INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Warri Refinery Operations and Its Effects on Ubeji Creek

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Abstract:
The Warri Refining and Petrochemical Company (WRPC) is an industrial complex of the Nigeria National Petroleum Corporarion (NNPC) downstream sector, located between Ekpan and Ubeji communities of Delta state of Nigeria at a surface location of 366,140.12 Easting and 174,200.08 in Northing. The research was to assess the impact of the Warri Refinery operations on Ubeji creek, the nearest water body to the refinery. Water samples were collected from WRPC treated wastewater effluent, Ubeji creek and Agbaro river (set up as the control) about 25 kilometers away from WRPC and analyzed considering such parameters as the physico-chemical properties, COD, BOD, and heavy metals (As, Cd, Cr, Cu, Fe, Ni, Pb, V, and Zn). The results from the study revealed that the values of some of the physico-chemical parameters of the treated wastewater effluent discharged exceeded the limits set by the Federal Environmental Protection Agency (FEPA) and WHO. The values for several other physico-chemical parameters were within regulatory limits. The results of some of the parameters determined for the treated effluent receiving water body (Ubeji Creek) renders the water unsuitable for domestic use. It was observed that the upstream of the creek terminal with the community receives reasonable quantities of assorted solid waste from the community residents which suggests other sources of pollution of the creek beside the refinery's effluent. The results from the study also further underscores the need for continuous monitoring of the quality of surface water bodies especially in settlements and rural communities bordering areas with high industrial activities.

Keywords: *Ubeji, Agbaro, Wastewater, Physico-chemical, Effluent, Upstream*

1. Introduction

The June 1992 Earth Summit in Rio de Janeiro, Brazil, focused on international agreements to deal with threats occasioned by environmental pollution (United Nations, 1992). To underscore the relevance and threats posed by a negligence of the environment June 5 every year is set aside and marked as World's Environment Day (Luke, 2008). Richard (2002) says it is worth noting that about 1.7 trillion dollars have been spent on the environment over the past decade.

The petroleum industry remains one of the most important sectors in the world. The strategic importance of the petroleum industry notwithstanding its activities leave behind it trails of numerous environmental impact on the host communities. Nigeria being an oil producing country, the activities of crude oil exploitation, petroleum refining, distribution and marketing all have their attendant environmental consequences. It is therefore of paramount importance to continually carry out assessment of the operational environment and evaluate the possible health implications (Ogunlaja, 2007).

Industries use huge quantities of water in their various processes and treat not more than thirty-three percent (33%) of such used water prior to discharge and in the process offload various mineral and chemical waste such as acids, alkali, brines, phenols, toluene, petroleum wastes, dissolved and suspended solids, etc into water bodies. These waste degrade the quality of receiving waters by imparting taste, colour, odour, hardness, salinity and some other minerals some of which are toxic to both plant and animal life (Williams, 1980).

Wastewaters released by petrochemical industries are characterized by the presence of large quantities of polycyclic and aromatic hydrocarbons, phenols, metal derivatives, surface-active substances, sulphides, naphthylenic acids and other chemicals. Due to the

ineffectiveness of purification systems, wastewaters may become seriously dangerous, leading to the accumulation of toxic products in the receiving water bodies with potentially serious consequences on the ecosystem (Israel, 2008).

2. Materials and Methods

2.1. Materials

Sample wares, pipette, burette. measuring cylinder, sodium sulphate, n-hexane, retort stand, separating funnel, round bottom flask, rotary evaporator, analar grade KCl, 0.01M EDTA solution, metal ion indicator, mercury-in-glass thermometer (0-100^{o}C). a Mettler Toledo (model xi) pH meter, Hach DR/890 colorimeter. Perkin Lambda EZ201 UV/Visible Spectrometer and a Perkin Elmer 3110 Atomic Absorption Spectrophotometer.

2.2. Methods

Measurement of the mineral content of the water samples was done by Perkin Elmer 3110 Atomic Absorption Spectrophotometer using the hollow cathode lamps and standards of the elements of the elements to be determined. The measurement of temperature of the water samples was done using a mercury-in-glass thermometer 0 – 100^{o}C while a calibrated Mettler Toledo pH meter was used to determine the pH of the samples. The conductivity of the samples was done at room temperature using a calibrated conductivity meter. The turbidity, suspended solids, hydrogen sulphide of the water samples was done by photometric method using Hach DR/890 Colorimer. The content of phosphate, silica, iron, ammonia of the samples was measured by a Perkin Lambda EZ201 UV/Visible Spectrometer. The total, calcium and magnesium hardness of the samples was done using complexometric titration while the measurement of biological oxygen demand (BOD) of water samples was done using titrimetry.

3. Results and Discussion

3.1. Minerals

Mineral	Wavelength (nm)	Sample Conc.(mg/L)			FEPA Limits
		O/C	UBC	AGR	
As	193.7	0.00±.0.00	0.00±.0.00	0.00±.0.00	0.1
Cd	228.8	0.00±.0.00	0.00±.0.00	0.00±.0.00	≤1
Cr	357.9	0.00±.0.00	0.00±.0.00	0.00±.0.00	≤1
Cu	324.7	0.00±.0.00	0.00±.0.00	0.00±.0.00	≤1
Fe	248.3	0.93±.0.06	1.31±.0.03	0.53±.0.03	20
Ni	232.0	0.00±.0.00	0.00±.0.00	0.07±.0.00	≤1
Pb	217.0	0.08±.0.00	0.00±.0.00	0.00±.0.00	≤1
V	318.5	0.00±.0.00	0.00±.0.00	0.00±.0.00	NS
Zn	213.9	0.34±.0.02	0.12±.0.00	0.00±.0.00	≤1

