

## WATER POLLUTION AND ENVIRONMENTAL CHALLENGES IN NIGERIA

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### ABSTRACT

*Fresh water is the most valuable natural resources for the existences of living organism. It is fundamental for sustenance of lives of human, animals and plants. However, there is constant threat to water due to human population growth and demand for more high quality water for domestic and industrial usage. In recent years the decline in water quality has attracted increasing attention globally from policy makers and communities, particularly in developing countries. Negligence in environmental protection is now a major source of water pollution. The paper also discussed the concept of pollution and causes, also concept of water and causes of water pollution. The impact of water pollution, health impact, agriculture, ecosystem, industrial and socioeconomic impact of water pollution. The paper conclude that water pollution is a major environment problem globally; mostly in developing country including Nigeria. Based on the conclusion, the paper recommended among others that water pollution control should be a subset of water resources management with continuous monitoring potential polluters.*

**Keywords:** Water, Pollution, environment, challenges and impact

### INTRODUCTION

Fresh water is fundamental for sustenance of lives of human, animals and plants. Its importance is without substitute. Global Water Partnership, (2003) made a definite statement that there should be safe and adequate water and that the supplies should be sustainable for all, at global and regional levels. Yet only 0.4% of the total earth's water is safe for use, while 97% of the earth's water is in the oceans and seas not safe for use because of its salty nature, most of the remaining 3% is in polar ice caps, glaciers, atmosphere or underground difficult to reach. Thus only 0.4% is available for use with so much pressure on it; due to rapid urbanization, and industrialization (Abhijeet, 2013). Nigeria as a nation has witness rapid urbanization, industrialization and mechanization of agricultural practices, this is not without negative effects of high increase of water pollution. These have not only, brought about water pollution but have increase high pollutant concentration in water reservoirs (Nakhaei & Shahidi, 2010). The increase pollutants into water bodies result in decrease water quality Sumita, & Kaur, (2017). This paper is concern about water pollution, the most valuable natural resources for the existences of living organism.

There is constant threat to water due to human population growth and demand for more high quality water for domestic and industrial usage. There is decrease water quality generally and especially Dissolved Oxygen concentrations; due to discharging of degradable wastewater in water bodies. This is of great concern if the eco system is to preserve and equally have a healthy society. Galadima, Garba, Leke, Almustapha, & Adam, (2011) noted the common sources of water available to local communities in Nigeria are fast being suffered by a number of anthropogenic factors, and pollution remain the most dominant problem.

Mostly, developing countries are victims of contaminated water because of the little infrastructure to deal with sewage and other water sanitation issues. According to the estimate

of United Nations 95% of untreated urban sewage from developing countries are discharge into the same lakes and rivers they use. In recent years the decline in water quality has attracted increasing attention globally from policy makers and communities, particularly in developing countries. Negligence in environmental protection is now a major source of water pollution. Hence the important of unpolluted water supply to human and ecosystem cannot be over emphasized. This can be achieved through identifying environmental pollutants and behaviours of pollutants in water environment by employing models; Wang, Dai, Zhao, Ding, Li, & Zhao, (2009) attest to this fact.

### **Concept of Pollution**

**Pollution:** is the alteration of the physical, chemical, or biological properties of water, or contamination of water, it also mean discharge of any sewage or trade effluent or any liquid, gaseous or solid substance into water either directly or indirectly making the water harmful, injurious, to public health /safety or to domestic, commercial, industrial, agricultural, and other uses. According to Ncube, (2015) pollution is introduction of chemical, physical or biological material in to fresh or marine water that degrade the quality of water and affects organisms living in it.

### **Sources of Pollution**

If water pollution is to be prevented, then the source of pollution needs to be known. The sources of pollution have been categorized into two, namely; point and non-point sources of pollution.

**Point Source:** these are organized sources of pollution where the pollution load can be measured e.g. surface drains carrying municipal sewage or industrial effluents, sewage pumping stations and sewerage systems, trade effluents from industries. Pollutant are discharge at specific locations via pipes, ditches, or sewers, into water bodies specifically surface water (van Leeuwen, 2010). This type of source can easily be identify, monitor and regulated because of it specific location.

**Non-point Source Pollution:** Davis and Hirji, (2003) referred to non-point source as low-concentration sources covering a large area, it occurs from a large area as opposed to a small number of well-defined points. The contamination takes place when rain water, snowmelts, or irrigation washes off ploughed fields, city streets (Ncube, 2015). According to Kuutondokwa, (2008) storm water, runoff from agricultural land carries silt, clay, fertilizers, pesticides, organic materials and bacterial into water courses. Non-point source pollution is a major cause of water pollution in many countries. On like point source non-point source is difficult to control and manage and that the long-time solution to this source of pollution is change in land use and management (Heal, 2007). Another source of water pollution is the discharge of hot water from cooling engines in the industries (Owa, 2013).

