Effect of Sewage Sludge Compost in Enhancing the Growth of Grasses in Phytoremediation of Diesel Contaminated Soil

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Introduction

The abundance of petroleum products in Oman occasionally results in spills contaminating soils and water. Diesel, like all fossil fuels mainly consists of mixtures of hydrocarbon. Petroleum products in large concentrations are highly toxic to many organisms, including humans. There is a pressing need for an effective, low cost and sustainable technology for the remediation of hydrocarbon impacted environment of Oman. Phytoremediation, which involves plants and their associated microorganisms to remove or break down contaminants, is a promising technology for the remediation of hydrocarbon-contaminated soils.

Objectives

- To assess the ability of selected two plant species (Bermuda grass and Ryegrass) to survive and grow in diesel-contaminated soil, and their potential use in rhizoremediation of petroleum hydrocarbons.
- To study the effect of Kala compost in enhancing the process of phytoremediation.

Materials and Methods

A study was conducted on the comparative efficiencies of identified plant species for phytoremediation of diesel under the arid climatic conditions of Oman. Diesel contaminated soil was brought from Barka for the study. The background soil used in the present study had almost the same physico-chemical characteristics as that of the contaminated soil except that the soil is not contaminated with the diesel. The effect of compost in complementing phytoremediation was also studied by applying compost at 10 % and 20 % levels to the tested soil. The study was conducted by using two plant species, Ryegrass (*Lolium perenne*) and Bermuda grass (*Cynodon dactylon*).There were 9 treatments and four replications in the experimental farm under natural photoperiod between April and June 2014. The efficiency of plants in the remediation of total petroleum hydrocarbons (TPH) was assessed in terms of TPH concentration in soil at mentioned period after planting.

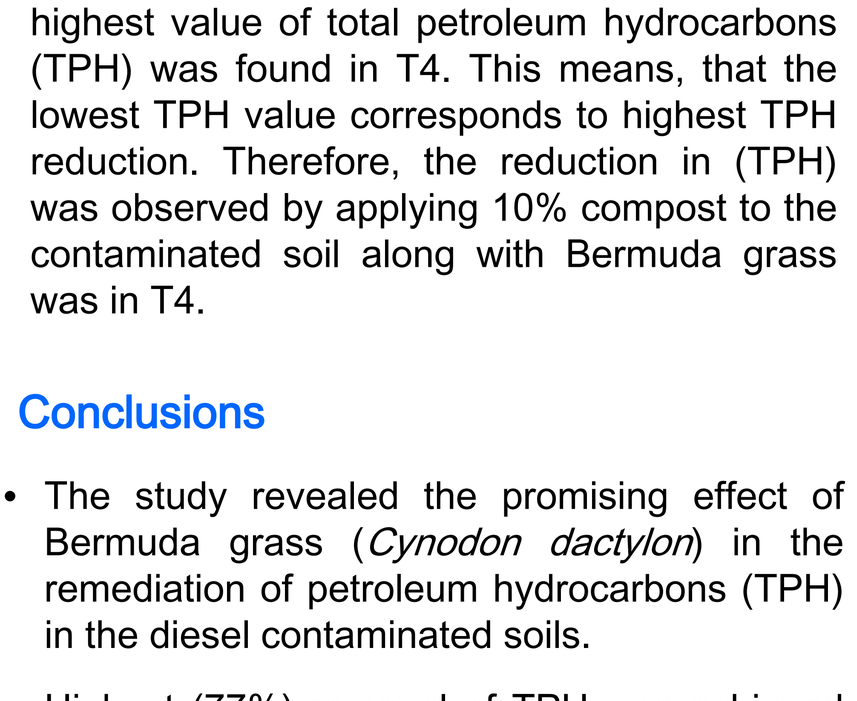
Results and Discussion

Effect of plants: Figure 1 shows maximum 77% reduction in TPH by the growth of Bermuda grass. The reduction was significant compared to the values obtained by the growth of Ryegrass and Natural Attenuation. The root excretions as well as the microbial growth in the rhizosphere of Bermuda grass with high mean root biomass of (15.97 g/pot) in Figure 2 might be the attributing factors for high TPH degradation. The organic compounds released by the roots triggered the microbial growth in the rhizosphere, which stimulated the root contaminant interactions, favoring more degradation of TPH in soil.

