UNIVERSITI TEKNOLOGI MARA

BIODEGRADATION OF NAPHTHALENE IN A SOIL MEDIUM USING *PLEUROTUS OSTREATUS* WITH THE ADDITION OF BIOMASS AS A NUTRIENT

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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 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 other 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

The efficiency and kinetics of naphthalene biodegradation in a soil medium using *Pleurotus ostreatus* (a type of white rot fungus) with and without the addition of Oil Palm Fiber (OPF) as a nutrient are evaluated in this study. For this purpose, *Pleurotus ostreatus* mycelium is specifically cultured in potato dextrose agar for 13 days prior to biodegradation. Three batches have been used in the biodegradation studies; (i) control-spiked soil, (ii) spiked soil with fungus, and (iii) spiked soil with both fungus and OPF. Biodegradation is conducted over a period of 22 days during which naphthalene is extracted from the soil using microwave extraction and its concentration determined using high-performance liquid chromatography. The results for the first part of the study indicate that the inoculation of *Pleurotus ostreatus* without and with the addition of OPF significantly enhances the rate of naphthalene biodegradation in contaminated soil by 76 and 117%, respectively. The high carbon content in OPF (> 40%) affords it to be a viable nutrient supplement for *Pleurotus ostreatus* and consequently indicates that it has the potential to be used in the biodegradation of other Polycyclic Aromatic Hydrocarbons (PAHs). The biodegradation kinetics data presented in this study may be used to scale-up existing laboratory-scale PAH biodegradation systems tailored for either *in-situ* or *ex-situ* contaminated soil remediation applications. In the second part of the study, the effect of the addition of different quantities of nutrient mass in the bioremediation process has been investigated. Four batches have been used, which constitute the addition of 0.5, 1, 2 and 3 g of OPF to each batch. The rate of biodegradation increases from 0.165 day^{-1} to 0.176 day^{-1} upon the addition of 1.0 g of OPF, however the highest biodegradation rate, 0.257 day^{-1}, is observed upon the addition of 3.0 g of OPF and exhibits a liner relationship between the rate of biodegradation and the mass of OPF added. A relationship has been determined with respect to the biodegradation rate constant of the form: $k = 0.0299 \times \text{OPF} + 0.1509$ with a correlation of determination value of 0.8191, which indicates that the data is well-described. This simple correlation may be used in order to perform quick estimation of the amount of OPF required to achieve specific biodegradation rates.

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TABLE OF CONTENTS