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Identification and Quantification of the Biodegradation Potential of Polycyclic Aromatic Hydrocarbon-Degrading Soil Bacteria from Fuel Stations: Implications for Effective Bioremediation

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Polycyclic aromatic hydrocarbons (PAHs) are a class of organic compounds containing two or more fused aromatic rings paired with hydrogen and carbon atoms. These compounds primarily result from the incomplete combustion of organic materials, also considered as environmental pollutants due to their carcinogenic, and genotoxic properties towards humans. Bioremediation is an eco-friendly application which utilizes bacteria to degrade or detoxify environmental pollutants including PAHs. This leverages the natural metabolic pathways of bacteria to break down hazardous substances into less harmful or non-toxic compounds. This study focused on naphthalene and phenanthrene by isolating bacteria that can break down these compounds, identifying the best bacteria with effective degradation, and studying their degradation percentages to utilize as a bioremediation solution. Initially, soil samples were collected from selected polluted fuel stations which were randomly selected. To assess the environmental pollution, environmental analysis was done using High-Performance Liquid Chromatography. From the collected samples, morphologically different bacterial strains were isolated. A primary screening plate assay technique was used and in the confirmatory step, spectrophotometric analysis was conducted using methylene blue (609 nm) to identify each strain's ability to degrade specific PAH. According to the results, *Staphylococcus hominis* strain SS2-U3 was identified as the optimum PAH degrader with 50.68% naphthalene degradation and 48.78% phenanthrene degradation percentage. In conclusion, *Staphylococcus hominis* strain SS2-U3 can be used as a potential biological agent to degrade naphthalene and phenanthrene-like PAHs, integrating this into real-world applications including porous bed-medium could further enhance the efficiency and reliability of bioremediation of PAH contamination.

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