

Full length Research paper

Effects of Oil Spill from Black Marketing on the Soil and Health Quality in Kaduna State of Nigeria

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This paper examines the effects of black marketing oil spills on the environmental in Chikun L.G.A of Kaduna state. Samples were collected at four (4) different points. Sample 'A' was collected at upside, sample 'B' from the major side, sample 'C' from the down side, and sample 'D' from the point where the soil is not contaminated with black market oil spill to act as the control. The Six (6) parameters that were examined from the samples are cadmium, lead, zinc, copper, organic carbon and pH. The research is covers only the area where the black market operators are prominent in Kaduna state of Nigeria. This area has close proximity to one of the Nigerian Petrochemical Refining Industry. The results of laboratory analysis, shows that the pH level of all the samples were within the accepted threshold limit with 7.29 as highest and 7.11 as lowest compared with FEPA 6-9 and USEPA 6-8; the result of all soil samples collected to test for chemicals such as Cadmium has mean of 0.27, lead 2.31, Zinc 4.87, Copper 5.02 Organic Carbon 3.72 were also within the accepted threshold level set by both FEPA and USEPA. Based on the findings it was suggested that a better techniques should be used in the sales of the fuel to prevent and control the situation through the Federal Ministry of Environment, NOSDRA, NESREA and States Environmental Protection Agencies should sensitize the community by providing various effective monitoring and auditing mechanisms in order to ensure that the individuals comply with the safety of the environmental laws. In addition, oil spill response system should be enhanced by the respective stakeholders to meet up with the requirement of world standard, especially ISO 18001. This endeavor can significantly address debilitating effects and impacts of this new trend of environmental pollution associated with local entrepreneurial economic venture.

Keywords: Effects of Black Marketing, Oil Spill, Soil pollution, Health Quality, Organic Carbon, Lead, Zinc, pH, Copper.

BACKGROUND OF THE STUDY

Oil is generally a term used to denote liquid petroleum products which mainly consists of hydrocarbons. The release of oil into the natural environment is termed oil spill. The extraction, refining, transportation and storage of oil are accompanied by seepages and spills by operations or accidents (Raimi, Towobola, & Madueke, 2013). Deliberate act such as sabotage, oil bunkering, lack of maintenance of engineering equipment, tanker

accidents can cause oil spill. Oil spill can also occur due to natural disasters like hurricane and earthquake, movement of tectonic plate and inadequate trap system (Eregha, & Irughe 2009). Oil spill affects the environment negatively. The most damaging and well documented effects of petroleum spillage are the oiling and tarring of beaches, death of seabird, and the destruction of intertidal marine communities (Ebigwai, Chiamaka, Eshiett, & Asuquo, 2014). The economy is also affected because of the cost of cleanup exercise, loss of the revenue that would have been generated by the spilled oil and also death of fishes (Zabbey, 2004). When people began to settle in the large number, man began to have

access road to move from one place to another his normal business his activities has resulted to polluting the environment with petroleum products and other waste resulting from road side, farmland in the process to meet his needs (Yahya & Mohamad Khan, 2011). The new trade (PMS roadside retail) refers to as black marketing resulted in serious unnoticed waste by the road side and farmlands as well as affecting water and soil quality within the environment. Oil spill from Premium Motor Spirit (PMS), Automotive Gas Oil (AGO), Dual Purpose Kerosene (DPK) and engine lubricants are harmful to the soil and water. The usual mishandling of such product in a form of black market retail makes the soil hardened and impossible for water to penetrate the ground (yahya and Mohamad Khan, 2011, Ebgwi, et.al. 2014). Black marketing resulting oil spill during the roadside sales have effect on soil, water and air because it causes a lot of harm to man and his environment. Mishandling of the substance in the negative way, during scarcity in particular have resulted fire outbreak in some houses and loss of lives (Hussaini, 2013; Friends of the Earth, 2004; Almeelbi, Ismail, Basahi, Qari, and Hassan, 2014; Elvidge, Baugh, Tuttle, Ziskin, Ghosh, Zhizhin, and Pack, 2009; Ichoku, Kaufman, Giglio, Li, Fraser, Jin, and Park, 2003; Kaufman, Justice, Flynn, Kendall, Prins, Ward, Menzel, and Setzer, 1998).

