



Assessment of the Effect of Auto-mechanic Activity on Microbial Population and Availability

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The long-term presence of the resulting pollutants in the soil increases concerns about soil microorganism poisoning, which can lower soil fertility, which is dependent on both the type and quantity of microorganisms living there as well as the soil's chemical makeup. Contaminated soil samples were collected using a soil auger in a randomized method along transect of automobile mechanic workshop within the study area. Result obtained from laboratory analysis indicates considerable reduction in bacteria population as a result of petroleum pollution around auto mechanic workshops in the study area. Laboratory analysis indicates that only *Pseudomonas sp.* and *Bacillus sp* were identified in polluted soil samples and this is due to petroleum effects which

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has affected the existence of other species as compared to the control sample. Petroleum pollution has continued to have its effect on population of fungi in soil especially in places where spills are persistent. Result on fungi pollution reveals that auto mechanic activities and its spill actions reduces fungi population. This is seen through reduction in fungi count for polluted and pollution free soil (control). Research has proven that these action from man affects negatively the population of bacteria by affecting respiratory processes. Laboratory results indicates that spent oil spill from auto mechanic activity has a direct effect on microbial population in soil. Protection of soil microorganisms should be adopted through prevention of Spent oil spill around soil at auto mechanic workshop by setting up appropriate collection drums and containers.

Keywords: Activity; assessment; auto-mechanic; effect; microbial; population.

1. INTRODUCTION

In Nigeria, auto mechanic activities have significantly deteriorated the environment. According to predictions, Africa will be the first continent to face anthropogenic-induced climate change, particularly in highly polluted countries like Nigeria [1]. Auto-mechanic activities in the vicinity of municipalities provide a portion of this anthropogenic pollution. Urbanization, population growth, and technology advancements are the main causes of this pollution, which has negative consequences on the environment and has made Nigeria a major environmental concern [2]. Dominguez-Rosado and Pichtel [3] reported that spent engine oil release during auto-mechanic service operations is a common and toxic environmental contaminant not naturally found in the environment. However, large amount of them are liberated into the environment during auto-mechanic activities (when the motor oil is changed and disposed into the soil which is a common practice by motor mechanics and generator mechanics).

Orji et al. [4] state that self-employed artisan mechanics work at auto-mechanic repair stations to perform auto-mechanic (motor and motorcycle) repairs and maintenance services. The used petroleum products produced by these repair services mostly consist of used diesel, petrol (premium motor spirit, or PMS), and engine lubricating oil, which are utilized to remove grease from machine parts. These wastes are frequently dumped on soil, where they might have an impact on plant growth and the microbial community. According to reports, the information and knowledge gaps caused by low literacy levels in these places have been linked to pollution and environmental degradation [5]. In Nigeria, petroleum-related activities in particular contributes to discharges that are harmful to living things (such as microorganism) especially since microbial habitats remains the

first recipients of these discharges. There has been concerns raised about the adverse effects of contamination of petroleum products on the soil [6]. Hitherto, human exposure has been associated with growing incidence of a range of acute and long-term adverse health effects and disease [7].

According to Orjiakor et al. [8], the percentage of vital components including microorganisms, soil water, soil air, and mineral compounds that are present in good quality soil defines its quality. Nonetheless, the amount of each of these components will probably vary depending on the kind of activity found in that particular soil. According to Orji et al. [4], these waste materials made from petroleum and derivatives (from auto-mechanic service stations) are regularly dumped into the soils inside the service stations within a 2-meter radius. The Effluents discharged from anthropogenic activities often contain toxic heavy metals that cause adverse effects in the environment [9].

