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ASSESSMENT AND IMPACT OF CURRENT SEWAGE DISPOSAL PRACTICES IN SELECTED NIGER DELTA ENVIRONMENT

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ABSTRACT: *The current waste disposal practice and its impact was studied in selected part of the Niger Delta, Sombrero River, Igbu-ehuda community. Field visits and analysis of biological and physiochemical parameters were used to ascertain the sewage disposal practice and its impact respectively. The findings from the visits show random and open disposal of sewage into the Sombrero River. While the physiochemical parameters indicted slight negative impact. The biological parameters showed serious negative impact attributed to the open defecation into the river. The poor sewage disposal practice was attributed to poverty while its high negative impact on water from the community bore hole was attributed to open defecation into the river and the high water table of the Niger Delta.*

KEYWORDS: Sewage, Niger Delta, Sombrero River, Assessment, Wast Disposal, Nigeria

INTRODUCTION

The designation of Nigeria as the third poorest nation of the world according to an EU (European Union) report at a workshop for Water Supply and Sanitation Sector Reform (WSSSR) program in 2006, gave rise to the need for assessment of the living condition and environment of the poorest communities in Nigeria. The measurement of poverty is not very explicit because it cuts across every facet of human development indices.

However, income level is a major indicator of poverty as it affects almost all aspect of human existence. Most Nigerians earn below $ 1.90 a day, hence Nigerians are generally poor (World Bank report, 2018). Though Nigeria has been appropriately classified as poor, not every Nigerian and not all parts of Nigeria is poor. The Niger Delta region is one of the poor regions of Nigeria because of environmental degradation occasioned by petroleum exploration and exploitation [Kadafa, 2012]. The poverty in this part of Nigeria has made it difficult for many inhabitants to afford the conventional sewage disposal facilities. It is sad to note that the cost of constructing the conventional septic tank is further exorbitant because of the geography and geology of the area.

The Niger Delta is typically a forest swamp with high water table (Abam, 2001). However, it is interesting to note that the physical environment is determined by interplay of many factors which include the geology and hydro-geology of an area. Geologically, Ahaoda east is located in the Niger Delta sedimentary basin. The basin which was formed in the tertiary period, is a prograding sedimentary system with an extensive and densely distributed series of growth faults, with the accompanying rollover anticlines (Short and Stauble, 1967). Stratigraphicaly, the Niger Delta comprises of three formations namely the Akata, Agbada and Benin formations, in order of decreasing age. The Akata Formation is Paleocene in age and is characterized by shale and silt stone. It was deposited in marine environment and has a maximum thickness of about 1000 meters. This formation is the source rock for hydrocarbon in the Niger Delta. The Agbada Formation (Eocene) consists of sandstone alternating with shale layers. It is the reservoir of oil and gas in the Niger delta complex. It has a thickness of about 3000 to 3,750 meters. The youngest formation in the Delta is the Benin Formation (Miocene to recent age), which consists of massive, highly porous sands and gravels with local thin shale inter-beds. The formation varies from 0 (north of the Niger delta) to about 200 meters (south of the Niger delta). This formation is the major aquiferous layer in the Niger Delta (Udom *et al,* 1997). The sand and shale interlocations in the Benin Formation results to a multi-aquifer situation in most parts of the Delta (Amajor, 1991). In Ahoda East, the aquifer is very extensive, unconfined, with water table generally high (between 1 to 15m). Amadi (1986) has reported yields of about 1.7 m^3/h to 181.8 m^3/h and transmissivity of 60 m^2/d to 1460 m^2/d for aquifers in some parts of the Niger Delta.

The combined effects of poverty, high cost of domestic sewage disposal facilities occasioned by high water table resulting from the hydro geology of Igbu-ehuda community, Ahoda-east, in River State, Nigeria has necessitated inquiry into the impact of their current sewage disposal practice. These assessement is necessary despite the fact that the ecosystem is self regenerating (Ngobiri *et al*, 2007).

This paper reports the assessment and impact of current sewage disposal practice in Igbu-ehuda community being the study area is a swampy, riverine locality in the Niger Delta area. Igbu-ehuda community is along a section of Sombrero River were most of the domestic and Industrial waste are disposed. The study area is located in Ahoada East, Rivers State, in the Niger Delta region of Nigeria. It lies between latitude 5^0 03′ 30′′ N and 5^0 05′ 45′′ N, longitude 6^0 38′ 45′′ E and 6^0 39′ 45′′ E. The study area is accessed through the East-West road going from Port Harcourt to Warri (Moore, 2019).

The map of the study area is presented in Figure 1a.