Oil spills can have detrimental effects on soil and water. Soil contaminated with oil has characteristics that it less useful to human beings in most cases (Eregha, & Irughe 2009). Petroleum products such as PMS are highly inflammable has high tendency to pollute the atmosphere and the environment in general. The identified negative consequences of this illegal practices on the soil, vegetation, water and air, prompted this study. Added to its effects on biodiversity black market oil spill contain heavy metals, when released into the environment which pose serious health hazard to human and animals (Khater, A.E., Kitamura, Shimizu, Somura, and Abou El Hassan, 2014; Arora, Kiran, Rani, Rani, Kaur, and Mittal, 2008).

Heavy metal refers to any metallic chemical element that has a relatively high density and toxic or poisonous at low concentration (Hoda, 2015). The elements most commonly are found at contaminated sites. The most prominent includes Lead (Pb), Cadmium (Cd), Zinc (Zn) and Copper (Cu) (Hoda, 2015). It remains in the environment for some time and are usually transmitted as an air pollutant posing a direct health hazard if inhaled or ingested (Yahya and Khan, 2012). This is in addition to eventually been deposited into the soil or water or both. Soils are the major sink for heavy metals released into the environment by anthropogenic activities, (Hoda, 2015). Unlike organic contaminants which are oxidized to carbon (iv) oxide by microbial or chemical degradation, the total concentration of these elements in soil persist for long time after been introduced (Barnes, 2014). The activities of black market retailing in Chikun of Kaduna

state Nigeria impacted seriously on the environment. The danger is associated with its bio-accumulation capability. Bio-accumulation means an increase of the concentration of a chemical in biological organism overtime, compared to the chemical concentration in the environment (Barnes, 2014; Allam & Negm, 2013).

The recent discovery of the level of environmental degradation in Nigeria associated with oil and gas production in the oil producing communities has raised serious concern, (UNDP, 2006). This also attracted the attention of environmentalists and other experts, to look at the other aspect such as pipe vandalization, illegal retailing and host of other activities that may have global consequences on the environment (UNDP Report, 2006). In addressing the aforementioned in Nigeria, the Kaduna State Environmental Protection Agency (SEPA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) were established (NESREA, 2004). The outfits are charged with the responsibility of enforcing environmental laws, regulations and standards, in order to deter people, industries and organizations from polluting and degrading the environment (NESREA, 2004). Therefore this research aim at discussing the environmental impact of black market oil spill waste in Chikun L.G.A of Kaduna state Nigeria.

LITERATURE REVIEW

Health Implication of Oil Spill on the Environment

The main problems with oil spill are the negative effects of ingesting toxic metals. Most of the oil spill contaminated sites contains appreciable amount of heavy metals and other contaminants that could affect the health of people living in the neighborhood of such area (Hoda 2015; Allam and Negri, 2013). The concentration of trace elements like (Chromium) Cr and (Barium) Ba detected in oil spill sites are dangerous to human health (Bentor & Yinon, 2015). Skin contact with certain chromium compounds can cause skin problem (NIOSH, 2011). Ingesting large amounts of chromium compounds can cause stomach upset and ulcers, kidney and liver damage and even death (NIOSH, 2011). The health effects of Barium depend upon the water solubility of the compounds (Bentor and Yinon, 2015). It also depends on the quantity. The larger the quantity the more it will have health effects on the affected person. It contributed immensely in making an impacted person to experience breathing difficulties, (NIOSH, 2011). It potentiality to increased blood pressures, health rhythm changes, stomach irritation, reflexes, swelling of brains and liver, kidney and heart damage is enormous, . Serious respiratory problems witnessed in many communities can be linked to environmental pollution. According to Omofonmwan and Odia, (2009) respiratory problems,

coughing up blood, skin rashes, tumors, gastrointestinal problems, different forms of cancer, an malnourishment, were commonly reported ailments in many communities.

Establishment of Relevant Government Agencies due to Pollution Matters

The Federal Ministry of the Environment is legally vested with the responsibility of protecting and sustaining the Nigerian environment through the formulation and implementation of regulatory frameworks (Decree 42, 1988). The National Policy on Environment on the other hand is one of the instruments developed by the Ministry to carry out its tasks (FEPA, 1989).

