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Aquatic Pollution in Nigeria: the Way Forward

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Adedeji O.B. And Adetunji V.E: Aquatic Pollution in Nigeria: the Way Forward.

ABSTRACT

There has been a significant increase in population growth in Nigeria and this has been accompanied by intensive urbanization, an increase in industrial activities, and a greater exploitation of natural resources and an increase waste generation with consequent challenges for waste management. These transformations have led to a huge increase both in the quantity of discharges and the range of pollutants that could reach the aquatic environment. This paper review and presents the state of aquatic pollution in Nigeria, its impact on aquatic resources, public health and suggested the way forward. It highlighted the major sources of pollutants and steps to be taken to prevent, control and monitor aquatic ecosystem health and integrity in the country.

Key words: Aquatic Ecosystem, Aquatic Resources, Pollution, Sources, Impact.

Introduction

Nigeria is located approximately between latitude 4° and 14° North of the Equator, and between longitudes 2° 2' and 14° 30' East of the Greenwich meridian. It is neighbor are to the north Republics of Niger and Chad, to the south by the Atlantic Ocean, to the east by the Republic of Cameroon and to the west by the Republic of Benin. The country has a land area of area of 923,773 km2 or 72.3 million ha, 18,000 km2 of which is brackish water or freshwater swamps. Nigeria has a coastline of 853 km from Lagos in the west to Calabar in the east, Mangrove area of 12,200 km2, and total marine area of 182,500 km2. The surface water resources potential of the country is estimated at 267.3 billion cubic meters while the groundwater potential is 51.9 billion meters [26]. Nigeria has an average temperature of 26.4 ℃ and annual rainfall of 4000mm in the south and 500mm in the north east. The relative humidity in the country is approximately 84.7%. The climate, which affects the quality and quantity of the country's water resources, results from the influence of two main wind systems: the moist, relatively cool, monsoon wind which blows from the south-west

across the Atlantic Ocean towards the country and brings rainfall, and the hot, dry, dust-laden Harmattan wind which blows from the north-east across the Sahara desert with its accompanying dry weather and dust-laden air. Nigeria present population is put at about 140 million [25] and also the eighth largest national population in the world.

Due to significant increase in population growth all over the world in the last few years, particularly in many countries in Africa, there has been an intensive increase in urbanization, an increase in industrial activities and a greater exploitation of natural resources. These trans-formations have provoked a huge increase both in the quantity of discharge and the range of pollutants that could reach the aquatic environment and have undesirable effects on aquatic resources and ecosystem health and integrity. Water pollution in Nigeria occurs in both rural and urban areas. In rural areas, drinking water from natural sources such as rivers and streams is usually polluted by organic substances from upstream users who use water for agricultural and domestic activities. The most common form of stream pollution associated with forestry activities is increased concentrations of soil particles washed into

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the stream by land disturbance. The large particles sink to the bottom and increase the beds load while, depending on the stream velocity, smaller particles remain in suspension. In the river Niger, for example, studies have shown that the suspended matter can obstruct the penetration of light and limit the photosynthetic zone to less than 1 m depth. Suspended sediments in watercourses have become a serious concern for the water supply authorities because they lead to increased water treatment costs. Many factories in Nigeria are located on river banks and use the rivers as open sewers for their effluents. The major industries responsible for water pollution in Nigeria include petroleum, mining (for gold, tin and coal) wood and pulp, pharmaceuticals, textiles, plastics, iron and steel, brewing, distillery fermentation, paint and food. Of all these, the petroleum industry presents the greatest threat to the aquatic environment. Frequent accidental oil spillages occur which endanger local sources of water supply, freshwater living resources and the overall ecosystem integrity, especially in the Niger delta. The objective of this study is to review aquatic pollution in Nigeria and suggest way forward for proper monitoring, early detection, prevention and control of aquatic pollution in the country for a safer environment for all and preservation of aquatic resources.

