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Increased Concentration of Diesel in Soil has Varying Impacts on Different Soil Biological Activities

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The resultant effects of the persistent contamination of the soil environment by organic pollutants are known to be deleterious to soil components and by extension, humans. Therefore, bioremediation monitoring is pertinent in ensuring the effective and efficient restoration of soil activities. In this study, soils polluted with varying concentrations of diesel (IC 1, IC 2, IC 3) at initial TPH concentrations of 14785.84 mg/kg, 23859.52 mg/kg and 42134.96 mg/kg, respectively, were bioremediated using rice husk as biostimulant. Different soil biological parameters namely soil enzyme activities (catalase and β-glucosidase), soil microbial biomass carbon (MBC), nitrogen (MBN) and phosphorus (MBP), soil microbial respiration as well as the soil phytotoxicity were used to monitor the bioremediation process. At the end of 56-day study, the degradation rate for IC 1, IC 2 and IC 3 were recorded at 99.1%, 98% and 97.6% respectively. The 1st, 2nd and nth-order kinetic equations were used in determining the efficiency of the treatment for the increasing concentrations of diesel polluted soils. The results of 1st order kinetics for IC 1 (k= 0.6745 d^{-1}, R^2= 0.9388); IC 2 (k= 0.5738 d^{-1}, R^2= 0.9287); IC 3 (k= 0.6058 d^{-1}, R^2= 0.9626); 2nd order kinetics for IC 1 (k= 8.748×10^{-5} d^{-1}, R^2= 0.8594); IC 2 (k= 4.301×10^{-5} d^{-1}, R^2= 0.8457); IC 3 (k= 3.046×10^{-5} d^{-1}, R^2= 0.9839); nth order kinetics for IC 1 (R^2= 0.9492, k= 4.472 d^{-1}, n= 0.7919); IC 2 (R^2= 0.9394, k= 6.239 d^{-1}, n= 0.7517); IC 3 (R^2= 0.9882, k= 0.0028 d^{-1}, n= 0.3082). From the results obtained, all biological activities for IC 1 except MBN were most responsive to the rice husk treatment than those of the IC 2 and IC 3. Improved plant growth was also observed in IC 1 and IC 2, as compared to IC 3, towards the end of the bioremediation study. These outcomes showed that the use of biological parameters is indispensible in monitoring the efficacy of a bioremediation process on contaminated soil.