

Rhizosphere Microbial Activity of *Crotalaria retusa* L. Grown in Soil Contaminated with Used Lubricating Oil

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Contamination of soil with used lubricating oil (ULO) has become one of the major environmental issues worldwide. ULO contains highly hazardous chemicals such as phenols, benzenes, heavy metals and polyaromatic hydrocarbons. Therefore, ULO contamination may negatively affect the overall soil quality and biota. Phytoremediation is a green technological approach which uses plants to remove organic and inorganic pollutants from the environment. Rhizosphere microbial activity plays a vital role in the phytoremediation. The aim of the present study is to evaluate the microbial activity in the rhizosphere of *Crotalaria retusa* L. grown on contaminated soils with ULO. A pot experiment was conducted using contamination levels of 5,000 (T1), 10,000 (T2), 15,000 (T3), 20,000 (T4), 25,000 (T5) and 30,000 (T6) mg kg⁻¹ ULO and uncontaminated control. A randomized block design (RBD) was employed with four replicates per treatment and control. Total microbial activity (TMA) was determined by using fluorescein diacetate hydrolysis (FDA) method and ULO content was determined by using gravimetric method in the soils taken from the rhizosphere in every 30 day interval during 90 days of experimental time. The calculated percentage biodegradation of ULO at the end of the experimental time was 52.2%, 43.8%, 35.6%, 32.2%, 25.2% and 22% for T1, T2, T3, T4, T5 and T6 ULO treatments, respectively. TMA was 20.22, 18.05, 16.81, 15.63, 13.94, 11.59 and 10.59 fluorescein $\mu\text{g ml}^{-1}$ for unplanted control and T1, T2, T3, T4, T5 and T6 ULO treatments, respectively. According to the results, rhizosphere microbial activity showed a contamination level dependent decrease and a time dependent increase. Further, correlation analysis indicated a highly significant ($p < 0.001$) positive correlation ($r = 0.975$) between the percentage biodegradation and the TMA. Therefore, overall results highlight the applicability of the rhizosphere microbial activity as an indicator to assess the biodegradation of ULO.

Keywords: Percentage biodegradation, Total rhizosphere microbial activity, Used lubricating oil

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