UNIVERSITI TEKNOLOGI MARA

BIODECOLORIZATION OF BATIK WASTEWATER BY *LACTOBACILLUS DELBRUECKII*

SITI ZURAIDA BT MOHAMAD

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science

Faculty of Chemical Engineering

March 2015

CONFIRMATION BY PANEL OF EXAMINERS

I Certify that a Panel Of Examiners has been meet on 9th October 2014 to conduct the final examination of Siti Zuraida Binti Mohamad on her Master of Science thesis entitled "Biodecolorization of Batik Wastewater by *Lactobacillus Delbrueckii*" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommended that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Norliza Binti Ibrahim, PhD
Faculty of Chemical Engineering
Universiti Teknologi MARA
(Chairman)

Jagannathan Krishnan, PhD
Faculty of Chemical Engineering
Universiti Teknologi MARA
(Internal Examiner)

Mohd Suffian Bin Yusoff, PhD
Associate Professor
Faculty of Chemical Engineering
Universiti Sains Malaysia
(External Examiner)

SITI HALIJAH SHARIF, PhD
Associate Professor
Dean
Institute of Graduate Studies
University Teknologi MARA
Date : 26 March, 2015

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 result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-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	:	Siti Zuraida Bt Mohamad
Student ID No.	:	2010984987
Programme	:	Master of Science (EH 780)
Faculty	:	Chemical Engineering
Thesis Title	:	Biodecolorization of Batik Wastewater by *Lactobacillus delbrueckii*
Signature of Student	:	.....
Date	:	March 2015

ABSTRACT

Water is the most precious natural resource and it is impossible to live without it. However, the potential beneficial uses of water are lost due to changes in its composition as a result of human activity especially from industrial effluents. It is estimated about 22% of the total volume of industrial wastewater is produced by the textiles industry, one of the largest industrial producers of high volume wastewater primarily in the dyeing and finishing operations. In Malaysia, there are about 1500 textiles factories and mostly, these industries are small scale industry producing the local "Batik". This industry engenders a huge contribution to Malaysia's economy development due to high demands locally and abroad. However, little awareness on the importance of clean practices in the production of Batik among Batik entrepreneurs has cause them to take improper actions by discharging the effluents without proper treatment. Numerous efforts are being made to minimize the problems caused by textile effluents, involving physical and chemical methods but these methods are costly and often generate toxic sludge. Nowadays, biological methods have been used for the decolourization of azo dye containing wastewater. The ability of microorganisms to decolourize and metabolize dyes has long been known, and the use of bioremediation-based technologies for treating textile wastewater has attracted the interest of researchers. In this study, a biological method using *Lactobacillus delbrueckii* (*L. delbrueckii*) as developed to explore their capability to remove colour from Batik wastewater and aqueous solutions containing two commercial synthetic dyes i.e. Reactive orange 16 (RO16) and Reactive black 5 (RB5). The best operating conditions were found to be at 37°C, pH 6, no shaking, 30 ppm of initial concentration, 3 mL *L. delbrueckii* dosage and 48 hours of contact time. This system was able to decolourize up to 46% of batik wastewater. In addition, in order to find the optimum condition for the removal of dye from Batik wastewater, the experiments were conducted according to the Central-Composite design. Meanwhile, the statictical analysis was performed in the form of ANOVA for the removal of dye using the Minitab14 program. Based on screening and optimization results, the most significant optimum variables were found to be 3.6 mL *L. delbrueckii* dosage, 96 rpm of agitation speed and 0.3 mL/mL ((v/v)) of initial batik wastewater concentration. Under this optimal condition, the bacteria was able to decolourize about 63.32% of the Batik wastewater within 48 hours. UV-vis and Fourier transform infrared spectroscopy (FT-IR) images showed that the *L. delbrueckii* has favoured the degradation of dye in Batik wastewater. Therefore, *L. delbrueckii* may be considered as a potential strain for decolourization of reactive textile dye effluent. Plus, it can be used as a practical alternative in the treatment of textile wastewater to achieve effluents that comply with the Malaysian emissions standards.

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim,

"First and foremost, all praise be to Allah, the Almighty, the Benevolent for His blessings and guidance, and for giving me the strength and opportunity to finish this project.

Many people have contributed to the completion of this project. First of all, I would like to offer my gratitude to UniversitiTeknologi Mara (UiTM) for giving me the chance to conduct this research and for providing me with the facilities vital to the completion of this project. I would also like to forward my deepest and sincere gratitude towards my supportive supervisor, Prof. Dr. Ku Halim bin Ku Hamid and my co-supervisor, Puan Nurhaslina bt Che Radzi for all their comments, guidance, support and motivation throughout this project. Without you, I would have been lost.

Special appreciation goes to all lecturers and laboratory staffs of the Faculty of Chemical Engineering for their aspiration, kindness and assistance during the commencement of my project. A special gratitude is extended to all postgraduate students, for their guidance and assistance throughout my research.

Thank you, to my husband, Mohd Nor bin Ariffin and my family members who have been encouraging me and being supportive during the completion of this research. Special thanks to RMI for awarding me with an Excellent Fund throughout 2 years of my study in UiTM. Last but not least, to all my classmates who have brought the best memories throughout the whole process of doing this research, thank you for everything and may Allah bless all of you."