

A LABORATORY STUDY ON THE ENHANCED BIOREMEDIATION OF PYRENE IN SOIL USING ACTIVATED CARBON

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ABSTRACT

Contamination of the environment by petroleum products such as polycyclic aromatic hydrocarbons (PAHs) is inevitable due to oil production, transportation and distribution activities. The potentials of activated carbon as a bioremediation alternative for soils contaminated with pyrene which is a PAH was studied. The rate of biodegradation of pyrene was studied for a period of 28 days under laboratory condition. The result of the microbial counts for soils spiked with 200 mg/kg pyrene was a total heterotrophic bacteria (THB) count in soil amended with commercial activated carbon ranging from 2.97 ± 0.22 to $7.03 \pm 0.24 \times 10^6$ CFU/g. Unamended control soil had THB count ranging from 1.54 ± 0.12 to $1.70 \pm 0.18 \times 10^6$ CFU/g while THB count in unamended autoclaved control soil ranged from 1.15 ± 0.02 to $1.21 \pm 0.01 \times 10^3$ CFU/g. The count of total hydrocarbon-utilizing bacteria (THUB) in activated carbon amended soil ranged from 1.70 ± 0.11 to $5.10 \pm 0.18 \times 10^5$ CFU/g while unamended control soil had THUB ranging from 7.10 ± 0.12 to $7.90 \pm 0.14 \times 10^4$ CFU/g and THUB count in unamended autoclaved control soil ranged from $5.50 \pm 0.01 \times 10^1$ to $5.80 \pm 0.04 \times 10^3$ CFU/g. The percentage pyrene removal in activated carbon amended soil was 62.2%, the percentage pyrene removal in unamended control soil was 7.70% while the percentage pyrene removal in unamended autoclaved control soil was 2.80% after 28 days. Evaluation of the first order kinetic model resulted in biodegradation rate constant of 0.196 day^{-1} and half-life of 3.54 days for activated carbon amendment of 30 g after 28 days of treatment while unamended control resulted in biodegradation rate constant of 0.012 day^{-1} and half-life of 57.76 days and unamended autoclaved control resulted in biodegradation rate constant of 0.001 day^{-1} and half-life of 69.31 days. The results suggest that activated carbon supplementation would be effective in the remediation of pyrene polluted soils.

KEYWORDS: PAH, Bioremediation, Biodegradation, Pyrene, Bacteria, Activated Carbon, THB, THUB