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HYDROCARBON POLLUTION OF SOILS AND WATER IN WARRI, DELTA STATE: A SYNOPSIS

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ABSTRACT

The aim of this study was to investigate the problem of hydrocarbon pollution in Warri and environs, Delta State. Samples of soil and water were obtained from six locations in the polluted area and analysed for hydrocarbon content. Results show high concentration of hydrocarbon with an average of 75,029.5ppm in soil and 31,358.3ppm in water samples. These levels were observed to cause disequilibrium in the entire ecosystem. Their implications to the environment are discussed, including the remediation options.

Keywords: Hydrocarbon, soils, pollution, spillage

INTRODUCTION

Globally, environmental pollution has attained an alarming state. The effects of pollution on the flora and fauna cannot be over-emphasised. Man has neglected to care for his environment due to his quest for technological satisfaction. The environment is considered polluted when an injurious or lethal substance is introduced, which by fouling it reduces the satisfaction and utility that is derivable from living or working within it. It was once thought that environmental pollution is the exclusive problem of developed societies. But it has now become widely accepted that even in poverty and more seriously in the process of trying to get out of poverty through development, the environment can be polluted.

The problem of environmental pollution is even more serious in a country like Nigeria, where development is rapid. Often, some of the environmental implications of our developmental activities are never considered. In some cases, although these implications may be known, the attitude seems to be that of "develop now and think of the environment later". Thus, by some of our planned actions, it seems as though we have consciously sponsored an assault on the environment.

Pollution in Nigeria are of various types namely: water pollution, land pollution, air pollution and noise pollution. In Warri, an oil producing area, and her environs in Delta State, the activity that has come to be identified with pollution of the land and waters is mineral oil exploitation. However the extent to which this area has been polluted has not been properly investigated. Much of the available data are scattered in a wide range of field manuals kept by the oil exploiting companies and can hardly be made available to researchers.

THE STUDY AREA

The localities in Warri under study for oil pollution included Ifie, Ogheye, Ekpan, Ekurede Itsekiri, Ugbori and Ajamimogha. For water pollution, Ogunu Creek, Ugbodede Creek, Warri River, Itori Creek, Esi River and Edjeba River were sampled.

RESEARCH DESIGN, SAMPLING AND LABORATORY METHOD

To achieve the aim of this study, soil and water samples were collected from the different areas where hydrocarbon pollution was noticeable. The soil samples were from the top soil, 0-15cm. The

soils were obtained from Ifie Ogheye and Ekpan while water samples were obtained from Ogunu Creek, Ughodede Creek and Warri River.

For the control observation, soil samples were collected from the relatively unpolluted areas of Ekurede Itsekiri, Ugbori and Ajamimogha while water samples were obtained from Itori Creek, Esisi River and Edjena River. The "grab-type" sampler was used (Cheremisinof 1975).

The total hydrocarbon content in the samples was determined by extraction with carbon tetrachloride and measuring colorimetrically using a spectrophotometer. The absorbency values were matched against those obtained with known concentration of reference crude oil.

RESULTS AND DISCUSSIONS

Concentration of Pollutants: Concentration of hydrocarbon pollutants are often expressed by fractions. A concentration of one part per million (1 PPM) corresponds to one part of gas, liquid or solid mixtures in which the pollutants occur (Hodges 1979). In liquids and solids the reference is generally to ppm by weight, while in gas mixtures it is in ppm by volume.

The results of laboratory analysis of soil and water samples collected from polluted and relatively unpolluted areas in Warri are shown in Tables 1 and 2. There is a high degree of hydrocarbon pollution in Warri, consequent to crude oil production, the presence of a refinery and petrochemical plant with allied or servicing industries.

SOURCES OF THE POLLUTION

The major sources of pollution in Warri are the on-shore and off-shore crude oil explorations, exploitation and distribution.

Table 1: Total hydrocarbon content (THC) of water samples around Warri, Delta State

Location	THC (PPM)		Classification
Ogheye	150,000.00)	—	Polluted areas
Ekpan	100,000.00)		
Ifie	200,000.00)		
Ekurede Itsekiri	50.00)	—	Relatively unpolluted areas
Ugbori	75.00)		
Ajamimogha	52.50)		

Table 2: Total hydrocarbon content (THC) of soil samples around Warri, Delta State

Location	THC (PPM)		Classification
Warri River	150,000.00)	—	Polluted areas
Ugbodede Creek	18,000.00)		
Ogunu Creek	20,000.00)		
Edjeba River	60.00)	—	Relatively unpolluted areas
Itori Creek	40.00)		
Esisi River	50.90)		

During exploration for crude, dynamite is shot into the ground and river beds. The explosions often cause crude oil deposit that lie close to the surface to gush out uncontrolled. Petroleum transportation also contribute to pollution because leakages are common in fully loaded tankers and pressure pipelines. At loading terminals both on land and sea, leakages occur due to hose failures or

well-head blow out. Frequent accidents of oil carrying tankers are common in Warri and their content flow out to cover vast areas of land.

