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Research Article

PETROLEUM HYDROCARBON POLLUTION IN QUA IBOE ESTUARY: IMPLICATION FOR FISHERIES DEVELOPMENT

John O. Esin¹, Pedroesin A Esin² and Jenny J. Ntamark³

^{1,2}Department of Hydrology & Water Resources Management, Maritime Academy of Nigeria, Oron, Akwa Ibom State, Nigeria

³Department of Urban and Regional Planning, University of Uyo, Akwa Ibom State, Nigeria

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ABSTRACT

The study examined the effect of hydrocarbon pollution on aquatic resources and water quality in Qua Iboe estuary, Nigeria. Specifically, the study was designed to identify the concentration levels of heavy metals arising from petroleum activities on marine resources using fish genera composition, condition factor and tissue analysis. Data for the study was obtained by extracting 1 gram of six different species of fisheries obtained from the estuary and macerated in 10ml distilled water and the aqueous extract used to analyze the heavy metal concentrations. Adult specimen of fish species were collected upstream and down streams from the Qua Iboe estuary using combination of traps and gill nets to determine the fish condition factor. The fish specimens were kept in coolers packed with ice and transported to the laboratory where the wet weight and total length of individual fish was measured with an electric weighing balance and a meter rule, employed in calculating the fish condition factor. Fish tissue analysis for heavy metal was carried out using PerkinElmer flame and graphite furnace atomic spectrometer (PerkinElmer, 4100ZL) which exposed micrograms per gram. The result revealed that the condition factor (k) values ranged between 0.784 to 0.895. These were outside the recommended level. Also, the tissue analysis of the different fish species showed that the concentration of lead (pb), Iron (Fe), Copper (cu), Cadmium (cd), Manganese (Mn), and Zinc (Zn) approached critical levels. This implies that petroleum exploration and exploitation activities pose eminent risk to fisheries development as obvious ecological stressors and perturbation abound in the estuary. Based on these findings, the study strongly recommends the need for a sound and effective environmental monitoring designed programme to be carried out by the oil and gas industry operating within the Qua Iboe river estuary of Ibenu with a view to reducing its negative effect on the estuary. Also there is need for timely clean up of pollutants from oil exploration and exploitation activities in the estuary to be done to cushion this negative effect on the aquatic life forms.

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INTRODUCTION

Since the discovery of crude oil in Nigeria in 1956 at Oloibiri in Bayelsa State in Niger Delta region of Nigeria, oil spills have posed a serious threat to the country especially in the coastal environment of the oil producing areas. Oil spill is the uncontrollable leakage or discharge of petroleum products into the bodies of water or land. The magnitude of the impact of crude oil pollution on the aquatic environment as well as its impact on the socio-cultural and economic well being of the people in vulnerable areas of oil spills cannot be over emphasized. According to the Department of Petroleum Research, an estimated quantity of 1.89 Million barrels of petroleum was spilled into the Niger Delta region between

1976 and 1996 (DPR, 2002). A UNDP Reports states that there have been a total of 6,817 oil spill incident between 1976 and 2001, which account for a loss of three million barrels of oil of which more than 70 percent was not recovered. Most of these spills occurred off-shore (69%), a quarter was in swamps and 6% on land (Akpofure, 2008).

In Ibenu Local Government area, the devastating impact of oil spillage in this area has caused hazards both on the environment and the ecosystem with a parallel effect on biodiversity and human health. The irony of the situation is that those who bear the cost of the environmental damage are the people who live in the oil producing area and not the oil companies. In the Niger Delta region, it has been observed that

*Corresponding author: **John O. Esin**

Department of Hydrology & Water Resources Management Maritime Academy of Nigeria, Oron, Akwa Ibom State, Nigeria

have thickness of about 180 meters with clay and gravel formation. The mineralogy of the coarse-silt and fine sand fractions of the coastal plains sand indicates the dominance of quartz while minerals such as Iron (Fe₂ O₂) and aluminum oxide (A₂ O₂) constitutes less than ten percent in the fraction. The area is blessed with an abundance of surface water supply because of its high rainfall. Relative low potentials evaporation, very high drainage density and streams frequency. The abundant of surface and ground water resources in the area, which area estimated at over 5,000 million cubic meters are also due to the porous sandy aquifers of the coastal plain sands (AKS,1997). Boreholes can be drilled any in the area with little efforts.