Short Statement of the Problem:

Nigeria lacks adequate technology and sufficient manpower or staff with necessary technical and managerial training and skills to properly handle wastes in an environmentally safe and sound manner. The usual methods of waste disposal in the country are: land filling, dumpsites, land spreads, water disposal, and incineration washed into surface water bodies during soil erosion or run-off. Inland and coastal waters in Nigeria are also usual resources for waste disposal; the emerging problems pose a serious threat to the sustainability of the aquatic resources and public health.

Pollution:

Environmental problems have increased in geometric proportion over the last three decades with improper management practices being largely responsible for the gross pollution of the aquatic environment with concomitant increase in water borne diseases [38]. Aquatic pollution is a worldwide phenomenon the practice and extend varies from one country to another. Pollution of water bodies is a phenomenon of concern in the developing nations of the world. Pollution of aquatic environment refers to the introduction of substances or energy directly or indirectly into water bodies by man, resulting in deleterious effects to living resources, hazards to human health, hindrance to aquatic activities such as fishing, impairment of water quality and reduction of amenities. Pollution had always been misused for contamination which can be defined as the presence of elevated concentrations of a substance in the air, water, soil or any other such thing not necessarily resulting in a deleterious effect. Aquatic pollution, therefore, is the direct or indirect human introduction of substances into the aquatic environment such as to harm living resources, affect human health and water quality. Pollution is not merely the addition of a substance to the aquatic ecosystem, but its addition at rate faster than the ecosystem can accommodate it. There are natural levels of chemicals such as arsenic and mercury in the environment but only if these levels exceed critical values can they be considered as pollutants. Pollutants are not only chemicals. To be a pollutant, a material has to be potentially harmful to life. Chemicals released into the rivers and seas such as Pb, Cu, Zn, Hg, and CN will cause the death of fish, algae and lesions in human beings even at very low concentrations. The Minamata epidemic was a case of mercury poisoning caused by consumption of fish from the Minamata Bay of Japan which was heavily contaminated by mercury compounds discharged by a nearby plastic industry. This epidemic occurred during 1953-60 and was the 1st serious outbreak of Hg poisoning. It was characterized by severe damage to the nervous system leading to ataxia, paraesthesia (abnormal pricking sensations), loss of vision and hearing and ultimately death. The primary pollutant was inorganic Hg, but an organic derivative, methyl mercury was found in the fish. This was converted by methylation through the microorganism in the water, fish gut, mud or all. Organomercury compounds being lipid soluble have very high affinity for cellular lipids and therefore accumulate in lipids of nervous tissues [31]. In Nigeria, the aquatic environment receives lots of insults due to man activities climate, and the geographical positioning of the country. Nigeria is entirely within the tropics and subject to heavy rains and because most of the landfills and dumpsites are usually unlined, toxic waste constituents, solvents, and leachates leak or leach from them into the soil, where they contaminate underground water. Under heavy rains, wastes from dump sites, landfills, and land spreads are usually washed into surface water bodies during soil erosion or run-off. Inland and coastal waters in Nigeria are also usual resources for waste disposal; the emerging problems pose a serious threat to the sustainability of the aquatic resource. The various sources of aquatic pollution and their impact in the country and the way forward are discussed.

Industrialization and Urbanization:

Industrialization is considered vital to the nation's socio-economic development as well as to its political standing in the international community. Industry provides employment opportunities for a large proportion of the population in medium to highly developed economies. Presently, there are about 11 major industrial categories readily discernible in Nigeria: petroleum, metals and mining; food, beverages and tobacco; breweries, distilleries and blending of spirits; textiles; tanneries; leather products; wood processing and manufacture, including furniture and fixtures; pulp, paper and paper products; chemical and allied industries; and others The characteristics and complexity of wastes discharged by industries vary according to the process technology, the size of the industry and the nature of the products. Ideally, the siting of industries should achieve a balance between socio-economic and environmental considerations. Relevant factors are availability and access to raw materials, the proximity of water sources, and a market for the products, the cost of effective transportation, and the location of major settlements, labour and infrastructural amenities. In developing countries like Nigeria, the siting of industries is determined by various criteria, some of which are environmentally unacceptable and pose serious threats to public health and ecosystem integrity. The establishment of industrial estates beside residential areas in most state capitals and large urban centers in Nigeria is significant in this respect. Surface water and groundwater contamination, air pollution, solid waste dumps and general environmental degradation, including the loss of land and aquatic resources, are major environmental problems caused by industrialization in Nigeria. Improper disposal of untreated industrial wastes has resulted in colored, murky, odorous and unwholesome surface waters, fish kills and a loss of recreational amenities. Industrial effluents are discharged directly into the drainage systems without treatment by many industries. The drainage systems are channeled into canals, which empty their contents into the rivers and lagoon. The implication of this is the pollution of surface water with consequent effects on ecosystem health and integrity. Industrial effluents contains salts in solution which when discharged untreated could accumulate to form toxic pond. Absorption of these salt solutions by aquatic organisms constitutes health hazard to the populace because they depend on some of these organisms for sustenance.

