UNIVERSITI TEKNOLOGI MARA

PRODUCTION OF XYLANASE BY *ASPERGILLUS NIGER* ATCC 16404 USING OIL PALM LEAF AS SUBSTRATE

NORAZLINA BINTI IDRIS

Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Chemical Engineering

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CONFIRMATION BY PANEL OF EXAMINERS

I certifiy that a panel of examiners has met on 25th June 2015 to conduct the final examination of Norazlina Binti Idris on her Doctor of Philosophy thesis entitled "Production of Xylanase by *Aspergillus Nige*r ATCC 16404 using Oil Palm Leaf as Substrate" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examniners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

Md Asadullah Md Hossain, PhD
Professor
Faculty of Chemical Engineering
Universiti Teknologi MARA
(Chairman)

Jailani Salihon, PhD
Professor Ir
Faculty of Chemical Engineering
Universiti Teknologi MARA
(Internal Examiner)

Mimi Sakinah Abdul Munaim, PhD
Professor
Faculty of Chemical Engineering & Natural Resource
Universiti Malaysia Pahnag
(External Examiner)

David Rooney, PhD
Professor
University of Queen's Belfast
United Kingdom
(External Examiner)

SITI HALIJJAH SHARIFF, PhD
Associate Professor
Dean
Institute of Graduate Studies
Universiti Teknologi MARA
Date: 22 February 2016

AUTHOR'S DECLARATION

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

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Name of Student	: Norazlina Binti Idris
Student ID No	: 2010144991
Programme	: Doctor of Philosophy (Chemical Engineering)
Faculty	: Chemical Engineering
Dissertation Title	: Production of Xylanase by *Aspergillus niger* ATCC 16404 using Oil Palm Leaf as Substrate
Signature of Student	: .....
Date	: February 2016

ABSTRACT

Malaysia generates agricultural wastes (agro-wastes) with the volume nearly 5 million tonnes yearly. At present, oil palm fronds are the major composition of agricultural waste materials that are exported to European countries for the industrial needs. Automatically, there is also a lot of oil palm leaf that was thrown away without being utilized. Oil palm leaf (OPL) was exploited as substrates for the cultivation of *Aspergillus niger* ATCC 16404 for the production of xylanase via solid state fermentation (SSF). SSF is generally defined as the growth of the microorganisms on solid material in the absence or near absence of free water. Five fermentation parameters were investigated in determining the most influential factors in maximizing the xylanase activity and via the five-factor two-level factorial design (statistical experiment design), only ratio of carbon and nitrogen, fermentation temperature and fermentation time were significant. These three significant parameters were optimized in Response Surface Methodology (RSM) using Central Composite Design (CCD) and it shows the optimized values for ratio of carbon and nitrogen is 0.3443, fermentation temperature is 31.2°C and fermentation time is at 6.7645 days (162.35 hours) with 53 U/ml of xylanase activity. By using the optimized OPL crude xylanase for the enzyme kinetic determination, it shows Lineweaver Burk plot with R^2 equal to 0.9374, V_{max} was 156.25 U/ml and K_m was 2.078 is the most suitable model in which these results were comparable with the commercial xylanase where R^2 0.967, V_{max} 270.27 and K_m was 1.757 respectively. Furthermore, the optimized crude xylanase also utilized in the sugarcane bagasse delignification and juice clarification. In comparison with commercial xylanase, OPL crude xylanase showed positive capability results as it was successfully remove the lignin and clarified the juice.

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