AN ANALYSIS OF PH VALUE, IRON AND MOIST CONTENT OF OIL POLLUTED SOIL

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ABSTRACT
The basis of this study is on analysis of PH value, iron and moist content of oil polluted soil. Three research questions were used in the study. 2g of dried soil samples were weighed in 100ml kjadahl flasks and placed on the Kjadahl digester. 15ml of digestion acid [(1:3) conc. HNO3 + H2SO4] was quantitatively transferred into flasks. The flask was then heated slowly initially and then vigorously. The heating was discontinued when the fluming and frothing had ceased and a clear solution obtained. The flasks were allowed to cool down to room temperature (RT). 20ml of distilled water was added and then filtered into volumetric flasks. Findings of the study revealed that at a PH value of 4.23 yielded a conductivity level of 61.75 us/cm. At a PH value of 4.35 yielded a conductivity level of 57.25. Within a depth of 30-45cm the PH value was 4.95 and THC value of 5.86. Research question 2 showed that at a depth of 0-15cm the moist % was 33.36. THC has achieved a value of 5.38 at 29.01% moist level. At moist level of 22.07% the conductivity level was 57.20. The CEC level was 55.62 when the moist level was 20.44%. Finally, research question 3 reveals that at a depth range of 0-15cm, the iron content was 1.46. At the depth of 15-30cm, the iron content level was 0.86. With a depth distance of 30-45cm, the iron content was 0.54. The PSA level of 90µ yielded an iron content of 0.72. It was recommended that there should be in place immediate clean up and compensation program to sustain the fertility and preservation of micro –organisms in the soil.

Keywords: PH value, iron, moist, polluted soil and oil spillage

INTRODUCTION

Crude oil spillage affects the nature and development of essential nutrient needed for soil fertility and production. Contamination of soil by oil spills is a wide range of environmental challenge that often needs cleaning up of the contaminated sites. These petroleum hydrocarbons have negative influence on the germination and growth of plants in soils (Samina and others, 2002). Oil spills influence plants by reducing basic nutrients such as nitrogen and oxygen required for plant development unavailable to them in the soil (Adam and others, 2002). Phytoremediation is an alternative means to more sophisticated solution technologies because it is a realistic, effective and non-intrusive technology that makes use of natural plant processes to boast degradation and removal of oil contaminants from the environment (Marmiroli and others, 2003). At different levels of oil exploitation, there are demerits on the environment impact assessment, and the greatest single intractable environmental problem caused by crude oil exploration in the Niger Delta region is oil spillage and community crises. Observation shows that more than 6000 spills had been recorded in the 40 years of oil exploitation in Nigeria, with an average of 150 spills per annum.

In the periods 1976–1996, 647 incidents occurred resulting in the spillage of 2,369,407.04 barrels of crude oil. With only 549,060.38 barrels recovered, 1,820,410.50 barrels of oil were lost to the ecosystem. The environmental impact or disadvantages of oil pollution on the inhabitants of Delta State are enormous. Oil spills have reduced the value of most agricultural lands in the State and have turned hitherto productive areas into wastelands. With increasing soil infertility due to the destruction of soil micro-organisms, and dwindling agricultural productivity, farmers have been forced to abandon their land, to seek non-existent alternative means of livelihood. Aquatic lives have also been destroyed with the pollution of traditional fishing grounds, exacerbating hunger and poverty in fishing communities.

The soil supplies significant mineral nutrient for proper plant growth. These nutrients include both the macro and the micro nutrient. The macro nutrients are used in the greatest amount by plant and they are the ones readily available for plants productions. Plants germinate, develop and grow in soil medium where water, air and nutrient resources supply plants for healthy growth for productive and profitable agriculture. Frequent crude oil spillage on farmlands, and the consequent fouling effect in all forms of life, renders the soil (especially the biologically active surface layer) toxic and unproductive. The oil reduces the soils fertility such that the most of the essential nutrients are no longer available for plant and crop utilization (Abii and Nwosu, 2009). Oil spillage on farmlands is as a result of crude oil exploitation, the soil (receptor) is soak up by the oil like sponges and prevents the lenticels of crops to absorb oxygen – hence oxygen starvation (Oyedejii *et al*, 2012).