The detailed breakdown of the National and State official population totals of the 2006 census of Akwa Ibom State reveals that Ibeno Local Government Area inhabits 78,380 people. The male population constitutes 44,311, while female population is 34,069 people. The population density for Ibeno Local Government Area is about 317 persons per square kilometer. The quaternary glass sand of the Ibeno coastline is a raw material for glass making industries. It is also a potential port town if only the Itak Akpa drainage system could be properly harnessed at Upenekang near terminal bridge and immigration post. It has a potential for fish-processing industries, for glue making and livestock feeds production. It is a potential market town for fish and other aqua-product sales, timber logs and fishing tools and equipment sales repairs and construction. It is also a potential site for boat construction and repairs. Ibeno Local Government Area has tourism potential at the Tourist Beach at Inua Eyet Ikot and Iwuo Opom Opolom and also rich in cash crops – cashew and rubber, which might attract rubber and food processing and drinks industries.

Information on the elemental and chemical properties of water samples in the study area was obtained from the laboratory analysis of water samples collected in the area. Water samples were collected at four points in the study area (Upenekang, Mkpanak, Inua Eyetikot and Iwochang). In order to ascertain the quality aspect of the water, the water samples were collected in sterilize two liters plastic containers with cover and was labeled to show different samples and their respective locations. Various titration methods were used to determine some physical and chemical properties of the samples.

The elemental and chemical properties of the samples were analyzed using Gallenkamp Flames Analyzer (Model FGA 330) and Atomic Absorption Spectrophotometer (Model PVE, INICAM SP 2900) respectively. Titrimetric and observatory method were used in determining some physical/chemical properties of the water. The pH values obtained from the analysis were compared with the World Health Organization (WHO) and EEPA Standards values to determine the levels of the pollution of the various samples. The parameters analyzed include THC vanadium, copper, lead, cadmium, nickel, iron and, alkalinity (caco₃) and ammonium (NH₃). All the values were expressed in part per million. Media preparation and culturing were used in determining the variation in the biological properties of the water samples, in order to ascertain the Coliforms and E. coli contents per 100ml of the samples. Also, values obtained from these analyses were compared with FEPA and WHO international standard values.

Adult specimens of fish species were collected upstream and downstream from Ibeno river with the assistance of local fishermen using a combination of trap and gill nets. The fish species were kept in coolers packed with ice and transported to the laboratory where the wet weight and total length of individual fish was measured with an electronic weighing balance and a meter rule. The condition factor (K) of fish was calculated using:

$$\text{Condition factor (k)} = 100 \times \frac{W}{L^3}$$

Where: W = wet weight of fish
L = total length

Fish and periwinkle tissue analysis for heavy metals was carried out using Perkin-Elmer flame and graphite furnace atomic absorption spectrophotometry (Perkin Elmer, 4100ZL) and results expressed in micrograms per gram. The results were also compared with the WHO standard in order to determine their pollution and attendant effects on the aquatic life.

DISCUSSION OF FINDINGS

Table 1 Total Hydrocarbon and Heavy Metals Content of Water Samples in Ibeno

Parameter (mg/l)	Site A	Site B	Site C	Site D	WHO
Total Hydrocarbon	0.01	0.01	0.01	0.1	1.0
Lead	1.0	1.03	2.0	1.0	0.05
Nickel	0.024	0.031	0.031	0.029	0.02
Copper	0.03	0.05	0.03	0.01	1.0
Iron	0.67	3.11	3.41	0.85	0.30
Vanadium	0.13	0.10	0.16	0.01	0.02
Cadmium	0.02	0.01	0.01	0.01	0.01
Arsenic	0.02	0.01	0.02	0.02	0.05

Source: Result of laboratory Analysis (2016)
N/B: Site A = Upenekang; Site B = Mkpanak; Site C = Iwochang;
Site D = Inua Eyet Ikot

Table 2 Physio-chemical characteristics of Water Quality in Ibeno

Parameter (mg/l)	Site A	Site B	Site C	Site D	WHO Standard
Temperature	30.10	28.90	31.70	29.90	25 – 28°
Conductivity	189.0	100.0	201.0	163.0	400µs
Alkalinity	241.0	246.0	252.0	246.0	100mg/l
Total Dissolve Solids	29.0	24.4	22.1	37.75	1500mg/l
Total Suspended Solids	3.0	9.0	2.0	4.97	28mg/l
Turbidity	4.00	4.30	4.10	4.10	25 unit
PH	5.7	5.2	6.0	5.7	6.5 – 8.0
Oil and mineral	0.18	0.19	0.19	0.18	0.01mg/l
Salinity	18.30	16.78	17.81	18.60	

Source: Result of laboratory Analysis (2016).
N/B: Site A = Ukpenekang; Site B = Mkpanak; Site C = Iwochang;
Site D = Inua Eyet Ikot.