The document describes guidelines and strategies for achieving the policy goal of sustainable development (Ntukekpo, 1996).

Also, the Federal Government has set up a new commission, the Oil Detection and Response Commission with the sole purpose of managing oil spill problems in the Nigerian Coastal and Inland waters (Agha et al. 2002).

Other agencies that deal with pollution are the National Maritime Authority, which deals with pollution in Nigeria's maritime waters. In addition the Department of Petroleum Resources is the environmental watch dog of pollution in the oil industry (FGN DPR, 1992).

The National Environmental standards and Regulations Enforcement Agency NESREA came into being in 1992 (Federal Republic of Nigeria, 2007). All these agencies are expected to play an important role in managing pollution.

The seemingly conflicting roles and responsibilities among the agencies notwithstanding, if there is good intention to ride the nation of all pollutants. Due to increasing awareness on the need to prevent and control spills in Nigeria, the Clean Nigeria Associates (C.N.A.) was formed (FGN, 1981).

The C.N.A. is a consortium of eleven oil companies operating in Nigeria, including N.N.P.C. The primary purpose of establishing the C.N.A is to maintain a capability to combat spills of liquid hydrocarbons or pollutants in general. The Clean Nigeria Associates employ the whole range of different methods and techniques for responding to oil spills (Agha et al, 2002).

STATEMENT OF PROBLEM

The problem of black marketing oil spill waste has only come to be recognized as a priority problem over the past two or three decades. Measures to control black marketing oil spill waste in Nigeria as a whole seem inadequate. Studies on environmental health problems associated with it were also poor. Determination of the major precipitating factors in actual sense or potential environmental disaster was not well known. The

identification of the series of gradual environmental degradation associated with oil pollution impacting on waters, destruction of aquaculture, vegetation and agricultural land call for all concerned Agha, et al. 2002; Hussain, 1997; Dioka, Orisakwe, Adeniyi, Meludu, 2004; Eragha, & Irughe, 2009; Akpofure, 2008).

The near absence of a standard law to support the agencies to fight the polluter's exacerbated the level of environmental degradation in Nigeria, Akpofure, 2008). The coming up of the Environmental Impact Assessment law in 1991 gave impetus to an environmental awareness and the need to care for the environment, (Decree no. 42, 1992).

The issuance of Environmental Guidelines and Standards for the Petroleum Industry in Nigeria provides the first details of the process and procedure of EIA by the Government in Nigeria (Federal Republic of Nigeria 1989).

Study conducted by Hoda, (2015), reveals that the intake of elements by plants irrigated with polluted water is an issue of concerned.

The study further reveals that most elements taken by the plants were concentrated more in soil than water.

The affirmation that the heavy metals concentration are usually low in the irrigated wastewater as a results of natural circle and filtration may be reverse because its usage for a long time could lead to accumulation of such heavy metals in the soil and the surrounding water as well (Hoda, 2015).

The study conducted by Eragha, and Irughe, (2009) revealed that there is an established relationship between serious pollution associated with oil pollution and prevalence of diseases like HIV/AIDS as a results of pollution induced poverty. Obinna, Anejionu, Blackburn & Whytt (2011) potent that pollution from oil exploration in the Niger Delta of Nigeria has to greater extent endangers the natural ecosystem. The culprit has been identified to be Gas flaring as one of the strongest agent of this environmental pollution in the region. This study therefore is concerned with the short term public health problem as well as long term environmental implication of this human activity with the aim to making positive contributions towards its reduction.

AIM AND OBJECTIVES

Generally the research determined the environmental and health effects of black market oil spill waste in Chikun Local Government Area of Kaduna state Nigeria. The specific objectives are:

- To determine the level of black marketing oil spill waste accumulation on the soil
- To compare the result obtained in (i) above with the controlled sample.
- To assess the health implication of black marketing oil spill on soil and people's health.

