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Microbial effects of manure from poultry droppings and pig dung in diesel-contaminated soil

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Abstract

In recent years, an increase in environmental pollution has been observed due to rapid industrialization, unsafe agricultural practices, and increased human activities on energy reservoirs. The wide use of petroleum hydrocarbon products as energy sources has contaminated the soil and the environment, thereby posing serious threats to all life forms, including humans. This study aimed to investigate the role of poultry droppings and pig dung in enhancing the bioremediation of diesel-contaminated soil. Soil samples were collected, processed by air drying and sieving, weighed in experimental bowls (5000 g), and contaminated with 250 ml of diesel. Then, poultry droppings and pig dung were added to the soil samples in different ratios, namely 1 : 1, 1 : 2, and 2 : 1. The diesel-contaminated soil sample without treatment served as the control. Thirty days after exposure to the experimental treatment regimes, the total bacterial count and the hydrocarbon-utilizing bacterial count of the diesel-contaminated soil ranged from 0.4×10^4 to 2.7×10^4 CFU/g and from 0.1×10^4 to 2.1×10^4 CFU/g, respectively. The total fungal count and the hydrocarbon-utilizing fungi count ranged from 0.6×10^3 to 2.1×10^3 SFU/g and from 0.2×10^3 to 1.7×10^3 SFU/g, respectively. *Bacillus subtilis*, *Micrococcus* sp., *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Aspergillus niger*, *Penicillium* sp., and *Mucor* sp were found to be active degraders. A significant reduction in the total aliphatic hydrocarbon (TAH) content of the diesel-contaminated soil was reported, with remediation approaching 95% in 30 days when the poultry droppings – pig dung mixture was added to the soil. The remediation of diesel-contaminated soils is important for the enhancement of the ecosystem. This study has shown that the use of farm waste such as the poultry droppings – pig dung mixture can enhance the remediation of diesel-contaminated soils.

Key words: bioremediation, farm waste, diesel-contaminated soil, petroleum hydrocarbons, hazard quotients, contamination factor

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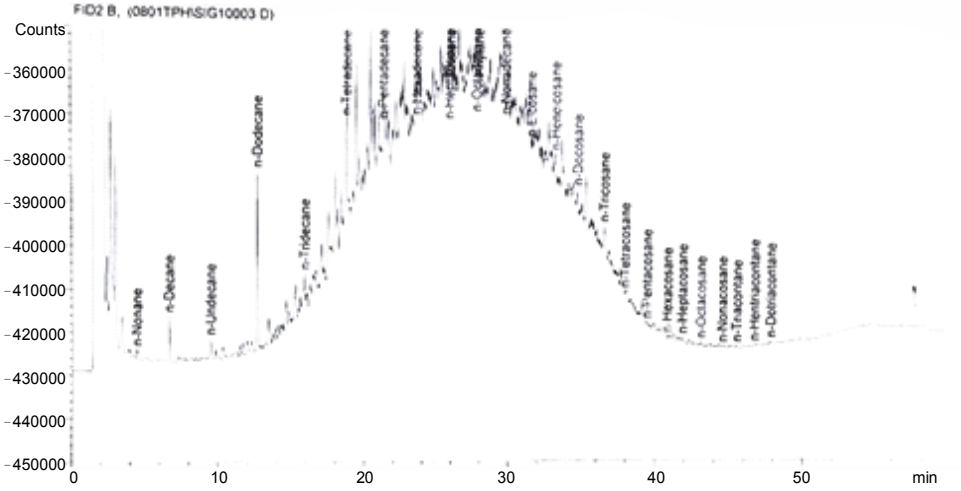

Fig. 1. Chromatograph of the diesel-contaminated soil (500 g treatment 1 : 1)