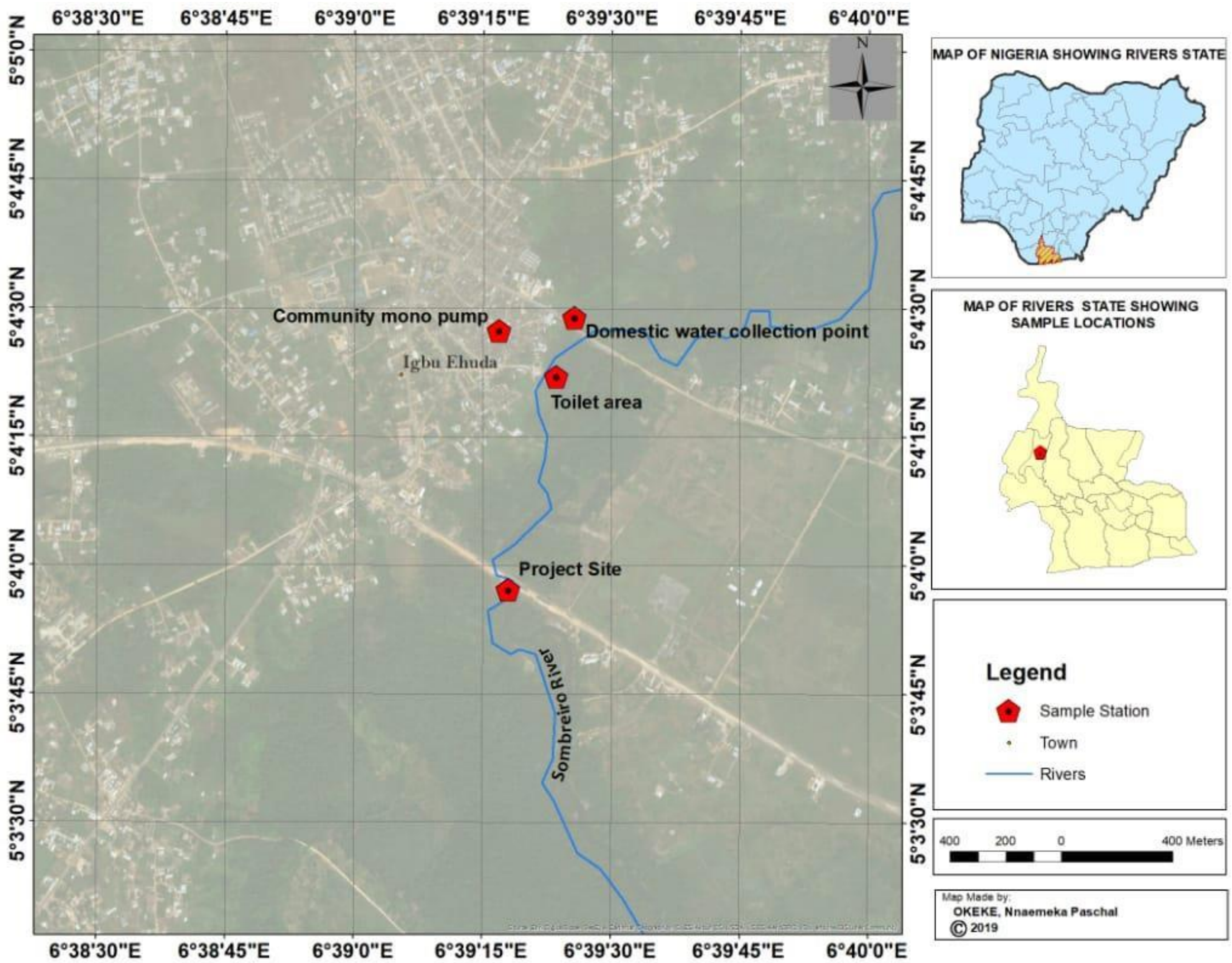

Figure 1a: Google Map of Study Area Showing Sampling Points.

METHODOLOGY

The assessment of the study area was carried out using site inspection/pictograms while the impact was ascertained using the laboratory method.

Sampling Point Selection

The sample points were selected and labelled after field visits to the community as presented in Table 1.0

Table 1: Sample Selection Points and Identification

Sample Identification	Collection Point	Co-ordinates
Sample A	Toilet Area	N 05^0 04.367′ & E 006^0 39.397′
Sample B	Domestic water use	N 05^0 04.482′ & E 006^0 39.432′
Sample C	Community borehole	N 05^0 04.456′ & E 006^0 39.286′
Sample D	Project Site.	N 05^0 03.952′ & E 006^0 39.305′

Sample Collection, Preservation and Analysis

Water samples were collected using four (4) different types of bottles for each point to prevent cross contamination. Sterile amber glass bottle (I L) for organics, Sterile amber glass bottle (I L) for microbial analysis, Transparent glass bottles (I L) for physicochemical parameters and Plastic bottles (1 L) for heavy metals.

