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Compost Bioremediation of Oil Refinery Sludge by Using Different Manures in a Laboratory Condition

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Abstract : This study was conducted to measure the reduction in polycyclic aromatic hydrocarbons (PAHs) content in oil sludge by co-composting the sludge with pig, cow, horse and poultry manures under laboratory conditions. Four kilograms of soil spiked with 800 g of oil sludge was co-composted differently with each manure in a ratio of 2:1 (w/w) spiked soil:manure and wood-chips in a ratio of 2:1 (w/v) spiked soil:wood-chips. Control was set up similar as the one above but without manure. Mixtures were incubated for 10 months at room temperature. Compost piles were turned weekly and moisture level was maintained at between 50% and 70%. Moisture level, pH, temperature, CO2 evolution and oxygen consumption were measured monthly and the ash content at the end of experimentation. Bacteria capable of utilizing PAHs were isolated, purified and characterized by molecular techniques using polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE), amplification of the 16S rDNA gene using the specific primers (16S-P1 PCR and 16S-P2 PCR) and the amplicons were sequenced. Extent of reduction of PAHs was measured using automated soxhlet extractor with dichloromethane as the extraction solvent coupled with gas chromatography/mass spectrometry (GC/MS). Temperature did not exceed 27.5O°C in all compost heaps, pH ranged from 5.5 to 7.8 and CO2 evolution was highest in poultry manure at 18.78 µg/dwt/day. Microbial growth and activities were enhanced. Bacteria identified were Bacillus, Arthrobacter and Staphylococcus species. Results from PAH measurements showed reduction between 77 and 99%. The results from the control experiments may be because it was invaded by fungi. Co-composting of spiked soils with animal manures enhanced the reduction in PAHs. Interestingly, all bacteria isolated and identified in this study were present in all treatments, including the control.

Keywords : bioremediation, co-composting, oil refinery sludge, PAHs, bacteria spp, animal manures, molecular techniques
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