Table 1: Results of the analysis for soil samples

Parameters	Unit	Concentration			
		A	B	C	D
Cadmium (Cd)	Mg/kg	0.20	0.66	0.10	0.01
Lead (Pb)	Mg/kg	1.60	3.45	1.88	1.26
Zinc (Zn)	Mg/kg	3.40	6.60	4.61	2.40
Copper (Cu)	Mg/kg	2.60	6.86	5.61	2.71

Source: Laboratory analysis, 2014

Table 2: Results showing the organic carbon levels (mg/kg⁻¹) and pH reading in soil

S/No.	Sample	OC (mg/kg ⁻¹)	pH (Soil)
1.	A	3.65	7.29
2.	B	4.87	7.12
3.	C	2.73	7.56
4.	D	1.86	7.11

Source Laboratory Analysis, 2014

RESEARCH METHODOLOGY

Study Area

Chikun is a local government area in Kaduna state with its administrative headquarters in Kujama town. It has an estimated area of 4,645km² and a population of 368,250 as at the 2006 census.

Sampling and Analysis

Purposive sampling technique was used in collecting the soil samples.

The soil samples were collected from the impacted area, the focus of the sampling was the top soil, while another Table 1, presents the results of the laboratory analysis of the five samples collected. The results reveal the total concentration of the four chemical elements tested minus pH. The results of cadmium (Cd) as presented on A,B,C,D, so also are Lead (Pb), Zinc (Zn) and Copper (Cu).

Table 2, presents the laboratory analysis results of organic carbon and pH found in the soil within the vicinity of the activities of the black marketers. The results are

Table 3, presents the set standard or acceptable threshold limit level by the Federal Environmental

sample of soil was taken from the site that has not been contaminated with oil spill waste to act as the control (i.e. reference soil).

The method used for laboratory analysis was the conventional diethalenetriamine pentaacetic acid (DTPA) chelation method as applied to tropical soil (Juo, 1983). All samples were analyzed for cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn) using a Flame Atomic Absorption Spectrophotometer. pH was determined by using a pH meter and organic carbon by the walkey black chromic acid titration method.

RESULTS AND DISCUSSION OF FINDINGS

attributed to the continuous indiscriminate spill of the oil in the process of transfer loading from the trucks and smaller litre retail to motorcycle, domestic power generator users, irrigation purposes, cottage industrial customers interested in the products.

Sample 'A', for OC was found to be 3.65 and pH in the same sample reveals 7.29, sample 'B', OC stood at 4.87 and pH 7.12, sample 'C' OC reveals 2.73 and pH 7.56 and finally sample 'D' 1.86 for OC and 7.11 for pH. Protection Agency now (NESREA) of Nigeria in 1991 and the standard sets by USEPA.

Table 3: Standard limit values set for Cd, Pb, Zn, Cu, Oc and pH in the soil (mg/kg)

Parameters	FEPA (1991) Standard in soil (mg/kg)	USEPA (Mg ^L ⁻¹)
Cadmium (Cd)	3 – 6	5 µg/l
Lead (pB)	250 – 500	15 µg/l
Zinc (Zn)	300 – 600	2.0 or 5000 µg/l
Copper (Cu)	Not fixed	1.300 µg/l
Organic carbon	Not fixed	0.5wt%-2 wt%
Ph	6 – 9	6.5-8.5

Source: FEPA, 1991 and USEPA

Table 4: Mean value of the Results compared with FEPA Standards

Parameters	Soil sample (mg/kg)				Mean value (mg/kg)	FEPA Standards in soil (mg/kg)	USEPA (Mg ^L ⁻¹)
	A	B	C	D			
Cadmium (Cd)	0.17	0.38	0.27	0.14	0.27	3 – 6	5µg/l
Lead	1.48	3.20	2.31	1.21	2.31	250 – 500	15µg/l
Zinc	3.06	6.64	4.99	2.51	4.87	300 – 600	200 -5000µg/l
Copper	3.20	6.95	5.01	2.62	5.02	Not fixed	1000 or 1300µg/l
Organic carbon	3.65	4.87	2.73	1.86	3.72	Not fixed	0.5wt%-2 wt%
Ph	7.29	7.12	7.56	7.11	7.32	6 – 9	6.5—8.5

Source: Laboratory test 2014

The standards in table 3 were used to compare the results obtained from the laboratory analysis and the discussion and findings from this research was ensued in table 4