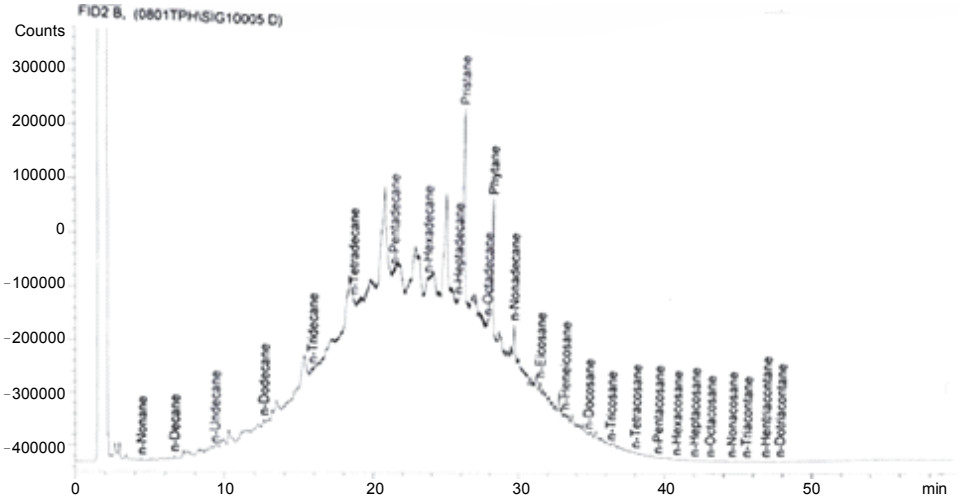

Fig. 2. Chromatograph of the diesel-contaminated soil (300 g treatment 1 : 1)

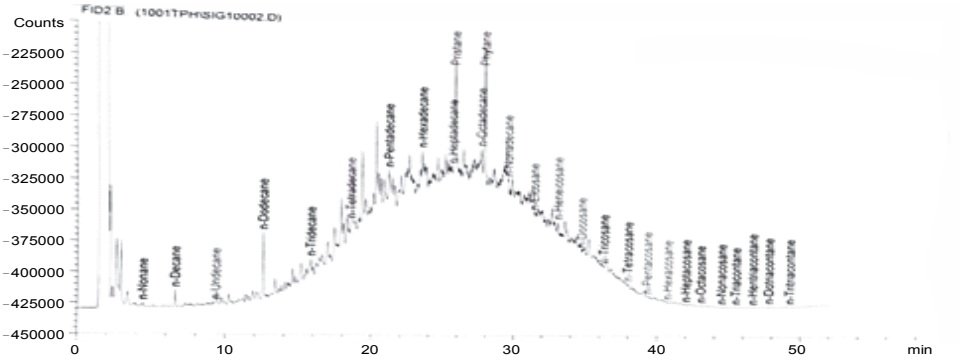

Fig. 3. Chromatograph of the diesel-contaminated soil (100 g treatment 1 : 1)

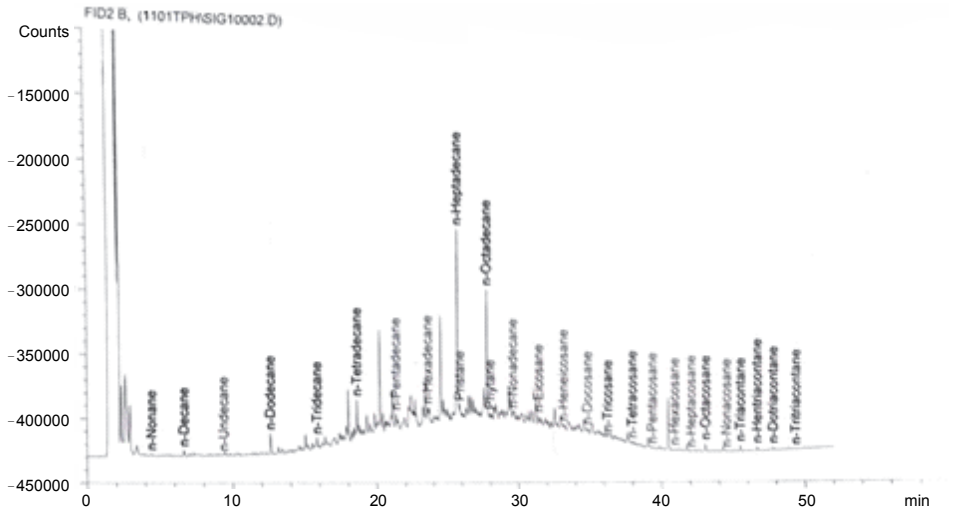

Fig. 4. Chromatograph of the diesel-contaminated soil (50 g/100 g treatment 1 : 2)

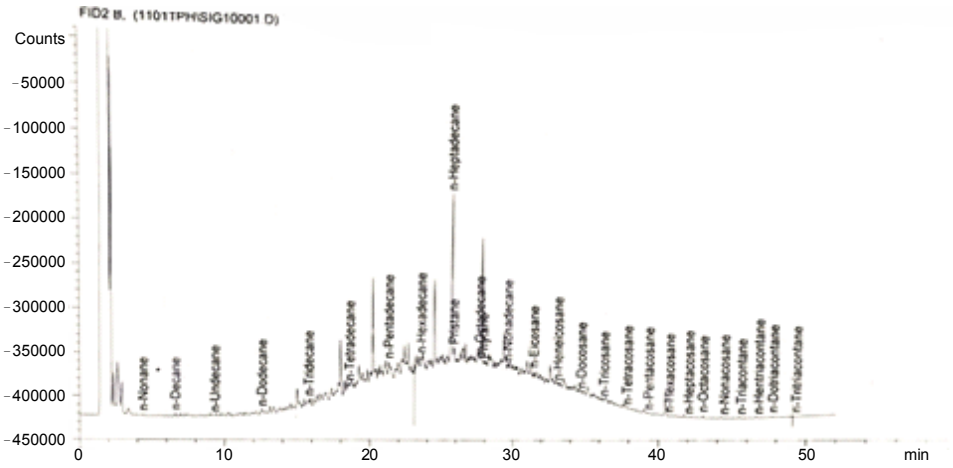

Fig. 5. Chromatograph of the diesel-contaminated soil (150 g/300 g treatment 1 : 2)

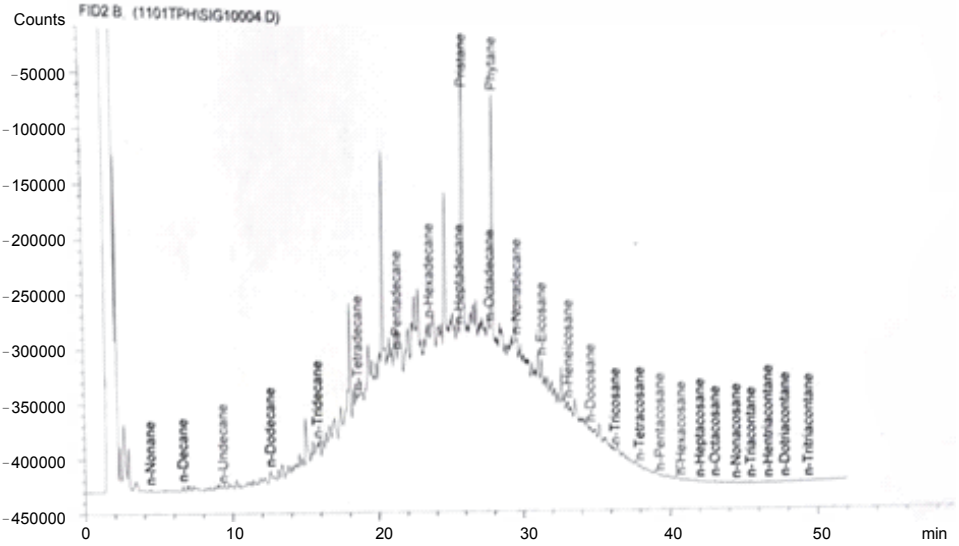

Fig. 6. Chromatograph of the diesel-contaminated soil (250 g/500 g treatment 1 : 2)

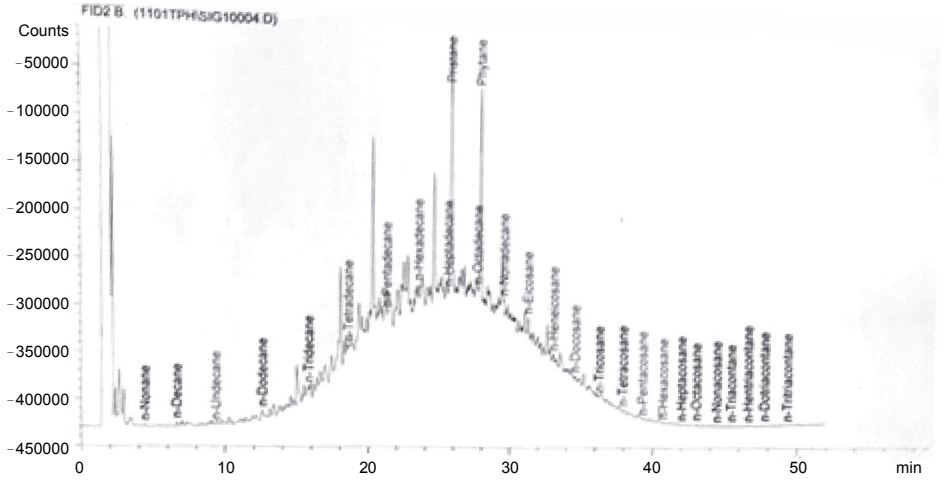

Fig. 7. Chromatograph of the diesel-contaminated soil (250 g/500 g treatment 1 : 2)

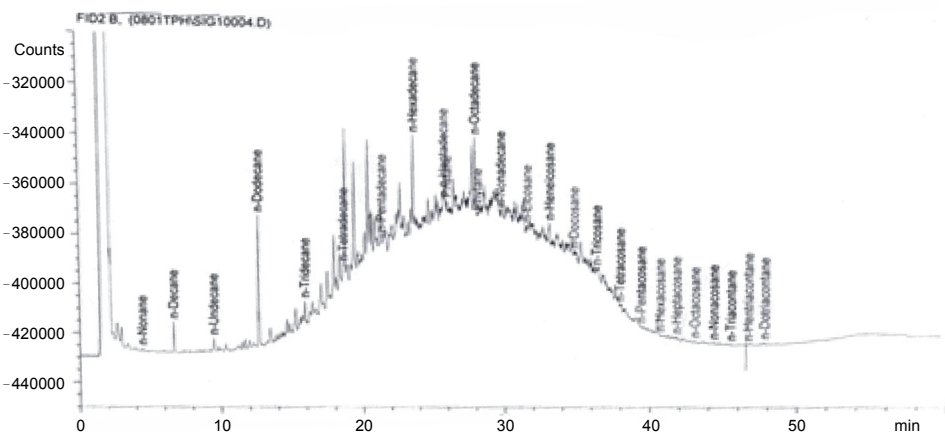

Fig. 8. Chromatograph of the diesel-contaminated soil (control with diesel)

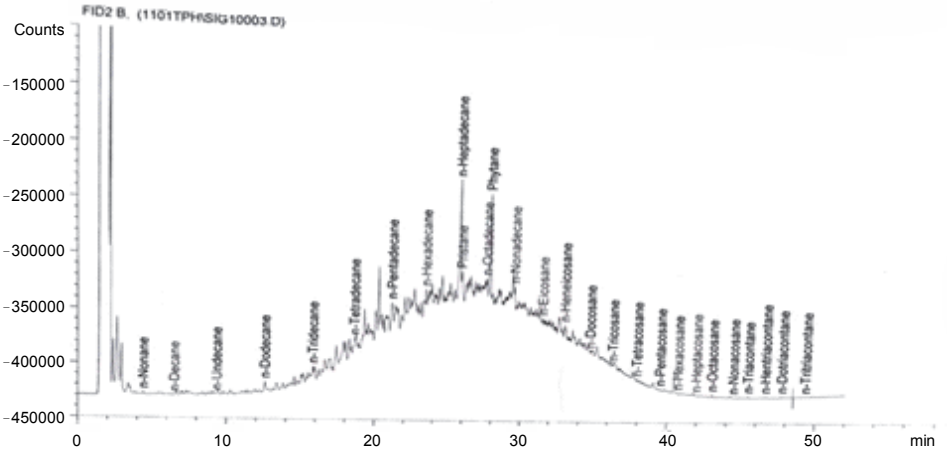

Fig. 9. Chromatograph of the diesel-contaminated soil (300 g/150 g treatment 2 : 1)

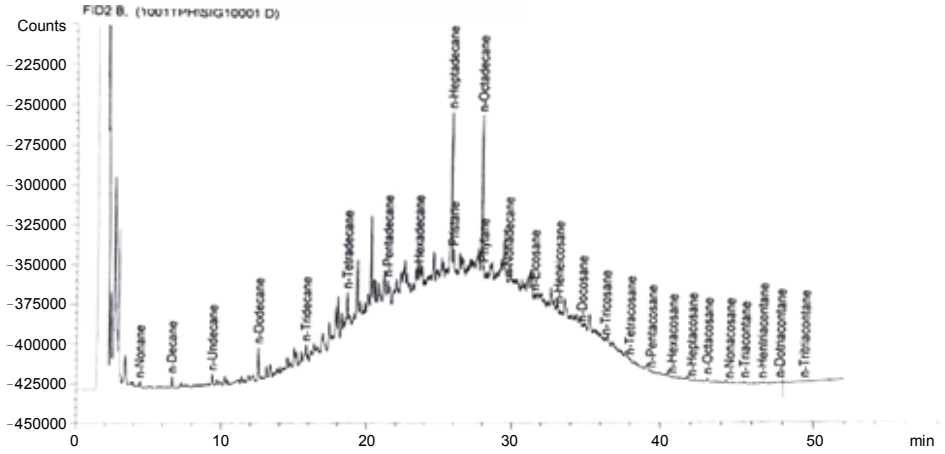

Fig. 10. Chromatograph of the diesel-contaminated soil (100 g/50 g treatment 2 : 1)

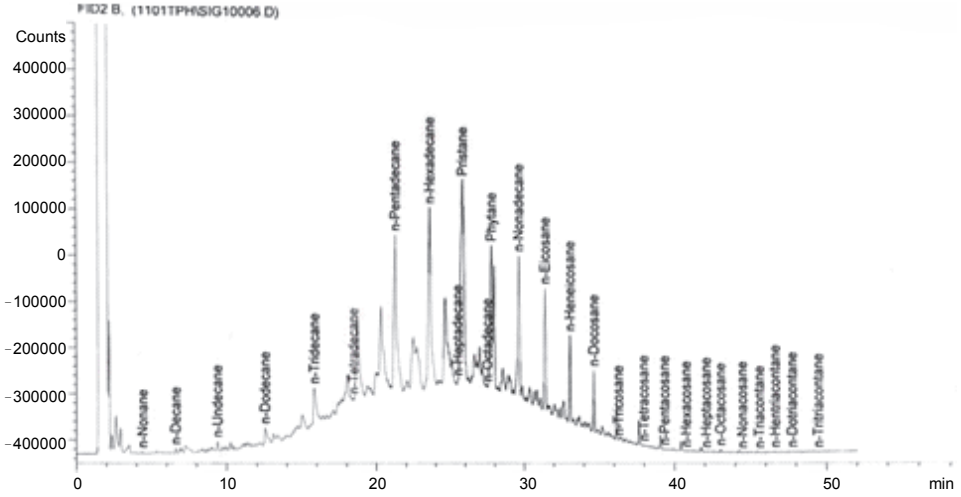

Fig. 11. Chromatograph of the diesel-contaminated soil (500 g/250 g treatment 2 : 1)