Table 4 Total Hydrocarbon and Heavy Metal Content in Fish and Periwinkle

Parameter	Fish	Periwinkle	WHO
THC (PPM)	270.2	234	<50PPM
Lead (µg/l)	0.01	0.10	1.7µ
Nickel (µg/l)	0.01	0.06	25-150µ
Copper (mg/l)	101.2	117	204 ^b
Hon (mg/l)	421.3	416	1.0
Vanadium (mg/l)	0.001	0.01	0.1
Cadmium (µg/l)	0.001	0.01	0.2 – 1.8 ^a

Source: Result of Laboratory Analysis (2016).

Table 5 Condition Factor (K) of Fish in Ibeno

Fish species	Condition factor (K)
Synodontis batusode	0.901
Chrysichthys nigrodigitatus	0.892
Macrobachum macrobachion	0.820

Source: Results of Laboratory Analysis (2016).

The study has shown that oil spills from petroleum exploitation and exploration have negative impact on water quality and aquatic resources. The results of the water quality analysis showed that water resources of Ibeno have been polluted mainly by Iron and Nickel while traces of pollution from other sources though with negligible threshold have also been identified. Water pollution from oil spillage in Ibeno is thus a serious concern as the locations of major oil companies and oil servicing establishments are found within the Local Government Area, thereby making oil spillage a major issue of concern (Adhahino and Eyinla, 2009). The pollution of water quality has much impact on aquatic life while human health is impaired. Quite often the quantity of oil spills at a time is so great that even fishes find it difficult to adjust to the polluted state of the marine environment. Water quality is impacted negatively by oil spills or petroleum residues and a great cause for concern if the resources of the marine environment are to be sustained. Incessant oil spills often result in the death of fish larvae and other sea foods in particular and a reduction in fish and shell fish stock in general, thereby leading to scarcity of aquatic resources, and associated nutritional disorders. Aside this, it also leads to the destruction of the sources of livelihood of the residents that entirely depends on the sale of these aquatic resources for their livelihood. This loss of source of livelihood could result in mental agony, stress and anxiety – related problems. Loss of biodiversity due to the high mortality of the fishes and aquatic resources were evident by the condition factor (K) for fish in the study area (Table 5). Thus, the drastic decline in catch per unit efforts as observed during fieldwork is also a clear indication of the adverse effect of oil spills on aquatic resources. Janjua et.al (2006) reported the adverse effects of high condition factor on fish specie performance and productivity.

The eating habit of the residents is such that no one can do without eating substantial quantities of food from aquatic sources each day. Everyone eats crayfish and fish on a daily basis. Others (especially those from the low income class) eat in addition periwinkle and other shellfishes like water snail's oysters etc. Shell fishes are filter feeders and can bio-accumulate toxic substances in their lipophilic tissues. Residents of Ibeno do complain of fish tainting due to oil spills. There has been a growing fear of disease outbreak arising from the consumption of polluted aquatic resources, thus making the inhabitants allergic to fish consumption. Added to malnutrition and skin diseases, unprecedented increase in some disease condition like persistent cough, weakness, stuffy nose, itchy eyes and difficulty in urination were observed among the inhabitants during field survey.

Laboratory tests conducted on water and fish in the study area reveals that the water in the marine environment is harmful to aquatic and terrestrial resources. The laboratory results further shows that *E.coli*, *proteus sp*; *Enterobacter sp*, *Aeromonas sp*; salmonella sp, Klebsella sp, had become inseparable member of the study area due to contamination by fresh raw faecal waste.

This may have accounted for the high incidence of typhoid, dysentery, cholera, and related diseases as observed during field survey. The link between public health and water lane related diseases have long been established (WHO,2007).

Heavy metals top the hit of most frequently occurring and toxic contaminations. Accumulation of heavy metals in aquatic ecosystems is of great importance. The progressive and irreversible accumulation of these metals in various organs of marine creatures (Table 5) ultimately leads to mental related diseases in the long run because of their toxicity, thereby endangering the aquatic biota and other organisms. Udoette (1997) reported that ingestion of hydrocarbon (directly and indirectly through contaminated food) results in poisoning. Mutagenic, carcinogenic, genotoxic, immunotoxic and neurotoxicological effects of exposures to hydrocarbon products have been well documented (kanoh,et.al,1990; Ohnishi et.al,1990;Zhang and Jensen,1991). Fishes being one of the main aquatic organisms in the food chain may often accumulate large amount of certain metals. Essentially, fishes assimilate these heavy metals through ingestion of suspended particulates, food materials and or by constant ion-exchange process of dissolved metals across lipophilic membranes like the gills/absorption of dissolved metals on tissue and membrane surfaces.