Cadmium

The value obtained on table 4, shows that the concentration of cadmium is higher in all the samples compared to the sample collected from the uncontaminated point that is sample D which is the control sample. The result of the comparison reveals a difference of 0.95mg/kg. Significant variation was observed between the various samples with sample B on table 1 having the highest Cadmium concentration of 0.66mg/kg. A part from black market spill identified in this study to have contributed to concentration of cadmium in the study area other sources includes, burning fossil fuels, oil and incineration of municipal waste such as plastics and nickel. Once on the ground, cadmium moves easily through soil layers and is taken up into the

DISCUSSION OF RESULT

food chain by uptake by plants (Hoda, 2015). Meanwhile inhalation of cadmium fume can cause kidney damage (Atolaiye and Labaran, 2010). Study conducted in a Udege mining site in Nasarawa state of Nigeria reveals a mean concentration value of cadmium of 0.34 mg/kg on the site, this is lower than what was obtained in this study. Though in addition to cadmium identified by the study of Atolaiye and Labaran, (2010), there were concentrations of other elements such as potassium, sodium, nickel, magnesium in the soil of their study area. However, the concentration of cadmium from values obtained in the soil samples is less than the permissible limit sets by FEPA but higher than the standards set by USEPA. This therefore shows that the activities of the black marketers in the form of oil spill portent serious consequences to the health of the community and the scavenging animals in the study area. It simply means it

There is adverse health effect on human and animals. One of the effects known as a result of cadmium ingestion is kidney problem. Another serious health consequence of cadmium includes a cumulative poison with toxicity. This toxic generated as a result of cadmium accumulation has not been confirm to be of either biological importance nor beneficial to human. But it has been confirm to serving as a promoter of renal arterial hypertension. In addition to causing kidney problems an elevated concentrations expedite anemia, retardation in child growth, and to a higher degree death (Atolaiye, & Labaran, 2010).

Lead

The concentration of lead is higher in the soil samples of the three contaminated points i.e. sample A (1.6mg/kg), B (3.45mg/kg) and C (1.88mg/kg) compared to the control point i.e. sample D (1.26mg/kg). When the controlled sample was compared with the mean of the remaining samples, a difference of 1.05mg/kg was recorded. This is due to several activities that are being carried out along the road sides day by day. These levels may reflect the long time selling and transporting of black market oil. It was revealed by Eregha and Irughe (2009) that higher lead concentrations in soils have toxic effect on microorganisms inhabiting the soil which consequently alters the flora and fauna of a location. Lead has been found to be the major cause of hypertension, impairment of central nervous system and other respiratory problems in adult (Dioka et al., 2006). Moreover, the concentration of lead obtained in the soil samples is less than the permissible limit by FEPA and USEPA and therefore will have no adverse effect on human health. An incidence recorded at the Zamfara mining site with traces of lead residues recorded a number of casualties of the local inhabitant near the mining sites. A deputy Director of the Zamfara state Environmental Protection Agency was recorded dead and was said to have recorded high dose in his blood. Doctors without Borders (2010) Borders/Médecins Sans Frontières (MSF) participated actively in trying to rescue those found to have ingested high percentage of lead as results of illegal mining activities in Zamfara state of Nigeria. As the time the doctors stated the rescue operation an estimated 400 children were said to have died (MSF, 2010). From the dead bodies a Laboratory test confirmed the presence of high doses of lead in the blood of the surviving children. In another village where the careless mining operations took place called Bagege an estimated 1,500 children are exposed to high dosage of lead poisoning (Michika, 2011). The laboratory tests further revealed that 500 children ingested into their blood lead below 45 µg/dl are on clinical follow-up and does form part of the active treatment. Out of the many children hospitalized 300 have been discharged some fully recovered while others are improving but of those hospitalized 60 children were

recorded dead. One very important issue to watch on the level of vulnerability is younger children are more with their higher ingestion rate of lead around 40-50% when compared to 10% for an adults (Gayton, & Mwatia, 2011).

