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DECOLOURIZATION OF TEXTILE WASTEWATER BY USING *LACTOBACILLUS* IMMOBILIZED ON *BAMBUSA HETEROSTACHYA*

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AUTHOR'S DECLARATION

I declare that the work in this thesis 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 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

Colouring agents that are used in textile manufacturing processes have greatly contributed to environmental problems, particularly in the form of wastewater. The wastewater produced by this industry is highly coloured which increases the pollution level of the aquatic ecosystem. Various techniques of removing colour from textile wastewater being studied worldwide as concern mounts over the unavailability of a specific solution for treating the broad diversity of textile wastewater. There have been extensive researches into the treatment of textile wastewater by implementing modified biological approaches using bacteria. The enhancements of biological approaches using microbes with organic matrix in immobilization processes have been found to be useful. Thus, the application of a novel organic matrix, bamboo as a microbial matrix in an immobilization process is presented in this study. Bamboo's physical characteristics have been studied as it has high porosity that qualifies it as an alternative microbial matrix. *Lactobacillus delbrueckii* was selected as the microbial agent. By using central composite design (CCD) to optimize the dye decolourization process with these significant parameters: agitation speed (10-150 rpm), dye concentration (10-100 mg/L) and *Bambusa-Lactobacillus* dosage (4–10 pieces); the experiments have been successfully conducted. The optimum condition for *Bambusa* as *Lactobacillus* matrix was found to be at pH of 7, 37°C and high concentration of M.R.S. broth under shaking condition. As for the decolourization process, this approach has successfully shown the ability to decolourize textile wastewater up to 75.43% with the correlation value of the model, R^2 of 90.10% at the optimum condition of dye concentration, 50 mg/L, 7 pieces of *Bambusa-Lactobacillus* dosage under static condition. These experiments have proven the effectiveness of implementing *Lactobacillus* immobilized on *Bambusa heterostachya* to decolourize textile wastewater.

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CHAPTER ONE
INTRODUCTION

This chapter provides the background of this research, its problem statement, scope of objectives, limitation of study and thesis outline. It also detail the significant potentials of organic materials as matrixes towards improving the growth of microorganisms to decolourize dyes in textile wastewater using the immobilization process.

1.1 RESEARCH BACKGROUND

Bamboo is a fast growing group of woody evergreen perennial plant in the true grass family of *Poaceae*, which are abundantly available in many rural areas [1] and over 1,000 species around the world [1, 2]. It is the most diversified type of plant that makes it more adaptable to dissimilar climatic zones compared to other softwoods [2]. It can cover approximately 70 per cent of the earth's land area [3]. Bamboo is one of the most sustainable resources in the green world as well as being one of the most economical and ecologically friendly plants on this planet [2, 4]. Through research and development, various ways have been found to utilise this multipurpose organic material [5]. Different species are used for different purposes, including woven handcraft products such as baskets and mats, textile products, as well as in the construction of flooring, fences and roofing [5, 6].

Scientists have been investigated the relationships between microorganisms and plants for more than two decades and have discovered many useful symbiotic interactions between them such as the nodules on the roots of *Fabaceae* [7, 8]. The types of microorganisms that habitually reside in bamboo's rhizosphere and/or phyllosphere include different independent groups of bacteria [8]. Significant amount of literature have described the interactions between a plant and its internal, endophytic bacterial flora [9]. The coexistence of plants and their related microorganisms exhibits a complex variety of exchanges [8, 9]. The plant provides a suitable habitat and nutrients, while the endophytes directly and indirectly stimulate the growth and development of the matrix [10, 11].