Table 1: Minerals content of water samples

*results are presented in mean and standard deviation
*definition of samples: O/C –treated effluent, UBC – Ubeji Creek, AGR – Agbaro river,
Arsenic, Cadmium, Chromium, Copper as heavy metals were not detected in the discharged treated waste water effluent of the refinery and all the other water samples. The value for Iron (Fe_3^+) obtained in the treated effluent sample was 0.93 ± .06 mg/L. The highest value was Ubeji Creek at 1.31 ± .03 mg/L while the least value was 0.53 ± .03 mg/lL for Agbaro river (the control). All the values obtained are lower than FEPA listed limits of 20 mg/L for iron discharged into surface water.
From the results in table 1 above it can be seen that lead was present at a level which exceeded FEPA set limit of 0.05 mg/L in the treated waste water effluent. This is a consequence of the continued use of tetraethyl lead as an additive to the refined gasoline to boost its octane number. Zinc was detected in the treated waste water effluent and Ubeji Creek the mean values ranged from 0.12 ± .00 mg/L for Ubeji Creek to 0.34 ± .00 mg/L for the discharged treated waste water effluent. None of the values exceeded FEPA set limit of 1 mg/L.

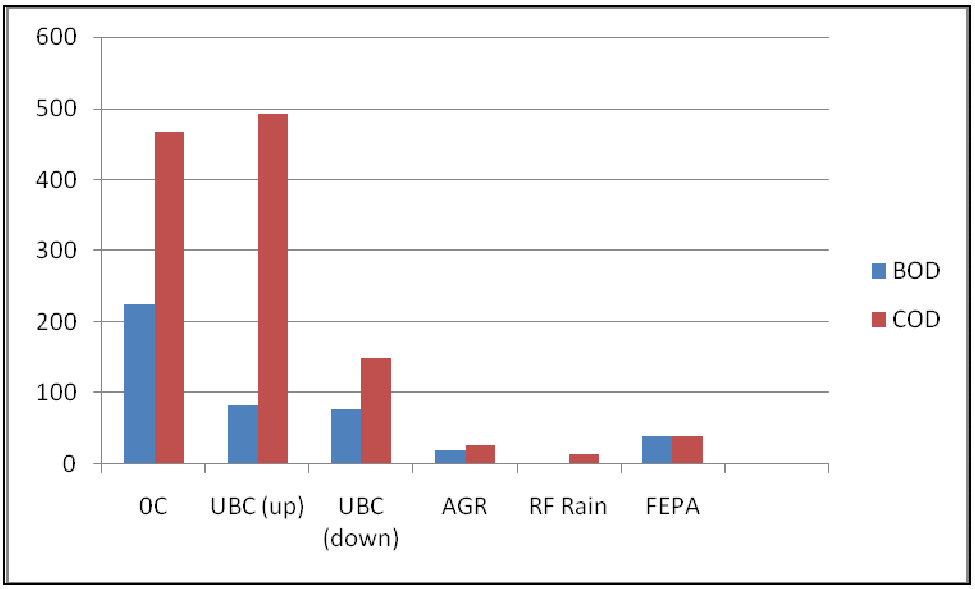

Figure 1: BOD and COD values of water samples

COD: The values of chemical oxygen demand obtained were also very high when compared with FEPA listed limits of 40mg/L. The COD values were observed to double the obtained BOD values for Ubeji Creek (up) and the treated effluent. The highest value was 493mg/L for the Creek (up) water sample while the least value was 27mg/L for Agbaro river (the control). The values for Ubeji Creek (down) was 90mg/L. It was instructive to note that water sample of the refinery rain had COD load of 14mg/L as shown in figure 1. The BOD and COD values indicates the unwholesomeness of Ubeji creek which is within the sphere of WRPC operations. The BOD value for Agbaro river (the control) at 20mg/L is a consequence of the river serving partly as laundry and bathing centre for some of the town's inhabitants. FEPA listed limit for BOD and COD is 40 and 50 mg/L respectively.

4. Conclusion

The study revealed that the Warri Refining and Petrochemical Company do have and operates a functional wastewater treatment plant. However, since purification systems are not always one hundred percent efficient it was observed that while some of the physico-chemical parameters of the treated wastewater effluent discharged exceeded the limits set by FEPA several other physico-chemical parameters were within regulatory limits. The results of some of the parameters determined for the treated effluent receiving water body (Ubeji Creek) renders the water unsuitable for domestic use. It was observed that the upstream of the creek terminal with the community receives reasonable quantities of assorted solid waste from the community residents which suggests other sources of pollution of the creek beside the refinery's treated effluent.

5. References

i. Israel A U, Obot I B, Umoren S.A, Mkpenie V and Ebong G A [2008]: Effluents and solid waste analysis in a petrochemical company – A Case study of Eleme Petrochemical Company Ltd., Port Harcourt, E-Journal of Chemistry, Vol. 5 No. 1, p 74 – 80.
ii. Luke O [2008], World Environment Day: Our carbon economy. The Guardian, June 10, 2008, p79
Ogunlaja A and Ogulaja O [2007]: Physico-chemical analysis of water sources in Ubeji Community and their histological impacts on the organs of albino mice in J. Appl Sci Environ. Manage. Vol. 11 [4] 91 – 94.
iii. Richard S.L (2002): Global Warming: The Origin and Nature of the Alleged Scientific Consensus, Massachusetts Institute of Technology, US.
iv. United Nations (1992): Earth Summit Convention on Climate Change 3-14 June 1992. United Nations.
v. Williams J.L (1980): Industrial Wastewater Technology, contributed to Riegel's Handbook of Industrial Chemistry, edited by James A.K, Van Nostrand Reinhold Co., New York, p823.