UNIVERSITI TEKNOLOGI MARA

STUDY OF OIL PALM FROND (OPF) PRETREATMENT WITH AQUEOUS [EMIM][OAC] IN A CLOSED SYSTEM

ROSMARIA BINTI ABU DARIM

MSc

January 2020

UNIVERSITI TEKNOLOGI MARA

STUDY OF OIL PALM FROND (OPF) PRETREATMENT WITH AQUEOUS [EMIM][OAC] IN A CLOSED SYSTEM

ROSMARIA BINTI ABU DARIM

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science
(Chemical Engineering)

Faculty of Chemical Engineering

January 2020

ABSTRACT

The 1-ethyl-3-methylidizolium ionic liquid was proven to have a significant potential in dissolving lignocellulosic biomass. However, there are three major constraints which prevent it from becoming commercially viable which are expensive, energy intensive in recycling of the ionic liquid and high in viscosity. This study was aimed to compare the crystallinity index (CrI) of untreated oil palm frond (OPF) with pre-treated OPF using 40v/v% of [EMIM][OAc], 10wt/v% of OPF and temperature 110ºC in a closed system; to optimize pre-treatment of oil palm frond using aqueous [EMIM][OAc], IL (20, 40, 60v/v%), OPF (5, 10, 15wt/v%), temperature (90, 110, 130ºC) and to observe the fermentation activity of the pre-treated OPF by using *Escherichia coli* KO11 (ATCC 55124) in the presence of [EMIM][OAc]. A Bio-Ionic Liquid-Reactor was used in order to conduct the pre-treatment process in a closed system. The mean/average of the CrI of untreated OPF and pre-treated OPF were recorded at 63% and 54%, respectively. The mean/average of the CrI of the pre-treated OPF was 9% lower than the untreated OPF. Meanwhile, the optimum conditions for OPF pre-treatment using aqueous [EMIM][OAc] in a Bio-Ionic Liquid-Reactor were observed at 48.23v/v% [EMIM][Ac] concentration, 12.23w/v% OPF loading, and temperature 91.58°C. The Oxygen Uptake Rate (OUR) and Carbon Dioxide Emission Rate (CER) in the fermentation activity showed the occurrence of respiration in the fermentation. The Respiratory Quotient (RQ) for the fermentation enriched with unwashed pre-treated OPF were lower than the RQ for the fermentation enriched with washed pre-treated OPF and control (without pre-treated OPF) which were 0.31 lower than 0.5 and 0.51, respectively. The findings from this study are expected to improve knowledge on the pre-treatment of OPF by using aqueous [EMIM][OAc] as a green and economically viable process for future renewable energy.

ACKNOWLEDGEMENT

First and foremost, my deepest appreciation to Prof. Dr. Ir. Jailani Salihon and Dr. Amizon Azizan for their supervision. I could not have accomplished this research without their expert advice and opinions.

I offer my regards and blessing to all my beloved friends. I also would like to extend my appreciation and thanks to my colleagues and friends who stands firmly behind me.

Not forgetting, my family, Mak and Ayah for their constant support as well as my husband, and my children I would like to express my love for their understanding and blessing.

.

TABLE OF CONTENTS