CATALYTIC PYROLYSIS OF BIOMASS FOR BIO-OIL PRODUCTION

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CATALYTIC PYROLYSIS OF BIOMASS FOR BIO-OIL PRODUCTION

by

LEE JIA YING

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APPROVAL AND DECLARATION SHEET

This project report titled Catalytic Pyrolysis Of Biomass For Bio-oil Production was prepared and submitted by Lee Jia Ying (Matrix Number: 121130641) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering (Environmental Engineering) in Universiti Malaysia Perlis (UniMAP).

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PIROLISIS BIOJISIM BERPEMANGKINAN UNTUK PENGHASILAN BIO-MINYAK

ABSTRAK

Satu kajian pirolisis berpemangkinan pada pelapah kelapa sawit (*Elaeis guineensis*), OPF telah dijalankan dalam reaktor fixed-bed. Hasil produk adalah bio-minyak, bio-char dan bio-gas. Komposisi bio-minyak dan bio-gas dianalisis melalui gas kromatografi-mass spectrometer, GC-MS dan penganalisis 5 gas pelepasan mudah alih. Kesan parameter pirolisis seperti suhu, jenis pemangkin dan nisbah jisim pemangkin / biojisim ke atas pengagihan hasil produk dan ciri-ciri bio-minyak telah disiasat. Pirolisis telah dijalankan pada 500 °C dan 600 °C dan dipanaskan selama 10 minit. Proses tanpa pemangkin dan dengan pemangkin pada pelepah kelapa sawit dilakukan pada keadaan optimum dengan pemangkin NaOH / C, zeolite ZSM-5 dan dolomit. Hasil bio-minyak, bio-char dan bio-gas yang diperolehi masing-masing adalah antara 16.90 - 23.63 %, 20.00 - 28.06 % dan 43.59 - 55.20 % masing-masing, pada keadaan pirolisis yang berbeza. Hasil bio-minyak tertinggi untuk pirolisis tanpa pemangkin adalah 23.63 % pada suhu pirolisis 600 °C, manakala hasil bio-minyak paling tinggi untuk pirolisis dengan pemangkin adalah 21.97 % dengan NaOH / C pada nisbah jisim pemangkin / biojisim 1:3.

CATALYTIC PYROLYSIS OF BIOMASS FOR BIO-OIL PRODUCTION

ABSTRACT

A study of the catalytic pyrolysis of oil palm (*Elaeis guineensis*) fronds, OPF was conducted in a fixed-bed reactor. The product yield are bio-oil, bio-char and bio-gas. The composition of bio-oil and bio-gas were analyzed through gas chromatography-mass spectrometer GC-MS and portable 5 gas emission analyzer. The effects of pyrolysis parameters such as temperature, type of catalyst and catalyst/biomass mass ratio on the distribution of product yield and bio-oil characterization were investigated. Pyrolysis runs were carried out at 500°C and 600°C each within 10 minutes of heating. The non-catalytic and catalytic process of oil palm fronds was performed at the optimum conditions with sodium hydroxide impregnated char, NaOH/C, zeolite ZSM-5 and dolomite catalyst. The obtained bio-oil, bio-char and bio-gas yields ranged between 16.90 - 23.63 %, 20.00 - 28.06 % and 43.59 - 55.20 % respectively, at different pyrolysis conditions. The highest bio-oil yield for non-catalytic runs was 23.63 % at 600°C pyrolysis temperature range while highest bio-oil yield for catalytic pyrolysis was 21.97 % with NaOH/C at catalyst/biomass mass ratio of 1:3.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES