

Remediation of Oil and Gas Exploration and Production (O&G E&P) Wastes Using Soil-Poultry Dropping Amendment

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Abstract : Oily wastes from oil and gas exploration and production (O&G E&P) activities were remediated for twelve weeks using Soil-Poultry dropping amendment. Culture-dependent microbiological, chemical and enzymatic techniques were employed to assess the efficacy of remediation process. Microbiological activities of the remediated wastes showed increased hydrocarbonoclastic microbial populations with increased remediation time; $2.7 \pm 0.1 \times 10^5$ cfu/g to $8.3 \pm 0.04 \times 10^6$ cfu/g for hydrocarbon utilizing bacteria, $1.7 \pm 0.2 \times 10^3$ cfu/g to $6.0 \pm 0.01 \times 10^4$ cfu/g for hydrocarbon utilizing fungi and $2.2 \pm 0.1 \times 10^2$ cfu/g to $6.7 \pm 0.1 \times 10^3$ cfu/g for hydrocarbon utilizing actinomycetes. Bacteria associated with the remediated wastes after the remediation period included the genera Bacillus, Psuedomonas, Beijerinckia, Acinetobacter, Alcaligenes and Serratia. Fungal isolates included species of Penicillium, Aspergillus and Cladosporium, while the Actinomycetes included species of Rhodococcus, Nocardia and Streptomyces. Slight fluctuations in pH values between 6.5 ± 0.2 and 7.1 ± 0.08 were recorded throughout the process, while total petroleum hydrocarbon (TPH) content decreased from $89,900 \pm 0.03$ mg/kg to 425 ± 0.1 mg/kg after twelve weeks of remediation. The polycyclic aromatic hydrocarbon (PAH) levels decreased with increased remediation time; naphthalene, flourene, pheneanthrene, anthracene, pyrene, chrysene and benzo(b)flouranthene showed decreased values < 0.01 after twelve weeks of remediation. Enzyme activities revealed increased dehydrogenase and urease activities with increased remediation time and decreased phenol oxidase activity with increased remediation period. There was a positive linear correlation between densities of hydrocarbonoclastic microbes and dehydrogenase activity. On the contrary, phenol oxidase and urease activities showed negative correlation with microbial population. Results of this study confirmed that remediation of oily wastes using soil-poultry dropping amendment can result in eco-friendly O&G E&P wastes. It also indicates that urease and phenol oxidase activities can be reliable indices/tools to monitor PAH levels and rates of petroleum hydrocarbon degradation.

Keywords : dehydrogenase activity, oily wastes, remediation, soil-poultry dropping amendment

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