Zinc

The value obtained that the concentration of Zn is higher in all the samples compared to the control sample. A difference of 2.47mg/kg was recorded between the control sample and mean value. Although zinc occurs naturally, most Zn finds its way into the environment because of human activities. In soils, most of the Zn stays bound to the soil particles, when high levels of Zn are present in soils; such as at hazardous waste site, the metal can seep into the groundwater thereby contaminating it if in excess. The Environmental Protection Agency (EPA) in most developed countries the environmental protection agencies set aside suspected hazardous waste sites with the plan of monitoring and evaluating the risks factors in such areas. EPA usually placed these potential sites in the National Priorities List (NPL) and will be subjected to a long-term federal clean-up programme of the agency. From the selected sites EPA was able to identify the presence of Zinc in at least 985 out of the 1,662 registered sites by NPL (Agency for Toxics Waste Substances Registry ATWSR 2005). Most of the factors to consider when trying to identify the effects of zinc or any substance on victim is establish the dose of substance in his (quantity), know how long (time), and media (source) of contact, this is in addition to knowing the age, sex, diet ,family traits, lifestyle, and health state of the victim (ATWSR, 2005).

Industries releases dust containing higher levels of Zn into the air we breathe (WHO, 1996). Eventually, the Zn dust will settle out onto the soil and surface waters. Rain and snow also can remove zinc dust from the air. High levels of Zn in the soil, water and air are often found along with high levels of other metals like lead and cadmium (EU, 2013). In most industries zinc is being used as coating material for steel and iron and related metals to protect them from corrosion using galvanization process. The makings of cell batteries as well as alloys are made possible by mixing zinc with other metals in most smelter industries. Bronze, brass, zinc and copper alloy are used to make financial coins or pennies in most countries (ATWSR, 2005).

Zinc is an essential nutrient needed by the body for growth, development of bones, metabolism and wound – healing. Too little Zn in the diet can cause adverse health effects such as loss of appetite, decreased sense of taste and smell, lowered ability to fight off infections, slow growth (Vangednderen, 2012). A short term illness called metal fume fever can result if people in the environment breathe very high level of Zn dust or fumes. This condition, which usually lasts from 28 to 48 hours, causes fever, excessive sweating and weakness.

However, the concentration of zinc i.e. the value obtained from the four soil samples are less than FEPA and USEPA standard and therefore will have no adverse effect on human health and the environment. But continuous accumulation in the environment above the threshold level could result in adverse health consequences.

Copper

The concentration of copper is higher in all the three contaminated soils compared to the control sample. Significant difference between the contaminated samples on sample A and B shows a difference of 3.2mg/kg. When the mean was compared with the controlled sample, a difference of 2.47mg/kg was recorded.

However, the concentration of copper i.e. the value obtained from the four soil samples are lower than both the FEPA standards since it is not fixed at the same time the limits set by USEPA was also not violated and will have no adverse effects on human health and the general environment. At the same time an uncontrolled mining and illegal copper activities could generate serious problem to both health and the environment.

Routes of Exposition

An analysis conducted by the International Coppers Association ICA (2015), shows that Copper is abundant in the various food we take, water we drink and the air we breathe. This therefore shows that copper forms part of our daily absorbed elements at different quantities depending on the kind of food we take (George, 2015). This is necessary because its intake is essential for human and animal healthy living on earth but at a desired quantity. Knowing full well that human's body can handle proportionately large concentrations of copper, but any amount exceeding the medically accepted level can still cause eminent health problems (ICA, 2015).

Living near smelter industries exposes such inhabitants to copper related illness, but mere ingestion through air outside the smelter related environment may pose no or less health challenges, (ICA, 1992; Ministry of Health London, 1991).

Effects

The usual occupational exposure related sickness from copper ingestion includes contagion to a flu-like condition known as metal fever. Though it hardly stays for long time it has to be of medical knowledge residual effects of two days and is caused by over sensitivity (Ministry of Health London, 1991). This is in addition to causing nose irritation, headaches, stomachaches, mouth and eyes irritation, dizziness, diarrhea and vomiting. It at extreme condition if intentionally taking an overdose causes the damage of the human kidney and severe case death. Its

carcinogenic ability has not been fully confirmed medically (ICA, 2015).

