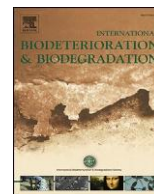




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Biodegradation of crude oil and phenanthrene by heavy metal resistant *Bacillus subtilis* isolated from a multi-polluted industrial wastewater creek



Ganiyu Oladunjoye Oyetibo ^{a, b, *, 1}, Mei-Fang Chien ^{b, 2}, Wakako Ikeda-Ohtsubo ^b, Hitoshi Suzuki ^b, Oluwafemi Sunday Obayori ^c, Sunday Adekunle Adebuseye ^a, Matthew Olusoji Ilori ^a, Olukayode Oladipo Amund ^a, Ginro Endo ^b

^a Department of Microbiology, Faculty of Science, University of Lagos, Akoka, Lagos, Nigeria

^b Biotechnology Research Common, Faculty of Engineering, Tohoku Gakuin University, Tagajo, Miyagi 985-8537, Japan

^c Department of Microbiology, Faculty of Science, Lagos State University, Ojo, Lagos, Nigeria

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abstract

A critical bottleneck associated with bioremediation technology in multi-polluted environments is microbiostasis due to metal toxicity. Autochthonous *Bacillus* species that would harness a repertoire of traits to catabolize hydrocarbons and simultaneously sequester heavy metals (HMs) is invaluable in the environment contaminated with divergent pollutants. Fourteen HM-resistant bacilli from polluted creek were characterized using phenotypic and molecular criteria, and studied for hydrocarbon degradation in chemically defined media amended with $\text{Co}^{2\text{p}}$ and $\text{Ni}^{2\text{p}}$ (5.0 mmol l^{-1} each). Phylogenetic analyses revealed distribution of the bacilli into three clades. Two dissimilar strains of *Bacillus subtilis* (M16K, and M19F) with 19.1% sequence divergence, exhibited excellent degradation of crude oil (>94.0%) with evidence of early degradation of isoprenoid hydrocarbons and concurrent metal removal 18 d post-inoculation. Similarly, phenanthrene degradation (>85.0%), and corresponding metal detoxification occurred in 28 d axenic culture of the strains. Strain M16K and M19F were metabolically active in matrices containing HMs, degraded hydrocarbons and simultaneously removed HMs from the medium. To the best of our knowledge, this is the first report of metal-resistant *Bacillus subtilis* strains showing simultaneous degradation of hydrocarbons and detoxification of metals, particularly in the Sub-Saharan Africa. The bacilli could be useful as potential biological agents in effective bioremediation campaign for multi-polluted environments.

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