The samples were preserved in a cooler box with ice packs at 4 C and adding 2. 2 mL of Nitric acid to stain the sample bottles for effective preservation. The samples were analyzed within their holding time.

The sample were analyzed for Physiochemical and biological parameters were analysed using American Society for Testing and Materials (ASTM), (2010) and American Public Health Association (APHA) (2005)) and American Public Health Association (APHA) (2005). The results obtained are presented in Table 2.0

RESULTS AND DISCUSSION

The overall consequence of the constraints in accessing hygienic sewage disposal facilities in the Niger Delta has occasioned uncoordinated sewage disposal practices. Sewage will either be disposed on land or in natural water bodies. This will likely worsen the already pollution impacted environment (Kafada, 2012, Fashola *et al*, 2012). As earlier stated, poverty affects all aspects of life in this area. The near absence of potable water supply compels the inhabitants to use the natural water body both for domestic consumption and sewage disposal. Hence, the need to ascertain the current impact of sewage disposal practice in riverine localities.

The results of the site inspections are presented in Figures 1a to 1d. Figure 1a shows the location of the study area in the tropical rainforest of Nigeria. This area is characterized by dense vegetation and consequent Funa. Figures 1b to 1d shows an elevated platform extending from the land area to inside the river, where the inhabitants of the area climb to defecate inside the river. This practice is unsafe because of poisonous reptiles and the unascertained integrity of the structure. Also, the facility may not be assessable at night.

Figure 1b: Location of the Study Area in the Tropical Rainforest of Nigeria

Figure 1c: Community Toilet Building Inside the River Overlooking the Sombrero River Channel.

Figure 1d: Floor Wooden Platform of the Community Toilet in the Sombrero River Showing Openings for Faeces Droppings into the River Beneath.

Figure 1e: Walkway to the Community Toilet inside the River.

The results of physicochemical and biological parameters of sections of Sombrero River are presented Table 2.0.

The Table included the following parameters; pH, Temperature, Colour, Odour, Total suspended solids, Total dissolved solids, Mineral oil, Turbidity, Total hardness, Chloride, Phenolic Compounds, Zinc, Magnesium, Calcium, Nitrate, Nitrite, Copper, Total iron, Manganese, Sulphate, Total Coliform, Fecal Coliform, Total heterotrophic bacteria, Total heterotrophic fungi, Hydrogen utilizing bacteria, Hydrogen utilizing fungi, Polyaromatic hydrocarbon, Total petroleum hydrocarbon, Total hydrocarbon,

The results of the pH, Temperature, Colour, and odour indicate a slightly acidic river compared to the control and standards; the World Health Organization and the Federal Ministry of Environment standards. This might be attributed to the Petroleum Industry activities in the area as well as the poor agricultural practices like bush burning. These activities send oxides of nonmetals like oxides of Carbon CO2 and CO, Sulphur SO2, etc into the Atmosphere. These gases dissolve in atmospheric moisture to form acids. The temperature is attributed to the closeness of the area to the equator. The non-clear colour and odour of the water are attributable to the slightly high temperature. Higher temperature increases solubility and consequent higher dissolves solids and poor odour.

The values for Mineral oil, Turbidity, Total hardness, and the elementals (Chloride, Phenolic, Zinc, Magnesium, Calcium, Nitrate, Copper, Iron, and Sulphate) are significantly low, and this is linked to the geology of the Niger Delta. The values are within the acceptable limits when compared with control and standards. However, the Nitrite concentration was higher than the control and standard. This may be due to the faeces and urine from the waste disposal practice.

The microbial parameters; Total Coliform, Fecal Coliform, Total heterotrophic bacteria, and Total heterotrophic fungi are all high compared to the control and standards. This is likely due to the direct passage of feaces and urine into the river. The Total hydrocarbon content was high, and this might be due to human activities.

These results from the community borehole were unexpectedly negative. This might be attributed to the high water table of the area.