In the last few years, there has been a significant increase in population growth all over the world, but particularly in many countries in Africa. This has been accompanied by intensive urbanization, an increase in industrial activities and a greater exploitation of natural resources. These transformations have led to a huge increase both in the quantity of discharges and the range of pollutants that could reach the aquatic habitat and have undesirable effects on aquatic ecosystem health and integrity. As a result of rapid urbanization coupled with absence of basic social amenities in the country a lot of people are concentrated in the urban centers and this has led to the generation of more waste in urban centers than the system can handle. According to [3] Nigeria lacks adequate technology and sufficient manpower or staff with necessary technical and managerial training and skills to properly handle wastes in an environmentally safe and sound manner. The usual methods of waste disposal in the country are: land filling, dumpsites, land spreads, water disposal, and incineration all these ends up in the aquatic environment. Impairment of water quality Land disposal of solid waste creates an important source of ground water pollution. The problem of pollution from refuse heaps is greatest where high rainfall and shallow water table occur. Important pollutant frequently found in leachates from refuse dump includes BOD, iron, manganese, chloride and nitrate.

Loss of lives and properties due to flooding is common knowledge. The retention of water on topsoil leads to soil liquefaction. Liquefaction of soil weakens the foundation and in some cases collapse of the structure. Sewage lagoons give off foul odour around the vicinity of the site. The most dangerous impact is ground water pollution. This is because the sewage fluid percolates down to the water table.

The rapidly increasing populations coupled with the deteriorating environment are some of the factors responsible for this trend [39]. Hospital records have confirmed high incidence of typhoid, cholera, dysentery, infectious hepatitis and guinea worm in urban settlements of Nigeria. Of all the costs of urban environmental degradation, damage to human health is by far the highest. There is a direct link between urban environmental degradation and public health in terms of water related diseases such as diarrhea, dysentery, cholera and typhoid. The rapid growth of urban centers in Nigeria, coupled with the development of unstructured infrastructural and social services have created an environmental situation in many parts of the country which is becoming inimical to healthy living. Recent studies have shown that zoonotic diseases are yet to be eliminated or fully controlled in the meat industry as shown in present situation of the public abattoirs in Nigeria [6]. Thus, they pose serious environmental health risk. Some of these infectious diseases are tuberculosis, colibacillosis, salmonellosis, brucellosis and helminthoses. These are common examples of zoonoses prevalent in slaughtered cattle population in Nigeria.

[20] revealed that the leading killer diseases in Ibadan are waste management related precipitated by ignorance, poverty and low standard of living. The morbidity pattern was also found to be applicable to the larger Nigerian urban society since waste management problem is not peculiar to a particular region but a common feature in every urban community in Nigeria. The discharge of wastewater into surface waters and the resultant deleterious changes in water ecology have been reported by several researchers [27,4] who also expressed concern over human health and the possible accumulation of human enteric pathogenic microorganisms by aquatic organisms. Incidences of water-borne diseases in rural areas of developing countries leading to millions of deaths have been reported [41]. Some of these deaths have been traced to the use of waters grossly polluted by untreated waste [11]. [7] also reported an increase in the number of total coliforms and of *E.Coli* in particular when faeces were added to the Lagos lagoon. [30] reported a similar trend in the pollution of a stream by wastewater from a sewage lagoon. [12] also reported relatively higher faecal coliform loads at stations on Warri River in Nigeria that received faecal matter from slaughterhouses and raw sewage from human sources. [16] also reported the same trend of contamination of well water with pathogenic enteric organisms in Sagamu Southwestern Nigeria. The discharge of wastewater from bathroom, laundry, slaughterhouses etc have been used to explain the deterioration of most tropical rivers as they pass through inhabited places [32]

