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STRATEGIES FOR OIL SPILL MANAGEMENT IN THE NIGER DELTA: A CASE STUDY OF BONNY RIVER

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ABSTRACT

Environmental degradation associated with petroleum oil exploitation activities in the Niger Delta is the most discussed contemporary issue in Nigeria. Ironically, there are hardly outlined strategies for the management of oil spill in the Niger Delta. The aim of this study is to examine the oil spill scenario in Bonny River (Niger Delta) and to suggest strategies for reducing the impact of oil spill on the ecology of the River. To determine the level of THC impact along the Bonny River, 12 sample stations were established along the Bonny River. Total Hydrocarbon (THC), Nickel and Vanadium concentration were determined for sediment samples collected at the sample stations. THC values obtained for all the sample location were generally higher than the biogenic level of 50mg/kg. The values obtained for Nickel and Vanadium indicate that the hydrocarbon is from petroleum sources. THC values obtained for the mesohaline zone were generally higher (172.5 – 2342.5 mg/kg) than those obtained for polyhaline (125.8 mg/kg to 325.3 mg/kg) and oligohaline zones (124.5 mg/kg (BN 2) to 1265.2 mg/kg). The high levels of THC in the sediment will persist as long as oil is spilled into the environment due to oil exploitation activities. Mitigation measures suggested are the use of pipes with higher tensile strength and hardness that can hardly be cut by conventional tools. It is also suggested that National Petroleum Corporation should reactivate and coordinate the oil spill response outfit, CLEAN NIGERIA for more efficient response to oil spill. Oil companies should also take advantage of the technology of transverse drilling to site oil facilities at locations where they can be better monitored to prevent wilful damage by irate youths.

Keywords: Oil Spill Management, Niger Delta, Bonny River.

INTRODUCTION

The Niger Delta covers about 50% of the total length of the Nigerian coastline; there are 21 major River channels from Benin River to Imo River. These are: Benin, Escravos, Forcados, Ramos, Dodo, Pennington, Digatoru, Bengatoru, Kulama, Fishtown, Sangana, Nun, Brass, St. Nicholas, Santa Barbra, St. Bartholomew, Sombriero, New Calabar, Bonny , Andoni and Imo River. All these rivers open to the Atlantic Ocean. Generally, the Niger Delta is characterized by sandy shoreline backed by extensive mangrove swamp and barrier islands separated by tidal channels.

The region is characterized by semi–diurnal tidal regimes with tidal amplitude of about 1.2 meters high and ebb flow reaching higher velocities than flood flow. The Niger Delta is rich in biodiversity with a unique feature as the intertidal mud flat. The intertidal zone is the breeding ground of most aquatic forms and it is the nutrient processing zone of the brackish water ecosystem [1-2], this is responsible for the relatively high environmental sensitivity index in most parts of the Niger Delta [3]. Environmental degradation or pollution associated with petroleum oil exploitation activities in the Niger Delta is the most discussed contemporary issue in Nigeria. Ironically, the extent and dynamics of degradation is sparingly understood and there are hardly outlined strategies for the management of oil spill in the Niger Delta. The aim of this study is to examine the oil spill scenario along the Bonny River and to suggest strategies for reducing the incidence and impact of oil spill in Bonny River.

Method for Determination of Oil Spill Scenario in Bonny River

A total of 12 sample stations were established along the Bonny River, between Bonny and Port Harcourt, a distance of 56 kilometres. The location of the sample points are indicated in table 1. The River was divided into three sections based on salinity differences. These were Polyhaline, Mesohaline and oligohaline zones.