Table 2: Result of Water Samples (Wet Season)

S/N	Parameters	Method	Sample A (Toilet Area)	Sample B (Domestic Water Collection Point)	Sample C (Community Borehole)	Sample D (Project Site)	Control Point	WHO/ FMENV Highest Desirable Point
1	pH	APHA 4500 – H^+ B	5.20	5.30	5.30	5.80	7.40	6.5 – 8.5/7 - 10
2	Temperature (^0C)	APHA 2550 B	25.90	25.70	26.40	26.10	26.60	NS/ 35
3	Colour (Unit)	APHA 2120 - C	42.00	57.00	2.00	47.00	9.3	15/-

4	Odour	APHA 2150 B	UO	UO	UO	UO	UO	Unobjectionable
5	Total Suspended Solid (mg/L)	APHA 2130 - B	10.00	30.00	10.00	8.00	6.33	NS/500
6	Total Dissolved Solid (mg/L)	APHA 2130 - B	92.00	86.00	58.60	68.66	50	600
7	Mineral Oil (mg/L)	APHA 2540 - D	<0.001	<0.001	<0.001	<0.001	<0.001	NS/ nil
8	Turbidity (NTU)		0.20	0.20	0.20	0.20	0.1	0.2
9	Total Hardness (mg/L)	APHA 2340 C	20.00	14.00	26.00	14.00	9.23	200/-
10	Chloride (mg/L)	APHA 4500 – Cl- B	7.10	7.10	21.30	7.10	5.50	200/-
11	Phenolic Compounds (mg/L)	APHA 5530 D	0.01	0.01	<0.001	0.01	<0.001	NS/ -
12	Zinc (mg/L)	APHA 311 B	<0.001	<0.001	<0.001	0.05	<0.001	1.0/ 1.0
13	Magnesium (mg/L)	APHA 311 B	0.10	0.24	1.13	0.19	<0.001	NS/ -
14	Calcium (mg/L)	APHA 3111 D	0.02	<0.001	0.92	0.04	90.12	NS/ -
15	Nitrate (mg/L)	APHA 4500 – NO3- E	7.8	7.6	7.2	6.4	0.01	50
16	Nitrite (mg/L)	APHA 4500 – NO3- B	3.62	3.61	3.06	3.15	0.01	3
17	Copper (mg/L)	APHA 311 B	<0.001	0.10	0.06	0.01	<0.001	2.0/ -
18	Total Iron (mg/L)	APHA 311 B	0.10	0.29	0.03	0.15	<0.001	0.3/ 1.0
19	Manganese (mg/L)	APHA 311 B	<0.001	0.18	0.04	<0.001	<0.001	0.1/ 5.0
20	Sulphate (mg/L)	APHA 4500 – SO4 - E 2	<1.0	2.00	<1.0	<1.0	1.0	250/ -
21	Total Coliform (MPN/100m)	APHA 9221 C	10.00	90.00	10.00	50.00	0	0/ 0

22	Fecal Coliform (MPN/100mL)	APHA 9221 C	1.80	25.00	1.80	9.30	0	0/ 0
23	Total Heterotrophic Bacteria (cfu/mL)	APHA 9215 B	1.10 × 102	1.31 × 102	7.89 × 102	1.25 × 102	0	0/ 0
24	Total Heterotrophic Fungi (cfu/mL)	APHA 9215 B	1.50 × 101	4.30 × 101	0.50 × 101	3.20 × 101	0	0/ 0
25	Hydrogen Utilizing Bacteria (cfu/mL)	APHA 9215 B	Nil	Nil	Nil	Nil	0	0/0
26	Hydrogen Utilizing Fungi (cfu/mL)	APHA 9215 B	Nil	Nil	Nil	Nil	0	0/ 0
27	Polycyclic Aromatic Hydrocarbon (mg/L)	US EPA 8270	<0.001	<0.001	<0.001	<0.001	<0.001	0/ 0
28	Total Petroleum Hydrocarbon (mg/L)	US EPA 8015	<0.001	<0.001	<0.001	<0.001	<0.001	0/ 0
29	Total Hydrocarbon Content (mg/L)	APHA 5520 C	292.45	213.05	198.77	211.52	<0.001	0/ 0
30	Oil & Grease (mg/L)	APHA 5520 C/ ASTM D 3921	74.70	69.14	44.35	66.16	<0.001	0/ 0

NS: Not Specified. UO: Unobjectionable.

NOTE:

1. Eight (8) parameters (pH, Colour, Nitrite, Total Coliform, Fecal Coliform, Total Heterotrophic Bacteria, Total Heterotrophic Fungi, and Total Hydrocarbon Content) recorded values outside WHO limit out of thirty (30) parameters monitored.
2. Sample for Control was obtained in the Environmental Impact Assessment (EIA) for

Assa North – Ohaji South Gas Development Project obtained in 2008.

CONCLUSION

The current sewage disposal practice in selected parts of the Niger delta, Igbu-ehuda section of Sombrero River, was assessed for its impact. The random and open sewage disposal in the community was believed to have negatively impacted the water quality in the community. The poor sewage disposal practice and its negative impact were attributed to poverty and the high water table of the Niger Delta.

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