In Nigeria, pollution of river water takes place at various centers of industrialization, chiefly at Lagos, Abeokuta, Ibadan, Warri, Port Harcourt Aba Kano etc. Industries generate a significant quantity of wastewater and discharge it into rivers and lake [1]. Industrial discharges generally contain organic substances, solids and mineral acids. Pulp and paper, dairy and textile industries generate putrifiable organic waste, while industries manufacturing organic-chemicals, pesticides, fertilizers, dyes and pigments, non-ferrous metals, steel and chloroalkali generate hazardous and toxic inorganic waste (heavy metals).

A study on water quality of Ogun River (Nigeria), in which industrial effluent from Lagos and Abeokuta is discharged, was conducted, and it was reported that the level of turbidity, oil and grease, faecal coliform and iron were very high in all the sampling sites [19]. The characteristics of selected effluents from industries in Benin city, Nigeria, were analyzed and it was reported that the concentration of pollutants in the effluents discharge is on the high side, exceeding the maximum recommended limits [29]. High blood lead level was reported among Nigerians due to exposure to the environmental

pollutant which can get into the human body through various sources [7].

Industrial waste and emissions contain toxic and hazardous substance most of which can be detrimental to aquatic life and human health. These include heavy metals such as lead, chromium and mercury, and toxic organic chemicals such as pesticides, polychlorinated biphenyls (PCBs) polyaromatic hydrocarbons (PAHs), petrochemicals and phenolic compounds.

World Bank reported that about 19000 tons of hazardous waste is produced annually in Nigeria and the waste comes mainly from steel, metal processing, pharmaceuticals, textiles, tanneries, and oil refining industries. [13].

Desertification exposes the topsoil to excessive loss of water and burning up of soil nutrients. The loss of soil nutrient translates to reduce agricultural yield. Oil field – brines disposal usually leads to brined-polluted aquifer thus affecting community water supply. Oil spillage in aquatic environment covers the water surface with oil. This cuts off the oxygen supply thus decimating aquatic population. In terrestrial habitat, oil spillage renders the soil unproductive for agricultural purposes. Industrial effluents contains salts in solution which when discharged untreated could accumulate to form toxic pond. Absorption of these salt solutions by plants constituted health hazard to the populace because they depend on plant for sustenance.

Agriculture Activities:

The important pollutants from agricultural drainage include the poisonous pesticide residues and mineral fertilizers. Unlike industrial effluents, it is very difficult to contain the transport of the nutrient chemicals and pesticides through agricultural drainage, which is a non point source of pollution. The fertilizers used in the agriculture are the major contributor of residual phosphates and nitrates in surface waters. Pesticides and herbicides are used in the control of different pest and in the control of weeds that affect animals and plants. The entire chemical finally ends up in the aquatic environment where they enter the nutrient or water cycle. In Nigeria there is an increase in the use of herbicides as reported [8], but total quantities applied are not known. Campaigns against quelea birds (*Quelea quelea*) have been conducted in the north. Regarding vector control, very large tracts of land have been cleared of dangerous parasites by means of pesticides. In northern Nigeria 72 000 km^2 have been made available for crop production and animal husbandry by exterminating the Glossina sp., a carrier of trypanosomiasis. Apparently, DDT and endosulfan are still in use for these purposes in a quantity of 50 000 kg/a. [21,22,23] studied the

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effects of insecticide application on the fauna of marshes in Nigeria and analysed the levels of pesticides in the brain, liver and fat of different aquatic birds, fish and snakes. Levels of 0.1 mg/kg of dieldrin were found in the fish while DDT was much lower, not exceeding 0.05 mg/kg.

