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Evaluation of the Physico-Chemical and Microbial Properties of the Compost Leachate (CL) to Assess Its Role in the Bioremediation of Polyaromatic Hydrocarbons (PAHs)

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Abstract : Background: Polycyclic aromatic hydrocarbons (PAHs) pose great environmental and human health concerns for their widespread occurrence, persistence, and carcinogenic properties. PAHs releases due to anthropogenic activities to the wider environment have led to higher concentrations of these contaminants than would be expected from natural processes alone. This may result in a wide range of environmental problems that can accumulate in agricultural ecosystems, which threatened to become a negative impact on sustainable agricultural development. Thus, this study aimed to evaluate the physico-chemical, and microbial properties of the compost leachate (CL) to assess its role as nutrient and microbial source (biostimulation/bioaugmentation) for developing a cost-effective bioremediation technology for PAHs contaminated sites. Material and Methods: PAHs-degrading bacteria were isolated from CL that was collected from a composting site located in central Scotland, UK. Isolation was carried out by enrichment using phenanthrene (PHR), pyrene (PYR) and benzo(a)pyrene (BaP) as the sole source of carbon and energy. The isolates were characterized using a variety of phenotypic and molecular properties. Six different isolates were identified based on the difference in morphological and biochemical tests. The efficiency of these isolates in PAHs utilization was assessed. Further analysis was performed to define taxonomical status and phylogenic relation between the most potent PAHs-utilizing bacterial strains and other standard strains, using molecular approach by partial 16S rDNA gene sequence analysis. Results indicated that the 16S rDNA sequence analysis confirmed the results of biochemical identification, as both of biochemical and molecular identification of the isolates assigned them to Bacillus licheniformis, Pseudomonas aeruginosa, Alcaligenes faecalis, Serratia marcescens, Enterobacter cloacae and Providenicia which were identified as the prominent PAHs-utilizers isolated from CL. Conclusion: This study indicates that the CL samples contain a diverse population of PAHs-degrading bacteria and the use of CL may have a potential for bioremediation of PAHs contaminated sites.

Keywords : polycyclic aromatic hydrocarbons, physico-chemical analyses, compost leachate, microbial and biochemical analyses, phylogenic relations, 16S rDNA sequence analysis
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