The effect oil spills on the quality of water and aquatic resources, cannot be under estimated for it is harmful to aquatic resources and human health, the quality of water is one importance phenomenon for livelihood, since the population of people in Ibeno are basically fisherman complains by fishermen on how this menace could be curb has been on the forefront of everyday discussion in business places and working environment in Ibeno L.G.A.

CONCLUSIONS AND RECOMMENDATIONS

Conclusively the study has confirmed that there is a significant effect of oil spills on the aquatic resources and the water quality in the Ibeno. The study strongly recommends the need for a sound and effective environmental monitoring designed programme to be carried out by the oil and gas industry operating within the Qua Iboe river estuary with a view to preventing or minimizing the possible negative effect of Petroleum Hydrocarbon pollution in the estuary. Also there is need for timely clean up of pollutants from oil exploration and exploitation activities in the estuary in order to cushion this negative effect on the aquatic life forms.

References

- Aghalino, S. O. and Eyinla, B. (2009). Oil Exploration and Marine Pollution: Evidence from the Niger Delta, Nigeria. Department of History, Faculty of Arts, University of Ilorine, Nigeria.
- Akwa Ibom State(1997). Map of Akwa Ibom State (Political). Compiled and Drawn by Cartographic Directorate, Bureau of Lands, Surveys and Urban Development, Uyo.
- Akpofure, E. A. (2008). *Oil Spillage in the Nigeria's Niger-Delta: Psycho morphological and Empirical Overview*. International Association of Impact Assessment, Opulence Environmental Service Ltd.

- Chindah, A. C. and Braide, S. A. (2000). *The Impact of Oil Spills on the Ecology and Economy of the Niger Delta*. In Proceedings of the Workshop on Sustainable Remediation Development Technology held at the Institute of Pollution Studies, Rivers State University of Science and Technology, Port Harcourt.
- Janjua, N. Z., Kasi, P. M., Nawaz, H. Farooqui, S. Z., Khuwaja, U. B., Najam-ul-Hassan.; Jafri, S. N.; Lutfi, S. A.; Kadir, Memedi. M. and Sathia, K. N. 2006. *Acute health effects of the Tasman Spirit oil spill on residents of Karachi, Pakistan*. BMC Public Health Journal, v.6. (Online) Available
- Kanoh, T., Fukuda, M., Itayami, E., Kinouchi, T., Nishifuyi, K., and Ohnishi, Y. (1990). Nitro-reaction in Mice Injected with Pyrene during Exposure to Nitroendioxides. *Mutat. Res.* 245-1-4
- Nwilo, C. P. and Badejo, T. O., (2005b). Oil Spill Problems and Management in the Niger Delta. International Oil Spill Conference, Miami, Florida, USA.
- Ohnishi, Y., Kinouchi, T., Nishifuyi, K., Miyamishi, K., Kanoh, T., and Fukuda, M. (1990). Metabolism of 1-nitropyrene oxides and effects of nitrogen dioxide on arene activation, in: Howard, P.C., Hectit, S.S., and Beland, F.A (eds.) *Nitroarenes: Occurrence, Metabolism and Biological Impact*. New York: Plenum Press. Pp85-93.
- Oni, S. K., Olayemi, J. d. and Adeboye, J. D. (1983). Comparative physiology of Three Ecologically Distinct Fresh Water Fishes, *Alestes nurse* (Ruppell), *Synodontis schall* (Bloch). S. Schinelder and *Tilapia Zilli*. (Gervais)". *Journal of Fish Biology* 22: 105 – 109.
- Udoette, U.B. (1997). Effect of Administration of Qua Iboe Light Crude Oil on Biochemical Parameters in Albino Wistar Rats. M.Sc. Thesis, Biochemistry Dept., University of Calabar, Calabar, Nigeria.
- Umo-Udo, N.S, Okijie, S.R and Akpabio, E.M. (2016). Conflict in the Niger Delta Region of Nigeria: Sources, Implications and Suggested Remedies. *Akwa Ibom State University Journal of Social and Management Sciences (AJSMS)*. Vol.1, Nos 2&3.
- WHO (1997). Health and Environment in Sustainable Development: Five Years After the Earth Summit. WHO/EHG/978. Geneva, WHO.
- Zhang, L.H., and Yensen, D. (1991). Site Specificity of N-methyl-N-nitrosourea- induced Transition Mutation in the hprt gene. *Carcinogenesis* 12:1903-1909.

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