Petroleum Activities:

(Dredging activities, oil exploration including geological survey and geophysical investigation, transportation, marketing, refining, plant forms and tank farms, oil spill and gas flaring,)

In 1971 Nigeria became the tenth largest producer of petroleum in the world, but in succeeding years production has increased and the country has moved up to the eighth position. In 1981, the total production was 71.1 million t, with a decrease in 1982 (63.8 million t). According to the 2008 BP Statistical Energy Survey, Nigeria had proved oil reserves of 36.22 billion barrels at the end of 2007 or 2.92 % of the world's reserves. The Nigerian government plans to expand its proven reserves to 40 billion barrels by 2010. Most of this is produced from the prolific Niger River Delta. The amount of oil lost to the environment has been estimated by [40] to be 53 500 t/a. The largest individual spills include the blowout of a Texaco offshore station which in 1980 dumped an estimated 400,000barrels (64,000 m^3) of crude oil into the Gulf of Guinea and Royal Dutch Shell's Forcados Terminal tank failure which produced a spillage estimated at 580,000barrels (92,000 m^3)**.** According to [10] the total number of reported spills between 1976 and 1996 in the oil industry is put at 4,835, resulting in a cumulative spill volume of 2,382,373.7 barrels of crude oil. Of this amount only about 15.91 percent was recovered, on the average, implying that about 84.09 percent of the cumulative spill was lost to the environment! Between 1986 and 2000 the Nigerian Petroleum Industry experienced three thousand eight hundred and fifty four (3,854) oil spill incidents. These oil spills resulted in the loss of 437,810 barrels of oil into the Nigerian environment. This loss amount to millions of dollars in the Nigerian export from the petroleum industry

Oil spill occurs majorly as a result of drilling (bringing oil to the surface for refining and distribution). Oil wells are found at both onshore and offshore. Oil and gas transportation is another main source. There are several ways of transporting oil and gas to the refining stations as well as to the distributing stations. These include offshore and onshore pipelines, marine terminals with offshore loading platforms, and tank vessels [36]. These methods are made use of in several parts of the world including Nigeria. Oil gets spilled to the environment through these methods, especially leaked

pipes, causing pollution. There are four broad categories of oil spillage. They are minor, medium, major and disaster. Minor spill takes place when oil discharge is less than 25 barrels in inland waters or less than 250 barrels on land, offshore or coastal waters that do not pose a threat to the public or welfare. In the case of the medium, the spill must be 250 barrels or less in the inland water and from 250 to 2500 barrels on land, offshore or coastal water. For the major spill, the discharge to the inland water is in excess of 2500 barrels on land, offshore or coastal waters. The disaster refers to any uncontrolled well blowout, pipeline rupture or storage tank failure which pose serious threat to human life [35].

The transportation and distribution of oil involves a very complex network spread all over the delta region, which is very rich in fish and shrimps. [17] reported widespread pollution in the delta, the creeks and estuaries of the various rivers, causing the death of a great number of specimens of *Callinectes gladiator* and *C. latimanus*, two species of edible crabs, but no quantitative data were available. A reduction in the diversity and density of life in the cleared mangrove forest swamps was also cited. Two years later, [18] and [2] presented a map of the Niger Delta showing the isopleths of oil concentration as measured by infrared spectrography, thus improving the information available a great deal, although not to full satisfaction.

A detailed analysis of oil spill accidents, which discussed the frequency and magnitude, spill size, monthly distribution, causes and companies involved, was made by [9]. From 1976 to 1980, 784 spills were reported, of which 588 were of minor scale and 11 involved more than 1 500 t. The total oil spilled was calculated to be 293 020 t. In an ecological study after a big oil spill, [14] found that 1.45% of the local mangrove forest was killed and that edible crabs and winkles were killed or tainted. [28] presented a study of the degradation and weathering of crude oil in the laboratory and in the field under tropical conditions. All these study show that under tropical conditions oil degrades more rapidly than in temperate regions. The Nigerian Institute of Oceanography and Marine Research also made investigations both in the laboratory [5] and in the field [34]. Laboratory studies indicated that undiluted wastewater effluents were toxic to mullets (Mugil sp.) but at 10% dilution the toxicity was highly reduced. In the field the effect of oil pollution was studied in the Niger Delta along the Bonny River for a period of six months. It was shown that primary production was reduced in respect to a control area and the algal species distribution was different.