Organic Carbon

The value obtained shows that the concentration of Oc is higher in all the samples of soil compared to the control sample with 1.89mg/kg difference between the mean value and control sample. Sample B (4.87mg/kg) has the highest value. Chronic inhalation to organic carbon may result in temporary or permanent damage to lungs and heart. Most food we eat is made up of compounds of carbon, giving a total carbon intake of 300g/day. Digestion consists of breaking these compounds down into molecules to make it easy for absorption into the wall of the stomach or intestine. Such absorbed molecules are further journeyed to the blood and to other sites where they are utilized or oxidized to release the energy for body usage. No negative environmental effects have been reported. Any soil that is defined as having high organic content are naturally rich in organic matter principally as a result of climatic factors. This type of soil contains more than 30 percent organic matter, this high concentration makes such soil to not be an important soil for cropping (Bot and Benites, 2005). However, the concentration of organic compound from the soil samples have no adverse effects on human health since it is not fixed which is believed to be less than the FEPA standards but higher than the USEPA standard it therefore needs to be checked to avoid impacting on the lives of the inhabitants of such areas.

pH

From the values obtained, the pH is higher in all the samples of soil compared to the control sample i.e. "sample D". However, the concentration of pH is within the accepted permissible limit recommendation by FEPA and USEPA of 6.5-8.5, all the pH, are within 7.12 and less, therefore, it will have no adverse effect on human health. A study conducted by Hoda, (2014), reveals that technically a pH of a solution is calculated as the negative common logarithm of the combination of the hydrogen ion activity thus: $\text{pH} = -\log(\text{H}^+)$. When hydrogen ion is diluted in solution it is approximately equal to the hydrogen ion concentration. To measure the pH of water is to determine the acid-base equilibrium and, this is usually controlled by the carbon dioxide-bicarbonate-carbonate equilibrium system in most natural waters. This shows that an increase in carbon dioxide concentration in water causes the pH level to become lower, while the opposite will cause it to rise.

A study conducted by Hoda, (2014), reveals that a pH level of 10 injected into the abdominal skin of a mouse presents an irritation after 6 h (9). The same dose to a rabbit presents an intracutaneous skin irritation above pH 9.0 (9). In addition, a pH above 10 has been reported to

be an irritant to the eyes of rabbits (9). No significant eye effects were reported in rabbits exposed to water of pH 4.5 (10). Exposure to extreme pH values results in irritation to the eyes, skin, and mucous membranes. Eye irritation and exacerbation of skin disorders have been associated with pH values greater than 11. In addition, solutions of pH 10–12.5 have been reported to cause hair fibres to swell (10). In sensitive individuals, gastrointestinal irritation may also occur. Exposure to low pH values can also result in similar effects. Below pH 4, redness and irritation of the eyes have been reported, the severity of which increases with decreasing pH. Below pH 2.5, damage to the epithelium is irreversible and extensive (10). In addition, because pH can affect the degree of corrosion of metals as well as disinfection efficiency, it may have an indirect effect on health.

CONCLUSION

Although adverse health effects of heavy metals associated with spill from the black marketing oil have been known for a long time, exposure to these hazards is on the increase with fuel shortages as a result of the breakdown of the Nigeria's refineries. Remediating soils contaminated with oil spills is necessary to reduce risks and make the land more productive. This is so because the higher the concentration of organic matter the higher will be the in cultivability of the soil. This paper examined the environmental effect of black market oil spill contamination in soil. Soil samples were collected from the contaminated areas and were analyzed in the laboratory. The level of heavy metals such as copper, cadmium, lead and zinc, organic carbon and pH in soil and their potential effects on human was determined in this study. The result showed that all the parameters analyzed were within the standard limit set by FEFA, 1991 and USEPA; the results of all parameters for various samples are slightly above the mean value of the control sample. This simple mean that an effort need to be made to herald the trend before it get bad.

RECOMMENDATIONS

- (1) The government through the Federal Ministry of Environment, NOSDRA, NESREA and States Environmental Protection Agencies should sanitize the community by putting in place various effective monitoring and auditing mechanisms in order to ensure that the individuals comply to the safety of the environment related laws. If perfectly plan it can lead to the stoppage of this new trend of environmental pollution.
- (2) Considering the presence of the heavy metal in soils associated with black market oil spills, toxicity and persistence a policy measures should be drafted in national and state level to reduce potential ecological and

human risks caused by excessive concentrations of heavy metals in the environment.

- (3) Oil spill response system should be upgraded to meet up with the requirement of world standard, especially ISO 18001.

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