The impact of auto-mechanic operations and disposed-of waste is contingent upon the nature and amount of contaminants, as well as the physical, chemical, and biological characteristics of the contaminated soil, all of which contribute to the persistence of pollutants [10]. The long-term presence of the resulting pollutants in the soil increases concerns about soil microorganism poisoning, which can lower soil fertility, which is dependent on both the type and quantity of microorganisms living there as well as the soil's chemical makeup. According to Vinay et al. [11] these heavy metals may bio accumulate in plants or become toxic to aquatic organism when released. Subsequently, when these contaminants are released, they affect water habitat, natural soil flora and fauna, and may pose as a potential health issues in humans when ingested [12].

This study is important as it will help to reveal the dynamics of microbial population in and at distance away from the auto-mechanic service station through laboratory analysis on microbial biomass. It will also provide adequate ideas of pollution levels and the extent to which proper waste disposal methods in auto-mechanic workshop is adhere to and hence, contribute positively to knowledge on the detrimental effect of such practices on soil microorganism and subsequently on soil fertility.

2. MATERIALS AND METHODS

2.1 Study Area

Ozoro is the headquarters of Isoko North Local Government Area of Delta State. It is one of the administrative units of the Isoko regions in Delta State Nigeria situated at Latitude: 5.5383 and Longitude: 6.2161 with approximate population of 13,411(at 2015) inhabitants and land mass of 1.136km². It is host to spills from petroleum products and subject to frequent flooding which helps in dispersing pollutants over a large area. Ozoro falls within the southern tropical evergreen forest zone and characterized by two climatic seasons. It comprises also of commercial activities and other municipal practices which causes environment pollution.

2.2 Collection of Sample/Preparation

Contaminated soil samples were collected using a soil auger in a randomized method along transect of automobile mechanic workshop within the study area. These sampling points have been subject to spent engine oil discharge and were labeled as samples A, B, C, D and E (Triplicate samples were collected). An additional soil sample from a point free from spent oil discharge was obtained as sample control. At each sampling location, auger-boring instrument was used to bore holes of depths 5 - 25cm. The samples were homogenized in a clean plastic bucket, poured into a polythene bag, labeled adequately and transported to the laboratory immediately for analysis of the effect of auto mechanic activities on microorganisms.

2.3 Methods

2.3.1 Determination of total heterotrophic bacteria (THB)

1g of representative soil samples were weighed and diluted with 9ml sterilized distilled water in sterilized test tubes to make serial dilutions of 10⁻¹ to 10⁻⁹. 0.1ml aliquot from the 5th serial dilutions

(mostly low concentration for bacteria) were collected and pour on already prepared nutrient agar plates. These plates were Incubate at 37°C for 24 hours before colonies were enumerated or counted using colony counter.

2.3.2 Determination of hydrocarbon utilizing bacteria (HUB)

1g of representative soil samples were weighed and diluted with 9ml sterilized distilled water in sterilized test tubes to make serial dilutions of 10⁻¹ to 10⁻⁶. 0.1ml aliquot from the 5th serial dilutions (mostly low concentration for bacteria) were pour on already prepared mineral salt agar (Bushnell Haas Agar) plates with antifungal (fungusol) added to suppress fungi growth. Ascetically, a filter paper saturated with sterile crude oil were placed on the inside of the inverted petri dishes of the cultured plate and then Incubate at 37°C for 4 days. Afterwards, the colonies on the plate were counted using colony counter.

2.3.3 Determination of total heterotrophic fungi (THF)

1g of representative soil samples were weighed and diluted with 9ml sterilized distilled water in sterilized test tubes to make serial dilutions of 10⁻¹ to 10⁻⁴. 0.1ml aliquot from the 9th serial dilutions (mostly high concentration for fungi) were pour on already prepared malt extract agar plates and Incubate at 28±2°C for 4-5 days before counting using a colony counter.

2.3.4 Determination of hydrocarbon utilizing fungi (HUF)

1g of representative soil samples were weighed and diluted with 9ml sterilized distilled water in sterilized test tubes to make serial dilutions of 10⁻¹ to 10⁻³. 0.1ml aliquot from 3rd serial dilutions (mostly high concentration for fungi) were pour on already prepared mineral salt agar (Bushnell Haas Agar) plates with antibiotic (streptomycin) added to suppress bacteria growth. Ascetically, a filter paper saturated with sterile crude oil on the inside of the inverted petri dishes was placed on the cultured plate and Incubate at 28±2°C for 7 days before colony count on a colony counter.