Indiscriminate dumping of oil by companies using petroleum products is another source of pollution in Warri (Nwankwo and Doxie 1981). Besides, pollution is also commonly caused by over pressure and overflow of separators and storage tanks, well head fires, refinery waste fires, washout from petrol filling station and mechanic workshops. Oyehulu and Adebayo (1983) had earlier observed that the Warri refinery loading stations are major sources of pollution in Warri. Nwankwo and Doxie (1981) has observed that pollution also occur due to sabotage of oil installations e.g theft or illegal bunkering during which pipes carrying crude are perforated to tap the crude oil illegally. When this happens to high pressure pipelines, spillage occurs.

Pollution can result from a wrong sense of revenge e.g. in most cases, the inhabitants of areas where large quantities of crude are discovered are usually resettled outside their ancestral homes. The aggrieved inhabitants, so separated from their forefathers, sometimes cause intentional damage to pipelines, leading to some of the spillages experienced in Warri.

The most recent of these acts of sabotage are the manoeuvres to claim compensation. Every village is now aware that a very large amount is paid to inhabitants of areas where oil spillages have been recorded. So it is not uncommon for unscrupulous villagers to damage pipelines cause spillage then stage a protest and demand for compensations.

EFFECTS OF HYDROCARBON POLLUTION

Hydrocarbon pollution affect Warri and environs in several ways which include:

- (a) Oxygen depletion and production of noxious gases: When spillage occurs, the crude oil spread and form blanket on the water and soil which does not permit easy diffusion of oxygen in and out of the systems. Under such conditions, living organisms in these systems die of O_2 starvation. Also, the progressive decomposition of sludge blankets containing organic solids cause harm to the ecosystem.
- (b) Direct damage to marine life: As spillages occur, the water becomes polluted and as a result of the toxic nature of the crude, aquatic animals like fishes and birds either die or they migrate. Aquatic plants are also affected and they die off. Records show that in areas where pollution occurs, subtle changes in the behavioural patterns of aquatic organisms are experienced. Fishes loose their ability to swim consciously, and hence cannot escape from predators, avoid injuries or reproduce young ones effectively.
- (c) Direct damage to farmlands: Farming communities in Warri have lost large areas of land to crude oil pollution, with crops and soil destroyed.
- (d) Pollution of sources of drinking warri: In areas where wells are used, spillage has covered up well, even polluting the groundwater sources. Likewise, rivers and inland waters have been rendered unfit for human use as crude oil is washed into them.

When organisms consume hydrocarbon in their food or water, the hydrocarbon finds its way into the fatty tissues of these organisms and can be biologically magnified up the food chain to man. This observation has been confirmed by the inhabitants of Ogheye and Ugbodede who complain that the brain of some fishes caught have the colour of crude oil even after cooking them.

The results of soil and water analysis from different locations in Warri and environs show that there is a high concentration of hydrocarbon in these systems, with an average of over 75,029.5 ppm in soil and over 31,358.3ppm in water samples. These high levels are linked to exploration, exploitation and distribution of crude oil and petroleum products. The adverse effect is noticed in the main occupation of the people which is fishing. The quantity of catch has reduced and could lead to protein deficiency. Likewise, destruction of farmlands have led to low foodstuff supplies.

RECOMMENDATIONS

Since, the petroleum industry is the major source of hydrocarbon pollution in Warri, this industry should be encouraged to ensure the maintenance of educational programmes that would keep staff and communities constantly aware of the adverse effects of oil spillage on the environment. There should be adherence to internationally accepted standard oil field practices, so as to minimise spillages and their effects. The relevant legislations should be enforced, with attendant penalties on defaulting operators. Their contingency plans should be regularly monitored. Service companies should be encouraged and accredited to provide quick and satisfactory remedies during emergencies.

The petroleum inspectorate in the Ministry of Environment should enforce the implementation of effluent limitation guidelines aimed to achieve the following objectives:

- (a) reduce the quantity of contaminants in the effluent (Liquid or gasses).
- (b) encourage plant operators to install and maintain process and pollution control equipment which represent the best practicable technology.
- (c) reduce the quantity or volume of effluents.
- (d) develop plant emission limits based on the capability and efficiency of the best practicable technology.

The following environmental management practices should be encouraged such as: (i) instilling environmental consciousness into individual operators and supervisors through employee motivation programmes (EMP) that aimed at reducing the rate of crude oil spillage and pollution (ii) ensuring that operators and supervisors participate in trainings designed to improve on their knowledge of environmental management. (iii) monitoring effluents and waste water in various parts of operations which will help to alert operators concerning impending spills and leakages.

These measures could reduce incidents of soil and water pollution in Warri. They would also enable speedy remediation action to be taken once spillage is reported.

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