UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION OF OIL PALM FRONDS HEMICELLULOSES EXTRACTED BY SUBCRITICAL WATER EXTRACTION

NORSYABILAH BINTI RIDZUAN

Thesis submitted in fulfillment
of the requirements for the degree of

Master of Science

Faculty of Applied Sciences

March 2015

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution for any degree or qualification.

I hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Norsyabilah Binti Ridzuan
Student I.D. No.	:	2010206738
Programme	:	Master of Science (AS780)
Faculty	:	Applied Sciences
Thesis Title	:	Characterization of Oil Palm Fronds Hemicelluloses Extracted by Subcritical Water Extraction
Signature of Student	:	.....
Date	:	March 2015

ABSTRACT

Oil palm plantations in Malaysia generate more than 36 million tonnes of pruned and felled oil palm fronds (OPF) and are generally considered as wastes. Fractionation of hemicelluloses from OPF using a hydrothermal process could be of interest in obtaining useable substrate for different product applications. The aim of this study was to optimize the subcritical water extraction (SWE) conditions of oil palm fronds on the hemicelluloses yield and consequently on the production of high molecular weight hemicelluloses (HMH) and low molecular weight hemicelluloses (LMH). In order to optimize the hemicelluloses yield, the effects of temperature (180-200°C), pressure (500-700 psi) and time (5-15 min) of SWE were examined applying three level Box Behnken design and response surface methodology (RSM). The liquid extract obtained at optimized conditions of subcritical water extraction was then precipitated with ethanol and filtered to produce high molecular weight hemicelluloses (solid precipitate). The supernatant was further separated using ultrafiltration 10kDa molecular weight cut off membrane to obtain low molecular weight hemicelluloses. All the samples were characterized for monosaccharides, xylooligosaccharides, lignin content, FTIR spectra and molecular weight determination. The statistical analysis indicated that three variables of SWE conditions had significant effects on the yields of hemicelluloses ($p<0.05$). The considered optimum conditions were: temperature of 185°C, pressure of 650 psi and contact time of 7 mins was 86.22%. Under these optimal conditions 16.64 mg/ml monosaccharides concentration of liquid extract, 7.86 mg/ml of HMH, 13.72mg/ml retentate of LMH and 13.17mg/ml permeate of LMH were obtained. The monosaccharides composition of the liquid extract, HMH and LMH (retentate and permeate) contained xylose as major constituent followed by arabinose. This study demonstrated that the maximum yield of oil palm fronds hemicelluloses could be achieved by optimized the conditions of SWE through the RSM. The HMH and LMH separated via ultrafilltration membrane would be further investigated in the pharmaceutical and food applications.

ACKNOWLEDGEMENT

First and foremost, I would like to thank ALLAH S.W.T for the wonderful gift of completing my study successfully, though this has been a long and difficult journey.

I would like to express my sincere gratitude to my supervisor, Dr Sabiha Hanim Saleh, for her valuable guidance and valuable advice in all the time of research and writing of this thesis. She has inspired me greatly to work in this research and her willingness to motivate me contributed tremendously to the success of this study. I would like to take this opportunity to thank Assoc. Prof Kasmawati Mohamed, Pn Siti Mariam Sumari, En. Zubir Othman, En. Rosmi Abdullah, En. Jamal Abdul Nasser Deraman and Pn Julia for their valuable help. My research and thesis writing would not have been possible without their helps.

I would also like to thank the Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM) for providing me a good environment and facilities during my study. I also have to thank the Faculty of Pharmacy, Universiti Teknologi MARA Puncak Alam for giving me the opportunity to conduct my HPLC analysis at their laboratory. Their cooperation and useful advices are really appreciated.

Finally, and most importantly I would like to thank my families En. Ridzuan Ab. Rani and Pn. Ruslina Mat Hussin, Mohd Maliki Zakaria, Nur Nabilah Maisarah and my friends Normah, Maizatul, Ila, Syira, Yan and others for their understandings, patience and supports throughout of my research study.

TABLE OF CONTENTS