UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF A BIOREMEDIATION PROCESS FOR DECOLOURISATION OF TEXTILE WASTEWATER

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for the degree of

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CANDIDATE'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.

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ABSTRACT

Colour in wastewater is the principal problem concerning the textile industries and biological treatments offers considerable advantages compared to other processes. In this study, bacterial strains capable of decolourising azo dyes were screened and isolated. An optimal population mix, able to grow robustly in wastewater, stable and display high decolourisation efficiency was developed and a stabilised inoculum easily packaged and has long shelf life was then produced. Initial screening resulted in isolation of nine bacterial isolates capable of degrading various dyes. Several microbial consortia were formed and tested for their effectiveness. The consortia were able to remove 70 - 100% colour within 72 hours with consortium C15 exhibited the greatest ability. The performance of the consortium also exceeded that of the individual isolates. Identification of the three isolates in C15 using 16S rRNA gene sequence revealed that strains #84 and #146 belong to *Chryseobacterium* genus while strain #178 was presumptively identified as *Flavobacterium denitrificans.* The statistical optimisation using Plackett-Burman and Box-Behnken designs, identified three critical nutritional factors; yeast extract, starch and corn steep solids that enhances the growth of the consortium and its decolourising capability. Optimisation results showed that 4.77 g/l yeast extract, 4.89 g/l starch and 0.84 g/l corn steep solids was the best combination for RV-5R; 5.00 g/l yeast extract, 2.99 g/l starch and 1.89 g/l corn steep solids for RR-11; 4.94 g/l yeast extract, 3.35 g/l starch and 0.55 g/l corn steep solids for DM. The consortium's potential usage in large scale treatments was tested on dye solutions and textile wastewater samples in a bioreactor. Overall, 80-100% colour removal was achieved within 48-72 hours. Analysis of the environmental parameters indicated significant COD removal in the anaerobic stage and the remaining COD was mineralised in the subsequent aerobic stage. Results of a yeast mutation assay showed no genotoxicity was evident. Preliminary chemical characterisation of the treated dye solutions and wastewater samples by HPLC and GC/MS did not indicate the presence of known carcinogens due to the decolourisation process. Finally, a method to preserve the bacterial cells of the consortium by storage in dehydrated sawdust appeared to be able to maintain the viability and decolourising capability of the cells even after 18 months storage.

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