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MICROBIAL SUCCESSION OF HYDROCARBON IMPACTED SITES IN A RURAL COMMUNITY IN SOUTH-SOUTH, NIGERIA

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ABSTRACT: *Hydrocarbon pollution has greatly altered the normal microbial flora of our environments, this has lead to the succession of oil degrading microbes in oil impacted sites. This study is a comparative study of the microbial flora of hydrocarbon impacted and the non-impacted site in Ogale community in Eleme Local Government Area of Rivers State. A total of 12 samples were collected, 6 from oil impacted site and 6 from non-impacted site. Sample were coded A –F. Physicochemical parameter of soil was determine, microbiological examination were conducted to determine the bacterial and fungal communities present at each site. Result shows that higher population of oil degrading microorganisms were found on the hydrocarbon impacted site, prominent among them were Micrococcus ,Acinetobacter ,Corynebacterium , Bacilus, Pseudomonas, Flavobacterium ,Actinomycetes, fungi isolated from impacted sites includes Candida , Rhizopus mucor and Aspergilus while the non-impacted site has ; streptococcus, staphylococcus, E.coli, and Actinomycetes species. There were also fungal isolate of which only Candida was the only isolate. Microbial growths ranges between* $1.1 \times 10^3 - 9 \times 10^3$ *cfu/ml .*

KEY WORDS: comparative, microbiota, hydrocarbon , impacted sites, Nigeria.

INTRODUCTION

Several crude oil producing towns have been suffering from the detrimental effects of oil pollution within the Niger delta region of Nigeria, whether accidental or through bunkering and illegal refining activities. Crude oil is a heterogeneous liquid consisting of hydrocarbons. Most oil spill occur as a result of microorganism which causes the deterioration of the product leading to corrosion and leakage of pipelines and storage tanks (wiri and Igoma 2020). Crude oil is classified according to its distillation residues as paraffin, naphtha or aromatics; and based on the relative proportions of the heavy molecular weight, constituents are classified as light, medium or heavy oils.

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METHODOLOGY

Impacted and non impacted Soil samples were collected using sterile polyethene bags. Samples were collected from hydrocarbon impacted sites of Ogale community in Eleme Local government area of Rivers State Nigeria. A Total of six soil sample were collected each, from the oil impacted and none oil impacted site around Ogale oilfield . The sample were labelled A-F and were immediately transported to the laboratory for analysis. Microbiological examinations were conducted to ascertain the various microbial flora of each site (oil impacted and none oil impacted). In the laboratory, 10g of each of the soil samples was weighed and transferred into 250ml flask containing 90ml of sterile distilled water. The suspensions were shaken intermittently for about 30 minute. Each solution was allowed to stand for about 1 h after which the suspension was decanted into another 250 ml flask. Serial dilution of each suspension was made up to dilution (six) 6. The physicochemical parameters of the various soil samples were also determine. SDA was used in fungi cultivation while nutrient agar was use to cultivate bacteria.

Geographical location

Eleme is ten village-cluster, comprising of Ogale, Ebubu, Aleto, Nchia, Alesa, Akpajo, Onne , Ejammah, and Eteo situated in Eleme Local Government Area (ELELGA) . The coordinates of the local government is latitude 5^0 4 6.00 N and longitude $6^0$3859.99 E . The local government borders Tai, Okrika, Oyigbo and the Ogu people.

Ocupation of the Eleme people

The people of Eleme are predominantly farmers and fishermen. A very few population of the people are into civil service.

Industrial activities

Eleme is an area of high industrial activities .Some activities of these multinationals causes oil/gas pollution of the area. Besides,effluent discharge from majority of these companies contains hydrocarbon and other dangerous chemicals inimical to the environment.

Table 1: Total microbial Community of soil samples from Ogale

Sample	Oil-impacted site		Non oil-impacted site	
	Bacteria (cfu/g)	Fungi (cfu/g)	Bacteria (cfu/g)	Fungi (cfu/g)
A	9.4×10^3	9×10^4	1.8×10^3	2.0×10^4
B	7.8×10^3	7.7×10^4	1.6×10^3	8.0×10^4
C	6.5×10^3	7.4×10^4	1.1×10^3	7×10^4
D	5.4×10^3	5.3×10^4	1.2×10^3	8×10^4
E	8.1×10^3	5.7×10^4	2.2×10^3	5×10^4
F	9×10^3	$2\ 1 \times 10^4$	$2\ 1 \times 10^3$	$7\ 1 \times 10^4$

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Table 2. Identified bacteria isolates from the oil impacted site of Ogale

Oil-impacted site	Non-oil impacted site
Pseudomonas species	*Pseudomonas species*
Bacillus species	*Staphylococcus species*
Micrococcus species	*Bacilus species*
Acinetobacter species	*Actinomycetes spp*
Corynebacterium species	*E.coli*
Flavobacterium species	*Actinomycetes*
Actinomycetes species	*Streptococcus species*

Table 3. Identified Fungi isolates from the oil impacted site of Ogale oil fieds

Sample	Morphology	organism	Specie
oil-impacted site	Ovoid	Yeast	Candida spp
	Filamentous	Mold	*Arthrobacter spp*
	Filamentous	Mold	*Rhizopus spp*
	Filamentous	Mold	*Aspergillus*
Non oil-impacted site	Ovoid	Yeast	*candida spp*