Bonny R. Stations	GPS Reading	
	Northing	Easting
BN1	N 04^0 26.818	007^0 10.633
BN2	N 04^0 32.048	007^0 10.211
BN3	N 04^0 38.164	007^0 07.354
BN4	N 04^0 40.235	007^0 05.932
BN5	N 04^0 42.848	007^0 05.316
BN6	N 04^0 46.407	007^0 04.059
BN7	N 04^0 48.837	007^0 02.826
BN8	N 04^0 48.580	007^0 04.608
BN9	N 04^0 45.287	007^0 00.391
BN10	N 04^0 45.487	007^0 00.091
BN11	N 04^0 46.248	006^0 59.719
BN12	N 04^0 46.879	006^0 59.794
Amadi Flat	N 04^0 43.005	007^0 01.234
Saw Dust	N 04^0 43.005	007^0 01.234
Abattoir	N 04^0 43.005	007^0 01.234
Petroleum waste	N 04^0 43.005	007^0 01.234

Table 1: Sediment sample Location In Bonny Estuaries

Sediment samples were collected at the sample stations and were prepared for the determination of Total Hydrocarbon (THC), Nickel and Vanadium. To determine THC, the sample was homogenized and known weight of samples was taken and spike with internal standard. Subsequently, extraction was with about 100ml methyl isobutyl ketone – analar grade. Extract was allowed to settle and then centrifuged and decanted. The supernatant was injected immediately for Gas Chromatograph (GC) analysis. GC analysis of the total hydrocarbons was done by a pye-unicam pu-4500 gas chromatographer equipped with a flame ionization detector. The peak was analysed with a Perkin Elmer LC1-100 laboratory computing integrator interfaced with the gas chromatographer to obtain digital record of the values. For the determination of Nickel and Vanadium, 5g of air dried, 2.00mm sieved, sediment sample was transferred into a clean beaker, 5ml of H_2O_2 was added and evaporated to dryness. 10ml of conc. Nitric acid, 5ml of conc. Sulphuric acid of perchloroc acid were added and heated until strong fume was produced and the mixture of acids was almost dried up. It was allowed to cool, transferred to a 50ml volumetric flask through filtration and made up to mark. Atomic absorption spectrophotometer (AAS) was calibrated with various standards and used to determine the concentration of Nickel and Vanadium in the sample respectively.

RESULTS

In the Polyhaline zone (Electrical Conductivity 2000 to 25000 us/cm^3) of Bonny River estuaries THC concentration ranged between 125.8 mg/kg to 325.3 mg/kg with a mean value of 202.3± 93.93 mg/kg and CV of 0.46, while Ni concentration varied from 0.24 – 0.46 mg/kg with a mean value of 0.37±0.13 mg/kg and a CV of 0.36 and the value for vanadium ranged from 0.09 mg/kg(BN 3) to 0.22 mg/kg (BN2) with a mean value of 0.16± 0.03 mg/kg, CV 19.76%. In the mesohaline zone (Electrical Conductivity 4600 to 9600 us/cm^3) THC values range from 172.5 – 2342.5 mg/kg with mean value of 1022.45± 929.39mg/kg and CV of 0.9%; the value for Ni varied from 0.25 – 0.85 mg/kg with a mean value of 0.475 ± 1.99 mg/kg and CV of 0.56 while V ranged from 0.12 – 0.32 mg/kg with a mean of 0.22 ± 0.10 mg/kg and a CV of 0.46 in the mesohaline zone. Also, THC concentration varied between 124.5 mg/kg (BN 2) to 1265.2 mg/kg, with a mean value of 647.83± 503.51 mg/kg and CV of 0.46 in the oligohaline zone (E.C 750 to 2300 µs/cm). In this zone Ni concentration varied from 0.12 – 0.4 mg/kg with a mean value of 0.24 ± 0.12 mg/kg and a CV of 0.48. The value for vanadium ranged from 0.016 mg/kg to 0.04 mg/kg with a mean value of 0.03± 0.07 mg/kg, CV 24.7%.