### **Causes of Pollution**

The cause of water pollution is broadly classified into two namely:

**Natural Causes** are caused by natural forces as cyclone, flood, and earthquake. Pollution that occurs from this source is known as natural pollution.

**Artificial Causes** came as a result of population growth and industrialization otherwise known as Pollution cause by intervention of human agency. Population growth places demand on food, goods and commodities which forces people to exploit natural resource without caution not mining the damage to environment. Wrongful disposal of house-hold waste, dust poisonous gases, that causes water pollution.

## **Concept of Water Pollution**

Water pollution is the presence of pollutants into water bodies' especially toxic substance making water unsafe for house-hold use, drinking and other uses, (James, 2008). World Health Organization, (2006) has defined water pollution as inclusion of any foreign material either from natural or other sources into a water body, thereby changing the natural qualities of water and making it unusable for its intended purpose. Water pollution is any contamination of water with chemicals or other foreign substances that are detrimental to human, plant, or animal health. These pollutants include fertilizers and pesticides from agricultural runoff; sewage and food processing waste; lead, mercury, and other heavy metals; chemical wastes from industrial discharges; and chemical contamination from hazardous waste sites.

Water pollution decreases the usefulness of water economically and brings about danger to human health and other aquatic forms of life (James, 2008). Although human beings benefit immensely from water, they are actually one of the main causes of water pollution through marine dumping, industrial wastes, agricultural effluent and mining wastes.

## **Causes of Water Pollution**

There are different causes of water pollution includes:

### ***Domestic Based Water Pollution***

Fakayode, (2005) reported that Domestic based water pollution has been identified as a serious problem of developing countries. It is inappropriate management of enormous wastes generated by human activities and its unsafe disposal into the surrounding environment, water bodies' especially freshwater reservoirs. It is a combination of different factors including increasing population, the flat terrain, and few sewage and waste disposal poorly managed Sanitary and sewage system (Yusuf, 2007). This unsafe practice has regularly rendered water unsuitable for both primary and/or secondary usage (Fakayode, 2005). Chukwu (2008) reported a study on the ground water pollution from abattoir waste in Minna state. The analysed wells showed physical, chemical and organic parameters that exceed the upper boundaries set by WHO. The waters are generally hard, containing elevated concentrations of CaCO<sub>3</sub>, MgCO<sub>3</sub>, sulphates, nitrates, phosphates and heavy metals. Nwanta et al. (2010) reported that a total of 194 kg of solid waste is generated daily in Nsukka metropolitan abattoir, without any hygienic disposal and/or management system. Further studies on the waste raised serious public health concerns, as bacteria such as *E. coli*, *Bacillus* sp, and *Staphylococcus* sp. were frequently detected. In addition to these, elevated heavy metals concentration, that is some time more than one thousand (1000) times the permissible limits in drinking water, had been reported from Oko-oba abattoir, Lagos state (Adeleye & Adebisi, 2003). "Abattoir to water" pollution is a great problem with common phenomenon across the country.

### **Local Market Induced Water Pollution**

The waste generated from sellers of food items, farm produces animals and birds and other household materials, cosmetics, and materials from a daily or weekly community market constitute about 90% of all markets in Nigeria. So much waste is generated from daily operations of the markets are dumped into fresh water ways; the majority of people involved in this act are the road side sellers who perpetually dispose all kinds of waste such as empty cans, fruits peels, wrappers, street mechanic dusts just to mention but a few (Galadima, Garba, Leke, Almustapha, & Adam, 2014).

### **Agricultural Pollution**

According to Galadima et al. (2011) globally agriculture, is a single largest user of freshwater. It is also a major cause of degradation of surface and groundwater resources via erosion and chemical runoff; this has global implications on water quality. The primary agricultural pollutants are nutrients (nitrogen and phosphorus), sediment, animal wastes, pesticides, and salts. The pollutants from these sources get into the surface water through direct surface runoff or through seepage to ground water that discharges to a surface water outlet. The dominant nutrients in surface water are chemical fertilizers and manure from animal facilities. These excess nutrients lead to eutrophication (excessive growth of algae); thus diminish oxygen content (called oxygen debt) suppressing the growth of other water plants and animals, disrupting the food chain.

The use of Pesticides contaminates surface and ground-water resources. Some of the pesticides contain endocrine disrupting chemicals that are able to mimic or antagonize the effects of endogenous hormones; that has adverse effect in the development and well-being of an individual organism, most importantly on the ability of the organism to reproduce, and the offspring surviving and reproducing. Nitrates infuse into the ground and is finally seep in drinking water; contributing to Health problems known as methemoglobinemia or blue baby syndrome which causes death in infants (Aboyeji, Oyebanji & Oluseun 2013).

