

**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 9<sup>th</sup> 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:

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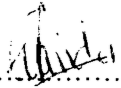
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## AUTHOR'S DECLARATION

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.

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## 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 statistical 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.

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