Dredging by Oil companies has caused the salty water from the Gulf of Guniea to penetrate the freshwater creeks of the Niger Delta where villagers get their drinking water. As a result villagers are

forced to spend hours in their canoes seeking drinking water. Some witnesses report that the villagers use containers that previously held toxic chemicals to ferry water to and from their villages. The fish used for subsistence and trading are been decimated by the side effects of oil production: saltinization, metals left in the creeks, high acidity of the water, increased sediment and stirring up of the creek bottoms and the incursion of foreign vegetation that "may poison fishery resources. These effects include lowering the pH of the environment (mostly soil and water) which may in turn lead to fish kill or migration in either case this is likely to have an economic backlash on the surrounding communities, who are mostly obligate fisherman. The low species diversity can be attributed to the harsh and variable environment occasioned by the oil production and exploration activities which have led to increased incursion of alien marine water into the area which were naturally low brackish waters. The low benthic population [bottom dwelling fauna] implies that there is inherent pollution in the area.

Saltwater incursion, dredging and the waste material left behind, metals, acid rain from gas flaring, oil spills all of these kill the local trees and plants, including the critical mangroves and the palm trees used by villagers for palm oil, wine, and trading. Coastal erosion caused by oil operations explain the 'inland flooding' and 'dying vegetation' found in the area. Impact of Pollution Gas flaring is known to have serous negative health effects on humans. Gaseous emission from the gas flare and other combustion units may negatively impact the air quality in the project area the main source of acid rain. This may bring about a high frequency of respiratory diseases among workers and neighboring communities. The most relevant result of this scientific activity was obviously an enforcement of pollution control measures, a long-term comprehensive monitoring plan and an oil pollution contingency plan. An Environmental Sensitivity Index based on geomorphic, ecological and socio-economic criteria was prepared for Nigerian areas that may be involved in oil accidents. A serious threat posed by oil related pollution is the impact on underground waters. When oil spills or when there is an effluent discharge or acid rain, it seeps into the ground and becomes mixed in the underground water system. It has been found that polluted underground water take many years before it can be remedied. Yet this underground water moves into streams and wells which are the only sources of local water supply in the community which results in the rise of water borne diseases. This has affected the traditional relationship of our people with water. There is a palpable fear that rather than being the source of life, these water systems have become sources of misery, disease and death.

Effluent from Abattoirs and Other Food Processing Outlet:

Effluent from industries is a major source of environmental pollution. The uses of water in industrial plants are for cooling, sanitation, manufacturing and processing. The quality of the effluent varies with the type of industry and type of use. In Nigeria, available reports cite gross contamination of most major River bodies across the nation by discharge of industrial effluents, sewage and agricultural wastes among others [44]. Contamination of river body from abattoir wastes constitutes a significant environmental and health hazards [24]. The location and operation of abattoirs are generally unregulated, aside, they are usually located near water bodies where access to water for processing is guaranteed. The animal blood is released untreated into the flowing stream while the consumable parts of the slaughtered animal are washed directly into the flowing water [24]. Improper management and supervision of abattoir activities as a major source of risk to public health in Nigeria has been identified by [24] who also found that wastes from slaughterhouses in Nigeria washed into streams typically contain fat, grease, hair, feathers, flesh, manure, grit and undigested feed, blood, bones and process water which is characterized with high organic level.

The total amount of waste produced per animal slaughtered is approximately 35% of its weight [43]. In a study, [42] found out that, for every 1000 kg of carcass weight, a slaughtered beef produces 5.5 kg of manure (excluding rumen contents or stockyard manure) and 100 kg of paunch manure (partially digested food). The weight of a matured cow varies with size, ranging from 400 kg for thin, 550 kg for moderate to 750 kg for the extremely fat. A cow weighing 400 kg would have its carcass weight reduced to about 200 kg after slaughter. Furthermore, it loses about one-third in fat and bone after passing through the butcher. Hence a 400 kg live weight animal will give about 140 kg of edible meat which represents only 35% of its live weight. The remaining 65% are either solid or liquid wastes. The organic load from abattoirs could be very high. Hence, abattoir effluents could increase levels of nitrogen, phosphorus, total solids in receiving water body considerably. Excess nutrients cause the water body to become choked with organic substances and organisms. When organic matter exceeds the capacity of the micro-organisms in water that break down and recycle the organic matter, it encourages rapid growth, or blooms, of algae, leading to eutrophication. Equally, improper disposal systems of wastes from slaughterhouses could lead to transmission of pathogens to humans and cause zoonotic diseases such as Coli Bacillosis,

