# Perturbation Of Selected Soil Enzyme Activities By Various Hydrocarbons

Pollution of farm land is ubiquitous in oil producing regions. The intent of this study was to evaluate the influence of various hydrocarbons on soil catalase as well as dehydrogenase activity. The experiment was consisting of known amount of soil treated with varying amounts of various hydrocarbons and left to stand for four, eight and twelve days. On each of these days, the activities of catalase and dehydrogenase were assayed using standard methods. The results showed a significant (p kerosene > diesel > engine oil. Also, a significant increase (p diesel > petrol > engine oil. The results in overall showed that hydrocarbons perturb soil enzyme reactions.Introduction Chemicals derived from petroleum are employed in many ways such as household solvents and specialty chemicals, all are important routes hydrocarbons pollute man's environment (Kenny et al., 2002; Achuba et al 2014). More so, mechanized farming that employs heavy duty machines contributes its quota to farm lands pollution during collection or storing petroleum oils as well as unguided disposal of spent petroleum oil into the natural environment (Odjegba and Sadiq 2002). The pollution of soil alters the nutrient status thereby decreasing its productive capacity (Achuba and Iserhienrhien, 2018) Enzymes are important component of soil which is responsible for soil biochemical reactions because they participate in the conversion of organic substances into plant nutrients (Zahir et. al., 2001; Achuba, 2010; Navnage, et al., 2018). Previous report hinted on spent oil perturbation of soil enzyme activities (Achuba and Peretiemo-Clarke, 2008). The study involve determination of two major soil enzymes, catalase and dehydrogenase activities that are vital in soil biotransformation reactions (Li et al., 2005; Achuba and Peretiemo-Clarke, 2008).These enzymes are sensitive to pollution and their values are used as toxicity testing instrument (Navnage et al., 2018). Therefore, the aim of this study was to determine the effect of hydrocarbons (kerosene, diesel, engine oil and petrol) treated soil on catalase and dehydrogenase activities in soil.Material and MethodsWarri Refining and Petrochemical Company supplied the petroleum hydrocarbons.

The soil (sand 84%, silt 5.0%, clay 0.4% and organic matter 0.6%, pH 6.1) was obtained from a vacant farm land in site II of Delta State University, Abraka. The soil was sieved using 2 mm-mesh after air drying. Each of polythene bags (1178.3cm3, 15 cm deep) was filled with the soil sample (1600 g) and randomly divided into six groups of five replicates. Groups one to five were treated as follows: 0.1%, 0.25%, 0.5%, 1.0% and 2.0% (v/w) respectively of each of the petroleum hydrocarbons. The sixth group served as control (0.0%). In group one, 1.0 ml of kerosene, corresponding to 0.1%, was added and the mixed thoroughly with hand to homogeneity. The procedure was adopted for 0.25%, 0.5%, 1.0%, 1.5% and 2.0% and subsequently applied to other hydrocarbons. Preparation of extract and assay of catalase

activityThe extract for the determination of catalase was prepared following the protocol described previously (Achuba and Peretiemo-Clarke, 2008) and the activity of the enzyme assayed for as reported by Rani et. al,. (2004)Assay of soil dehydrogenase activityDehydrogenase activity was assayed for according to the method described by Tabatabai (1982) and the activity of the enzyme evaluated using the extinction coefficient proposed by Dushoff, (1965).RESULTS AND DISCUSSIONPrevious investigation has indicated the variation of soil enzyme activities by spent engine oil (Achuba and Peretiemo-Clarke, 2008). This is unison with this research in which soil catalase activity was varied by the various hydrocarbons in relation to the number days of treatment of soil and with the type of hydrocarbon applied (Tables 1-3). Earlier studies reported that petroleum contamination lead to poor soil aeration, immobilization of soil nutrients, lowering of soil pH, reduction in soil microorganisms and decrease in soil enzyme activities (Atuanya 1987; Maila and Cloete, 2005; Osuji and Nwoye, 2007; Achuba and Peretiemo-Clarke, 2008).

This may account for the decrease in catalase activity after four days of treatment (Table 1). This is against the increase in the activity of the enzyme after eight days (Table 2) which could be predicated on induction of microbial enzymes towards biodegradation of available hydrocarbon thus culminating in reduced available soil carbon content. This might be responsible for the decrease in the activity of the enzyme after twelve days of incubation with petrol and kerosene (Table 3). Earlier reports indicated a proportionate reduction in catalase activity as biodegradation decreases (Van der Waarde et al., 1995; Wyszkowska, 2002). Moreover, catalase activity was maintained in diesel and engine oil treated soil samples after twelve days more than the activities in petrol and kerosene treated soil. These observations indicate that biodegradation increase in the manner of petrol > kerosene > diesel > engine oil. The result of the current investigation showed that dehydrogenase activity similar to catalase activity varied by petroleum treatment of soil. The activity of the enzyme increased after four (Table 4) and eight days (Table 5) but decreased after twelve days (Table 6) of post treatment with the four types of hydrocarbons (petrol, kerosene, and diesel and engine oil). This observation agrees with previous studies (Li. et al., 2005; Achuba and Peretiemo-Clarke, 2008).

The increase in enzyme activity could be due to the participation of some microorganisms in the metabolism of hydrocarbons, however, the decrease in the enzyme activity after twelve days of post treatment could be attributed to decease in carbon content of the soil. Previous study reported decrease in soil dehydrogenase activity after biodegradation of petroleum (Margesin and Schinner, 1997; Achuba and Peretiemo-Clarke, 2008). In addition, the overall results indicated that the toxicity of the hydrocarbon takes the fashion of kerosene > diesel > petrol > engine oil. The high toxicity of kerosene and diesel was previously reported (Wemedo et al., 2002; Wyszkowska et. al., 2002). In conclusion, this study established that of the four types of hydrocarbon, kerosene inhibited the studied enzymes more than the other three hydrocarbons in short term.