UNIVERSITI TEKNOLOGI MARA

OPTIMIZATION OF COMBINATION PRETREATMENT ELECTRON BEAM IRRADIATION (EBI) AND IONIC LIQUID (IL) ON EMPTY FRUIT BUNCH (EFB)

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ABSTRACT

Lignocellulosic Biomass (LCB) is believed to have potential source of energy in the future since it comes from renewable source such as agricultural waste. LCB can be used to produce biofuel via converting carbohydrates polymer to fermentable sugar. In this study, Empty fruit bunch (EFB) was chosen as source of LCB since Malaysia is one of the biggest palm oil plantation in the world and produces lots of waste from this activity. LCB consists of cellulose, hemicellulose and lignin. Lignin is a protective layer for cellulose and hemicellulose, causing the enzyme to have limitation to access for cellulose, therefore the pretreatment method was used to break the lignin layer. In this study, the combination of pretreatment which are Electron Beam Irradiation and Ionic liquid pretreatments were used. The study was performed by using Box-Behnken Design using Minitab version 17.3.1. The parameter used in this study are irradiation dose, mixing time and mixing speed. From this design, 15 sets of suggested experiment were performed. The result is then analyzed by using X-Ray Diffraction (XRD) and Fourier Transform Infrared (FTIR) analysis. It was found that the crystallinity index (CrI) was reduced from 50.08 % for untreated EFB to 34.80 % after pretreatment. The optimum conditions for this experiment are at 367 kGy irradiation dose, 800 rpm mixing speed and 1.48 hours mixing time.

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CHAPTER ONE
INTRODUCTION

1.1 TITLE OF RESEARCH

Optimization of Combination Pretreatment Electron Beam Irradiation (EBI) and Ionic Liquid (IL) Pretreatment on Empty Fruit Bunch (EFB).

1.2 BACKGROUND OF RESEARCH

Lignocellulosic Biomass (LCB) from residual agricultural waste such as EFB from palm oil industry is the possible main sources of energy for future generation after oil and gas. This is because of the characteristic of biomass which is renewable as compared to hydrocarbon sources where takes more than million year to renew, makes it a better option for future generation. LCB resources can come from any living plant for example palm oil, corn straw, wheat straw, rice straw etc (Amin *et al.*, 2017). In this research EFB is chosen as sample of experiment. EFB contains lignocellulose which is composed of cellulose, hemicellulose and lignin. Cellulose skeletons are surrounded by hemicellulose present as matrix while lignin presents as encrusting material served as protective layer (Amin *et al.*, 2017). The covalent cross-linkages between lignin and polysaccharides are formed from these three components making biomass composite material (Amin *et al.*, 2017). Figure 1-1 shows the structure of LCB.

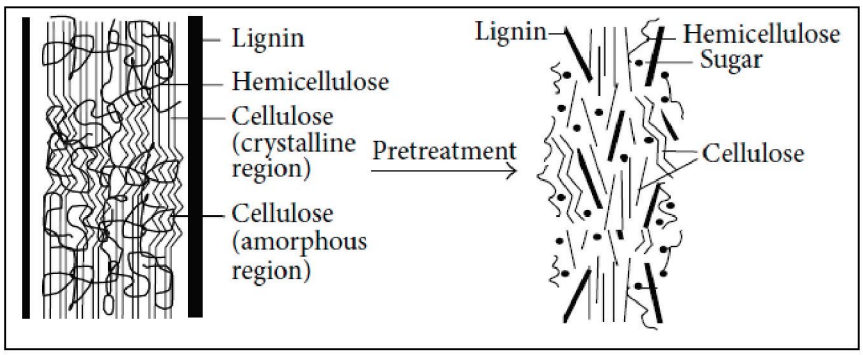

Figure 1-1: Schematic Diagram of LCB before and after pretreatment (Saini, Aggarwal, Sharma, & Yadav, 2015)