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Salmonellosis, Brucellosis and Helminthes [33]. Improper management of abattoir wastes and subsequent disposal either directly or indirectly into river bodies portends serious environmental and health hazards both to aquatic life and humans.

Way Forward:

For effective prevention and control of aquatic pollution in Nigeria, the following are essentials: Political will, Education and Research, Right government policy, Enforceable legislation, Right to an adequate standard of living, Monitoring of discharges from industries, Clean up and rehabilitation, Monitoring of the human impacts of pollution (oil, gas, pesticides, metals etc), Use of Geographical Information System to Monitor, Adequate waste management and Monitoring of aquatic ecosystem health.

The National Policy on the Environment which was launched by the President in Abuja on 27 November 1989 [15] must be revisited. The goal of that policy was to achieve sustainable development in Nigeria and, in particular to: Secure for all Nigerians a quality environment adequate for their health and well-being. Government must have the political will to see to the implementation of the policy and take adequate protection measures. Environmental protection measures are only meaningful if the environment to be protected is adequately understood. Neither over-protection nor under-protection of the environment is desirable. Ideally, standards should be set and monitored based on nationally generated, environmental baseline data. Such data are scarce in Nigeria in the present circumstances and little or no monitoring programme in place. An alternative approach is to adapt standards and guidelines adopted by the World Health Organization (WHO) and the developed nations of Europe and America. The water quality components of the guidelines are based on the WHO guidelines. An ecosystem approach should be taken into consideration in setting standard. However, in transposing data between countries, socio-economic and climatic differences must be taken into account. Environmental pollution resulting from uncontrolled discharge of sewage and toxic industrial effluent can be managed by monitoring chemical out-flows from the industries. One method of approach is to first conduct a chemical determination of the off-limit concentration of all the chemical constituents of the effluent beyond which environmental safety cannot be guaranteed. Standard laboratory should be set up in all the state of the federation, these laboratories should be equipped with sate of the heart technology and qualified staff with adequate experience should be employed. There should be relevant training for staffs that are to carry out this exercise.

A vigorous program on afforestation and irrigation of arid zones should be pursued to check mate the rapid advancement of the desert. Injecting the brine through wells into deep formation that are geologically isolated from overlying fresh water aquifer can control pollution arising from oil-field brine. Oil spillage can be tackled by bailing and skimmer pumping. Most importantly, enforcement of existing legislation on oil-field practices is the most effective solution. Gas flaring and other activities which are detrimental to the aquatic environment and the environment in general should be strictly regulated. Government should be ready to impose heavy sanction on defaulters.

Conclusion:

Pollution of aquatic environment in Nigeria occurs from different sources with its consequence effects on the aquatic ecosystem which must be prevented, controlled and monitored. Acid rain, effluents, oil spill, thermal heat and waste resulting from industrial processes will make fish and other aquatic organisms to disappear from lakes and other water bodies and also destroy aquatic nurseries. Crayfish produce fewer eggs in acid water and the eggs produced often grow into malformed larvae. Acid rain leaches Al, Pb, Hg, Cd from soils and rocks in a drainage basin and discharges them into rivers and lakes. The metals can clog the gills of fish and cause suffocation. The heavy metals pose health hazards when they are concentrated in fish which are passed on to people, mammals and birds when they eat the fish. NH_3 present in effluents are toxic to aquatic organisms. Toxic industrial and organic sewage are to be properly disposed, education and research is essential, with the government promulgating the necessary laws to ensure they are complied with in order to conserve and protect aquatic resources, biodiversity, ecosystem integrity and public health, provision of safe seafood for human consumption and protecting means of livelihood.

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