soaked and electron beam irradiation on OPF was demonstrated to be more effective by the significant reduction of Lateral Order Index (LOI) (FTIR) and reduction of Crystallinity Index (CrI) (XRD). The value of LOI of ILS OPF decreased from 0.77 (untreated OPF) to 0.64 at 800 kGy doses of irradiation and CrI value of ILS OPF also decreased from 63.99% (untreated OPF) to 55.87% at 1000 kGy doses of irradiation.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Currently, the fossil resources are not considered as sustainable and questionable from the economic, ecology and environmental point of views. The energy demand of fossil fuels are increasing, where more than 80% of the total global energy is obtained by burning fossil fuels, of which 58% alone is consumed by the transport sector (Escobar *et al.*, 2009). There are major challenges with these conventional fuels that are being faced by each country which is 1) increasing the consumption of all kinds of fossil fuels due to the growing industrialization and motorization of the world, 2) the contribution to greenhouse gas emissions and global warming and 3) oil supply disruption by the major oil producer countries.

The burning of fossil fuels is a big contributor to the increasing of the CO_2 level in the atmosphere which is directly associated with global warming observed in recent decades. The adverse effects of greenhouse gas (GHG) emissions on the environment, together with declining petroleum reverses, have been realized. Thus, the best initiative must be taken to replace the fossil resources to reduce the global warming. Therefore, there is renewed interest on the production and use of fuels from plants or organic waste (Naik *et al.*, 2010).

The biofuels produced from the renewable resources could help to minimize the fossil fuel burning and CO_2 production. Biofuels produced from biomass such as plants and organic waste could help to reduce both the world's dependence on oil and CO_2 production.

Plants use CO_2 to complete the photosynthesis and also for growth. Thus, plants are able to reduce the amount of CO_2 in the atmosphere and thus decrease global warming. Through consumption of biofuels, the CO_2 admissions can be offset since plants take up the CO_2 during the growth that is produced when the fuel is burned. In another word, lignocellulosic ethanol causes lower net greenhouse gas emission than first generation ethanol production, thereby reducing environmental pollution.