Table 4, Physicochemical parameter of soil

Parameter	Impacted soil	Non impacted soil
PH	9.50	7.20
iron(mg/kg)	25.50	7.50
EC	1437	1012
Cadmium (mg/kg)	0.001	0.001
Oil and grease (mg/kg)	32090	400
Lead (mg/kg)	0.003	0.000
Zinc (mg/kg)	0.099	0.017
Arsenic (mg/kg)	0.002	0.001
Chromium (mg/kg)	0.001	0.001

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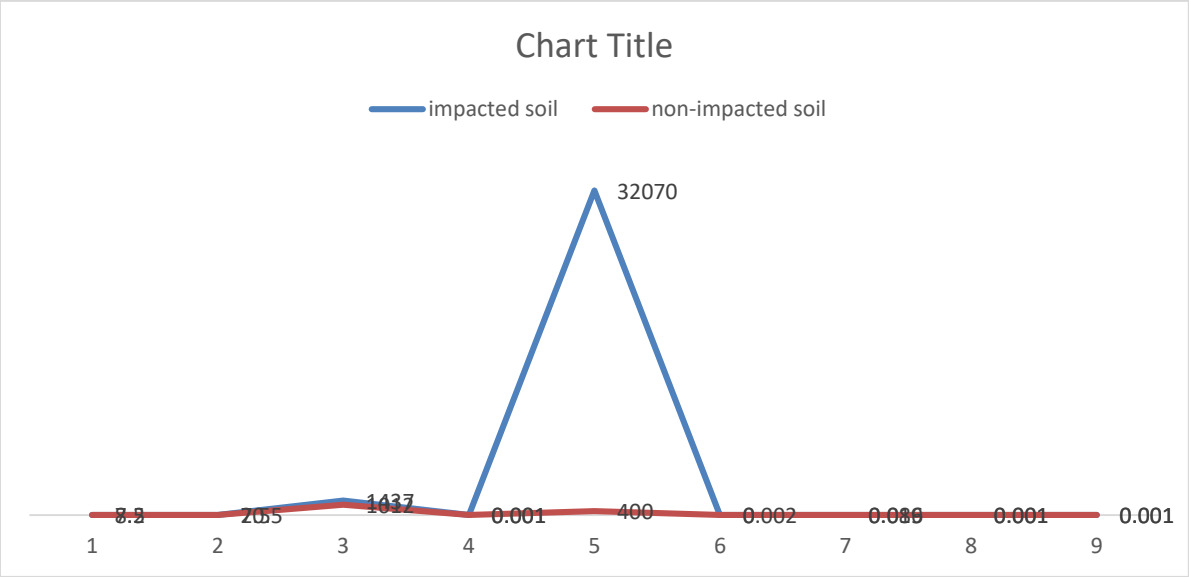

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
8.5	8	33527.59	4190.949	1.27E+08
7.2	8	1419.519	177.4399	133188.7

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	64433030	1	64433030	1.01245	0.331392	4.60011
Within Groups	8.91E+08	14	63640726			
Total	9.55E+08	15				

The result of the graph show an upward increase in the population of microorganisms in the oil impacted Soil. The result of the graph above indicates a single factor analysis of variance of oil impacted soil and the non-oil impacted soil. The test was conducted to prove the significant difference between the two samples. The group statistics shows positive mean, positive variance

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indicating that the two sample have strong relationship between the two variance in the study area. This is in line with research conducted by (wiri, et,al 2019). The analysis of variance between the two samples shows a positive F-statistics, positive P-value and a positive F-critical value, all thse positive values indicated that at the long run crude oil from the impacted soil will spill to the non-impacted soil which will lead to succession of a new microbial communities in a positive manner.

RESULTS AND DISCUSSION

Result shows the microbial counts (Table1) of oil impacted and none impacted soil in Ogale community in Eleme Local Government Area. Sites that are impacted have high microbial counts due to change in physicochemical parameters of polluted soil. Microbial counts from the none impacted sites were low, This result agrees with works of Wiri, Desmond, Mbato,and Nabiradee (2019) which reported that a higher microbial counts is usually associate with oil polluted sites . Table 2 is the results of the various microbial isolates, prominent among isolates from the impacted sites are *Micrococcus ,Acinetobacter ,Corynebacterium , Bacilus, Pseudomonas, Flavobacterium ,Actinomycetes species* while isolates from non impacted sites includes *Staphylococcus, Bacilus, Streptococcus* species etc. Table 3 shows morphological features and fungi isolates from oil impacted and non oil impacted sites , Candida was predominantly fungal species from oil-impacted site, others includes Mucor, Rhizopus, *Arthrobacter* and Aspergillus while predominantly Candida was the only fungal isolate from non impacted site of Ogale community .

This result agrees with the results of Okereke, Obiekezie and Obasi (2007) who reported same result; hydrocarbon are harmful to vegetation.

CONCLUSION

It is concluded that hydrocarbon pollution enhances the proliferation of hydrocarbon degrading microorganism of which Pseudomonas and Candida are prominent among them. Urgent steps should be taken by government and multinationals to remediate the soil immediately after spill occurs. Immediate remediation of polluted environments will further safeguard the environment and prevent the extinction of the microbial population. However, in the event of remediation, a more ecofriendly technology should be adopted to prevent further harm to the indigenous microbial flora of the soil. The Significance of the result is that it will be a reference point to similar research within and outside Nigeria.

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