DISCUSSION

Petroleum Oil spilled into the creeks and rivers in the Niger Delta is generally influenced by the hydrodynamics of the creek/River; these include the height of tide, water current speed

and direction, and the shape of the creek/ river at the point of spill. As oil spills, it is carried by incoming tidal water into the intertidal zone. On its path it coats the pneumatophores or breathing roots of the mangrove plants, starving the plants of the much needed oxygen. Also the direct effect of the toxic components of crude oil is the outright scorching of the affected roots. The plants die within a period of 6-10 weeks starting from the shoreline inwards to the supra-intertidal zone, a phenomenon referred to as *Die-Back* (IPS, 1989). It is generally observed that the extent of die-back is proportional to the spread of the incoming tide and the width of the intertidal zone at various points. As the oily water recedes at the turn of the tide the intertidal zone is smeared by the stranded oil sleek, coating the surfaces of the intertidal mud flats and vital substrates of the intertidal communities. In this process virtually all the sedentary forms in the area are killed and some of the mobile forms barely escape [4,5].

THC values obtained for all the sample location were generally higher than the biogenic level of 50mg/kg (FME Guidelines and standards 2002). The values obtained for Nickel and Vanadium indicate that the hydrocarbon is from petroleum sources. THC values obtained for the mesohaline zone were generally higher (172.5 – 2342.5 mg/kg) than those obtained for polyhaline and oligohaline zones. Alakiri and Orubiri oil fields located within the area of the mesohaline sample stations are most likely responsible as various oil spills resulting from the operational activities of these facilities over a long period have introduced more hydrocarbon into the system. The high levels of THC in the sediment will persist as long asoil exploitation activities continue and oil is spilled into the environment.

Mitigation measures

The following mitigation measures are suggested to reduce the impact of petroleum oil in the environment.

- The seasoned reasons advanced by the communities that oil spill, as a result of equipment failure and aging oil pipes and the counter argument by the oil companies that oil spills as a result of sabotage from community youths is stale and should be replaced by proactive efforts on the part of the oil companies. One way out of this argument, is to use pipes with higher tensile strength and hardness that cannot be cut with conventional cutting equipment. Detailed investigation on such pipes and the possibility of using for new pipelines and to replace obsolete pipes are needed.
- Most companies have established oil spill response procedures, which are either not practiced in the event of an oil spill or is not efficient enough to contain the spread of spilled oil. Often time, hydrodynamics of the location and the technical input employed at the time of spill could limit the extent of coverage of the spill and so reduce the magnitude of impact of the spill. This was the reason for the formation of CLEAN NIGERIA, an organisation of oil companies operating in Nigeria at that time. The mandate of the organisation is to pull resources that will be deployed to contain oil spilled by member companies. In its earlier years the organisation was effective but over the years it lost steam as rhetoric and the politics of cause of spill between the companies and the communities gained prominence over spill control and impact mitigation. CLEAN NIGERIA should be revived with clearer objectives and regulation, by the Nigerian National Petroleum Corporation.
- Oil companies can take advantage of the technology of transverse drilling to site oil facilities at locations where they can be better monitored to prevent wilful damage by irate youths.
- Political will on the part of various levels of government is needed to create employment and divert the attention of the youths of Niger Delta from vandalizing oil facilities

REFERENCES

[1] IPS -Institute of Pollution Studies (1989). Environmental Data Acquisition of some NNPC Operational Area. Institute of Pollution Studies

Rivers State University of Science and Technology RSUST/IPS/TR/89/03.

[2] Chinda, A. C and S. A. Braide (2001) Meiofauna occurrence and distribution in different substrate types of the Bonny brackish wetland of the Niger Delta. *J. Applied Scs and Environ. Mgt.* Vol. 5 (**1)** 33-41

[3] Research Planning Institute (RPI) Columbia, South Carolina, USA. (1985). Environmental baseline study for the establishment of control criteria and standards against petroleum related pollution in Nigeria. RPI/R/84/4/15-7

[4] Ekweozor, I.K.E, (1989). A review of the effect of oil pollution in West African Environment. Discovery and Innovation. 1(3): 2-14.

[5] IPS -Institute of Pollution Studies (1994). Ekulama II oil spill: Post impact assessment study. Institute of Pollution Studies Rivers State University of Science and Technology, RSUST-IPS—94-03, pages i-v, 1-200.