3. RESULTS AND DISCUSSION

3.1 Results

Result from laboratory analysis of soil sample indicates considerable influence from automechanic operation. Soil samples were subjected to laboratory analysis with result indicated below;

Table 1. Result of total heterotrophic microbial count

Total Heterotrophic Count						
Microorganism	A	B	C	D	E	Control
Bacteria (cfu/g x10 ⁹)	3.67	3.12	2.77	3.04	2.94	4.89
Isolates	<i>Pseudomonas sp; Bacillus sp</i>					<i>Micrococcus sp; Bacillus sp; Staphylococcus sp; Pseudomonas sp.</i>
Fungi (cfu/g x10 ⁴)	0.33	0.24	0.20	0.21	0.22	0.51
Isolates	<i>Aspergillus sp; Tricophyton sp</i>					<i>Aspergillus sp; Mucor sp; Penicillium sp</i>

Table 2. Result of hydrocarbon utilizing microbial count

Hydrocarbon Utilizing Microorganism						
Microorganism	A	B	C	D	E	Control
Bacteria (cfu/g x10 ⁹)	0.64	1.33	0.40	0.97	0.64	1.64
Isolates	<i>Pseudomonas sp; Bacillus sp</i>					<i>Bacillus sp; Staphylococcus sp; Pseudomonas sp.</i>
Fungi (cfu/g x10 ⁴)	0	0	0	0	0	0.11
Isolates						<i>Aspergillus sp;</i>

Table 3. Microbial isolates from soil samples

Samples	Morphological Test		Biochemical Test					Species Name	
	Grain Stain	Shape	Motility	Catalase	Coagulase	Oxidase	Spore		Indole Production
A, B, C, D, E and Control	-	Rod	-	+	-	+	-	-	<i>Pseudomonas sp.</i>
A, B, C, D, E and Control	+	Rod	+	+	-	-	+	-	<i>Bacillus sp.</i>
Control	+	Coccus	-	+	-	-	-	-	<i>Staphylococcus sp.</i>
Control	+	Coccus	-	+	-	+	-	-	<i>Micrococcus sp.</i>

Table 4. Geographical coordinates of sample point

Samples	Coordinates
A	N5°32'53.94", E6°14'8.808"
B	N5°32'55.07", E6°13'40.182"
C	N5°52'50.20", E6°13'40.386"
D	N5°32'52.07", E6°13'40.7"
E	N5°52'55.07", E6°13'41.182"
Control	N5°32'47.42", E6°13'31.14"