However, the crop withers and dies in large numbers thereby leaving the land barren and unproductive. Recent studies have shown that oil spills lower soil fertility and cause poor growth of plants. As the spill occurs, oil contaminated farmlands may become anaerobic and reducing conditions can result in increased solubility of iron (fe) and manganese (mn) to the extent that these potentially photo-toxic elements are absorbed by roots/plant. High oil

concentration on soil not only reduces the amount of water and oxygen available for plant growth, but also interferes with soil-plant – water relationships through direct physical contact (coating of root tissues) thereby adversely affecting plant growth (Abii and Nwosu, 2008).

PURPOSE OF THE STUDY

The study looked at an analysis of PH value, iron and moist content of oil polluted soil. Specifically the study sought to:

1. Find out the range of PH value across the polluted soil.
2. Find out the range of moist content value across the polluted soil.
3. Find out the range of iron content value across the polluted soil.

RESEARCH QUESTIONS

The following research questions guided the study:

1. What is the range of PH value across the polluted soil?
2. What is the range of moist content value across the polluted soil?
3. What is the range of iron content value across the polluted soil?

SCOPE OF THE STUDY

The work is limited to the analysis of PH value, moist content and iron value of the polluted soil.

METHODS

2g of dried soil samples were weighed in 100ml kjadahl flasks and placed on the Kjadahl digester. 15ml of digestion acid [(1:3) conc. HNO_3 + H_2SO_4] was quantitatively transferred into flasks. The flask was then heated slowly initially and then vigorously. The heating was discontinued when the fluming and frothing had ceased and a clear solution obtained. The flasks were allowed to cool down to room temperature (RT). 20ml of distilled water was added and then filtered into volumetric flasks.

Filtrates were made up to the mark with distilled water in the various flasks and transferred into plastic sample containers. These samples are ready for AAS and flame photometry. Na and K were run on the flame photometer while the rest were done on the AAS.

DATA ANALYSIS

RESEARCH QUESTIONS 1

What is the range of PH value across the polluted soil?

Table 1: Range of PH value across the polluted soil

Dept. cm	PH	Cond. (us/cm)	CEC	PSA	Text	THC
0 - 15	4.23	61.75	37.87	193 µ	M.S	4.87
15-30	4.35	57.25	33.38	175µ	M.S	5.38
30-45	4.95	57.20	34.03	165µ	F.S	5.86
Contl.	5.35	55.62	55.72	90µ	Silty	1.82

Table 1 showed that at a PH value of 4.23 yielded a conductivity level of 61.75 us/cm. At a PH value of 4.35 yielded a conductivity level of 57.25. Within a depth of 30-45cm the PH value was 4.95 and THC value of 5.86.

RESEARCH QUESTIONS 2

What is the range of moist content value across the polluted soil?

Table 2: Range of moist content value across the polluted soil

Dept. cm	Moist.%	Cond. (us/cm)	CEC	PSA	Text	THC
0 - 15	33.36	61.75	37.87	193 µ	M.S	4.87
15-30	29.01	57.25	33.38	175µ	M.S	5.38
30-45	22.07	57.20	34.03	165µ	F.S	5.86
Contl.	20.44	55.62	55.72	90µ	Silty	1.82

Table 2 showed that at a depth of 0-15cm the moist % was 33.36. THC has achieved a value of 5.38 at 29.01% moist level. At moist level of 22.07% the conductivity level was 57.20. The CEC level was 55.62 when the moist level was 20.44%.

RESEARCH QUESTIONS 3

What is the range of iron content value across the polluted soil?