Impact of Kala Compost: Figure 3 shows, the highest value of total petroleum hydrocarbons (TPH) was found in T4. This means, that the lowest TPH value corresponds to highest TPH reduction. Therefore, the reduction in (TPH) was observed by applying 10% compost to the contaminated soil along with Bermuda grass was in T4.

Conclusions

- The study revealed the promising effect of Bermuda grass (*Cynodon dactylon*) in the remediation of petroleum hydrocarbons (TPH) in the diesel contaminated soils.
- Highest (77%) removal of TPH was achieved when 10% Kala compost was used in soils for growing Bermuda grass.



Greenhouse pot experiment

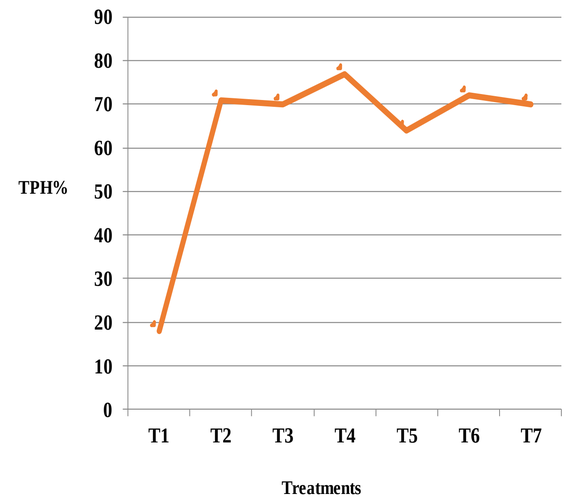


Figure 1: TPH removal efficiency

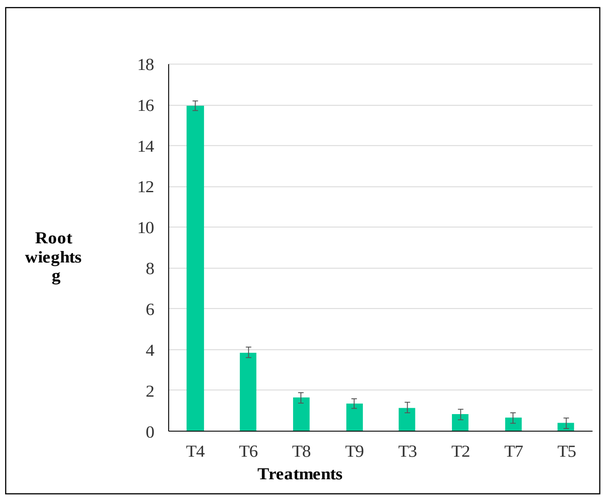


Figure 2: Mean values of root weights

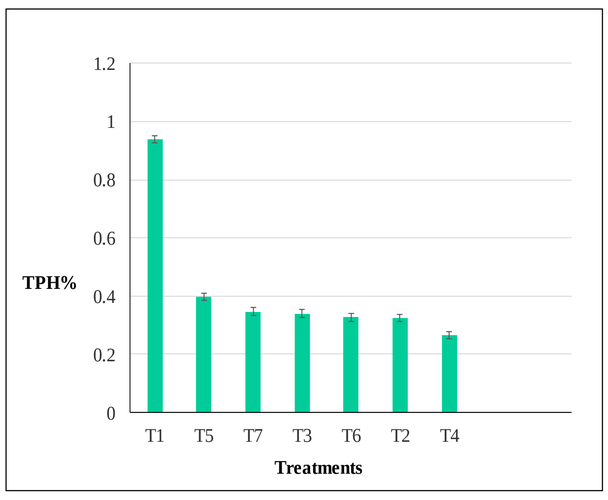


Figure 3 :Mean values of Total Petroleum Hydrocarbons

T1: contaminated soil, T2: contaminated soil with Bermuda grass, T3: contaminated soil with Rye grass. T4: contaminated soil with 10% compost with Bermuda grass. T5: contaminated soil with 10% compost and Rye grass. T6 : contaminated soil with 20% compost and Bermuda grass. T7: contaminated soil with 20% compost and Rye grass . T8: Clean soil and Bermuda grass .T9: Clean soil and Rye grass