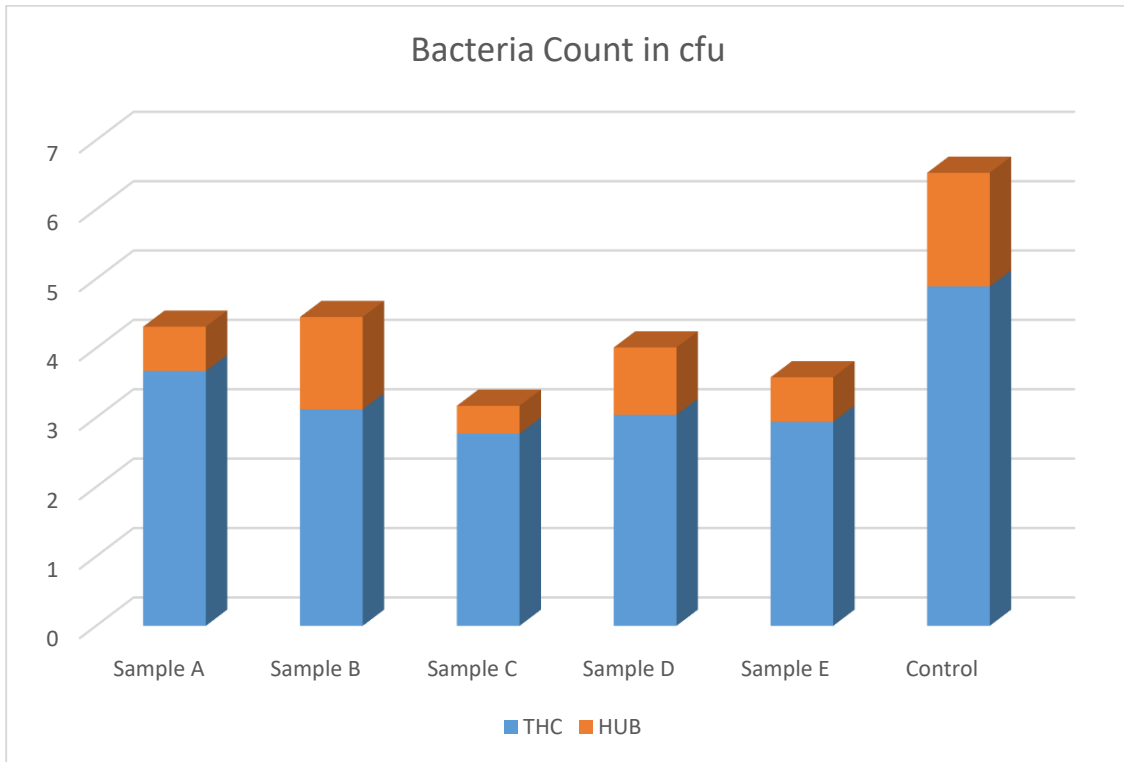


Fig. 1. Heterotrophic and hydrocarbon utilizing bacteria count

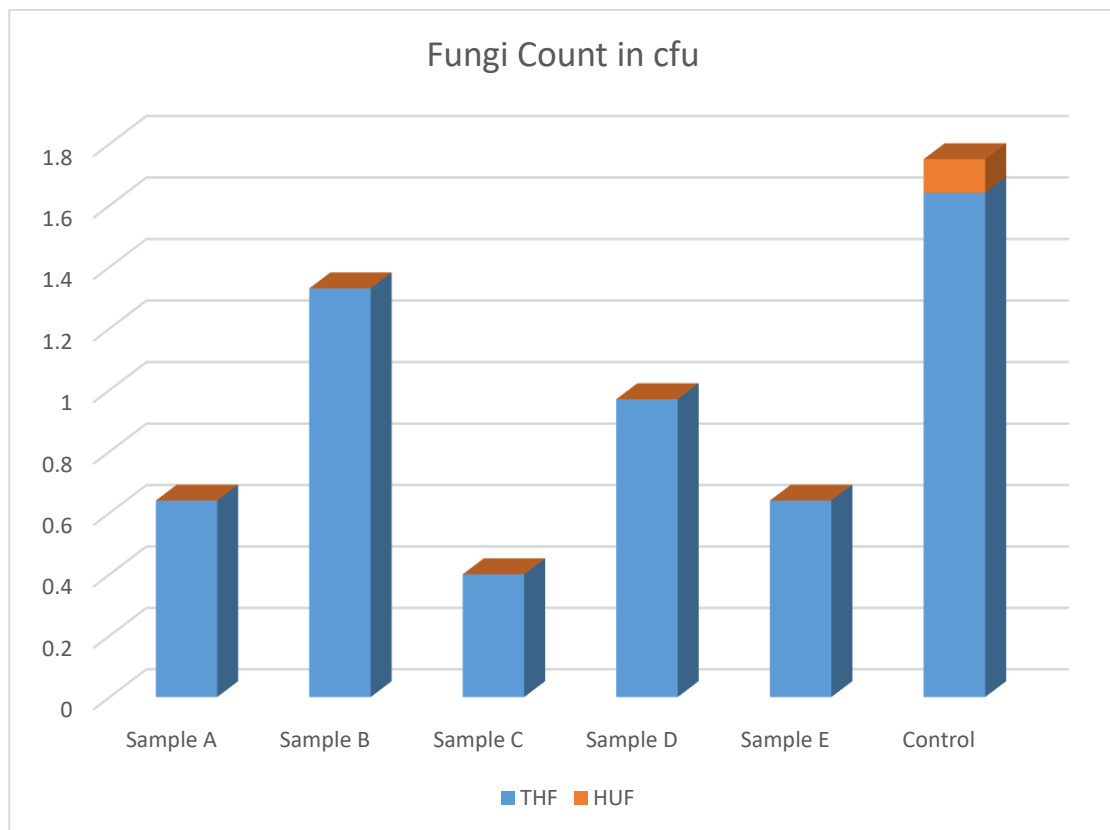


Fig. 2. Heterotrophic and hydrocarbon utilizing fungi count

3.2 Discussion

Soil pollution from used engine oil has continued to pose threat to the existence of bacteria. Research has proven that these action from man affects negatively the population of bacteria by affecting respiratory processes.

Result obtained from laboratory analysis indicates considerable reduction in bacteria population as a result of petroleum pollution around auto mechanic workshops in the study area. Orji et al. [4] reported similar results with decrease in number of heterotrophic bacteria of years of existence of workshops and reduction through counts on the numbers of hydrocarbon utilizing bacteria. Their study shows that there were more bacteria populations and isolated from soils in mechanic workshops abandoned for over a year than soils from the functional workshops showed that petroleum hydrocarbon discharged by mechanic into the soils have reducing influence on the microbial population. As obtained in this study, reduction (in bacteria count of heterotrophic and hydrocarbon utilizing bacteria) can be attributed to pollution concentration as also revealed by Ekpo and Ebeagwu [13]. This is supported by report from Ayandele (2018) on the effect of spent oil discharge on soil microbial population.

Isolates from laboratory analysis were similar to those published by Orji et al. [4] and Emoghene and Eyong (2008) in which bacteria such as *Micrococcus sp*, *Bacillus sp* *Staphylococcus sp*, *Pseudomonas sp*. were identified in soil samples. However, laboratory analysis indicates that only *Pseudomonas sp*. and *Bacillus sp* were identified in polluted soil samples and this is due to petroleum effects which has affected the existence of other species as compared to the control sample. Petroleum pollution has continued to have its effect on population of fungi in soil especially in places where spills are persistent.