Table 3: Range of iron content value across the polluted soil

Dept. cm	Cond. (us/cm)	Fe	CEC	PSA	Text	THC
0-15	61.75	1.46	37.87	193µ	M.S	4.87
15-30	57.25	0.86	33.38	175µ	M.S	5.38
30-45	57.20	0.54	34.03	165µ	F.S	5.86
Contl.	55.62	0.72	55.72	90µ	Silty	1.82

Table 3 reveals that at a depth range of 0-15cm, the iron content was 1.46. At the depth of 15-30cm, the iron content level was 0.86. With a depth distance of 30-45cm, the iron content was 0.54. The PSA level of 90µ yielded an iron content of 0.72.

SUMMARY OF FINDINGS

The following are the summary of the findings:

1. Research question 1 showed that at a PH value of 4.23 yielded a conductivity level of 61.75 us/cm. At a PH value of 4.35 yielded a conductivity level of 57.25. Within a depth of 30-45cm the PH value was 4.95 and THC value of 5.86.
2. Research question 2 showed that at a depth of 0-15cm the moist % was 33.36. THC has achieved a value of 5.38 at 29.01% moist level. At moist level of 22.07% the conductivity level was 57.20. The CEC level was 55.62 when the moist level was 20.44%.
3. Research question 3 reveals that at a depth range of 0-15cm, the iron content was 1.46. At the depth of 15-30cm, the iron content level was 0.86. With a depth distance of 30-45cm, the iron content was 0.54. The PSA level of 90µ yielded an iron content of 0.72.

DISCUSSION OF FINDINGS

Hydrocarbon are also known to hinder root respiration, thereby causing death to root cells and of mechanical grip. High hydrocarbon content of soils has been known to affect soil physical-chemical properties, which in turn affects the agricultural potential of such soils (Amadi,Dickson & Maete, 1993). This could affect the agricultural productivity; in other words, there could be reduced productivity following the impaired state of soil fertility. Crops affected are yam, corn, vegetables, okra, pepper and so on.

The degree of acidity and /or alkalinity is considered a master variable that nearly affect all soil properties-chemicals, physical and biological. While some organisms are affected by broad range of values, others may exhibit. The result from table 1 to 2 shows that the PH value is lower at 0-30cm this makes the upper surface more acidic then 30cm-45cm at

the time the study was carried out. Also from the data collected on the control sites in table 1 to 2 it was observed that the study site was already on the slightly acidic level before contamination with the PH value of 5.35-5.51 if petroleum contamination drops the PH level below 5, as is the case in tables 1 to 2, the soil would have high concentrations of soluble aluminum and manganese, which would be toxic and ultimately discourage plant growth (Duffus, 1980 & Manatian, 1994).

Microbial metabolism might also be hindered in strongly acidic environment, which might reduce the hydrocarbon utilizing capacity of resistance strains of heterotrophic organisms that should be active in degrading the oil (Williams, Bjorou, Dokata, & Winter, 1986 & Okpokshili, 1994). Hence, from the PH obtained on the study areas in tables 1 to 2 (PH range of 4.21-4.45) at 0-30cm depth this value may put a constraint on the remediation process of the affected areas. The PH can be raised to desirable levels to enhance metabolic activities and remediation processes on the sites; this may be done by application of lime (calcium and magnesium compounds) on affected soils.

CONCLUSION

In all, oil spillage and soil contamination by petroleum products should be avoided because it has so much negative effects on the chemical and biological properties of soils and vegetation in the surrounding. The activities of microorganisms, especially beneficial microorganisms is so important to nutrient release to crops vegetation growth on a particular soil, hence the need for avoidance of pollution and contamination of soil is vital. Petroleum products are very toxic to living organisms in soils which indirectly control the chemical and biochemical activities in soils for plant nutrition, hence the need for strict application of environmental management regulations to preserve and protect the area.

RECOMMENDATIONS

Finally, it was recommended that there should be in place immediate clean up and compensation program to sustain the fertility and preservation of micro –organisms in the soil.

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