Result on fungi pollution reveals that auto mechanic activities and its spill actions reduces fungi population. This is seen through reduction in fungi count for polluted and pollution free soil (control). Similar report was made by Emoghene and Eyong (2008) in which *Aspergillus sp*. recorded decrease in count over concentration increase. Adeleye et al. [14] noted that fungi such as *Aspergillus sp*. are potential microorganisms responsible for crude oil hydrocarbon remediation. However, the degree

of pollution was recorded to have had a major effect on fungi pollution as no fungi was recorded for hydrocarbon utilizing fungi count.

4. CONCLUSION AND RECOMMENDATION

Laboratory results indicates that spent oil spill from auto mechanic activity has a direct effect on microbial population. It can hence be concluded that spent oil spill reduces microbial population in soil which can affect soil fertility. Statistical test revealed that significant difference ($p < 0.05$) in fungi population exist between the observed and expected population count at 5% level of significance on pollution activities on the soil which kills both bacteria and fungi.

From the above conclusion, it is recommended that; Protection of soil microorganisms should be adopted through prevention of Spent oil spill around soil at auto mechanic workshop by setting up appropriate collection drums and containers. Analysis of effect on microbial population in soil along these stations should be done at greater depths to ascertain the leaching powers of petroleum products. Education of auto mechanic technicians on the adverse effects of unsafe/detrimental actions around the workstations should be conducted.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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