### **Industrial Based Water Pollution**

Industrial wastewater is an important source of pollution to the water environment. The last century witness the discharged of enormous amount of industrial wastewater into rivers, lakes and coastal areas. This Causing grave pollution problems and negative effects to the ecosystem and human’s life (Hanchang SHI). Different industries generate different wastewaters based on their operation and processing. The content of the wastewaters are suspended solids, both degradable and non-biodegradable organics; oils and greases; heavy metal ions; dissolved inorganic; acids, bases and coloring compounds (Kosaric, 1992 cited in Aboyeji, Oyebanji & Oluseun, 2013). In Nigeria, many small and large cottage industrial establishments also discharge such harmful wastewater effluents.

### **Industrial Waste Water**

There are many types of industrial wastewater based on the different industries and the Contaminants; each sector produces its own particular combination of pollutants.

**Table 1. Water Pollutants by the Industrial Sector**

Sector	Pollutant
Iron and steel	BOD , COD, oil, metals, acids, phenols, and Cyanide
Textiles and leather	BOD, solids, sulfates and chromium
Pulp and paper	BOD, COD, solids, Chlorinated organic Compounds
Petrochemicals and Refineries	BOD, COD, mineral oils, phenols, and chromium
Chemicals	COD, organic chemicals, heavy metals, SS, and Cyanide
Non-ferrous metals	Fluorine and SS
Microelectronics	COD and organic chemicals
Mining	SS, metals, acids and salts

Adopted from SHI, (2017)

(**COD**- Chemical Oxygen Demand is the total measurement of all chemicals in the water that can be oxidized. **BOD**- Biochemical Oxygen Demand is supposed to measure the amount of food (or organic carbons) that bacteria can oxidize, **SS**- Stainless Steel).

Metal-working industries discharge chromium, nickel, zinc, cadmium, lead, iron and titanium compounds. Photo processing shops produce silver, dry cleaning and car repair shops generate solvent waste, and printing plants release inks and dyes. The pulp and paper industry relies heavily on chlorine-based substances, and as a result, pulp and paper mill effluents contain chloride organics and dioxins, as well as suspended solids and organic wastes. The petrochemical industry discharges a lot of phenols and mineral oils. Also wastewater from food processing plants is high in suspended solids and organic material. Like the various characteristics of industrial wastewater, the treatment of industrial wastewater must be designed specifically for the particular type of effluent produced. Generally, industrial wastewater can be divided into two types: inorganic industrial wastewater and organic industrial wastewater, (SHI, 2017).

### **Oil Spill Based Water Pollution**

The result from leakage of hydrocarbon from the pipes. This has been associated with poor maintenance of oil pipelines and poor monitoring of pressure regimes of the fluids with respect to the strength of the pipe. In the production of oil and gas there is discharge of substantial brines (wastewater). Its constituents include sodium, calcium, ammonia, boron, trace metals, and high total dissolved solids, (Galadima et al. 2011). In Nigeria, Niger-Delta is mostly affected by Oil spillage and are faced by environmental hazards and destruction of the ecosystem, (Krist, 2000).

Galadima et al (2011) documented several oil spill incidents that occurred in various parts and at different times along Nigerian coasts, like GOCON's Escravos spill in 1978 of about 300,000 barrels, SPDC's Forcados Terminal tank failure in 1978 of about 580,000 barrels and Texaco Funiwa-5 blowout in 1980 of about 400,000 barrels. Peter & Olusegun, (2006) also reported some oil spill incidents includes: Abudu pipe line in 1982 of about 18,818 barrels, and the Idoho Oil Spill of January 1998, of about 40,000 barrels. Also in January 17 1980 Nigeria witness the most publicized oil spills of 37.0 million litres of crude oil into the environment. This spill was as a result of a blow out at Funiwa 5 offshore station. The largest of Nigeria's oil spill was an offshore well-blow out in January 1980 with an estimated of 200,000 barrels of oil (8.4million US gallons) spilled into the Atlantic Ocean damaging 340 hectares of mangrove (Nwilo & Badejo, 2005).

Peter and Olusegun, (2006) posited that in Nigeria, 50% of oil spills is due to corrosion, sabotage account for 28%, 21% to oil production operations. While 1% is attributed to engineering drills, inability to effectively control oil wells, failure of machines, and inadequate care in loading and unloading oil vessels.

### **Impact of Water Pollution**

Despite importance of water, it is still one of the natural resource that is poorly managed globally. Industrialization and urbanization contributes greatly to the poor quality of water through indiscriminate disposal of solid waste, industrial effluents and other toxic wastes threatening the existence of human (Rahman et al., 2008). The poor management of water has a lot of consequence/ hazard to human health, aquatic animals, agriculture and generally the entire ecosystem. The Consequences of water pollution can be disastrous, depending on the type, concentration and where the pollutants are found. In Nigeria the major consequences of water pollution according to Galadima, Garba, Leke, Almustapha, & Adam, (2014) are socio-economic, health and environmental problems.

### **Health Impact on Water Pollution**

Globally about 2.3 billion people suffer from diseases that are related to water (Lai, Adarsh & Pankaj, 2011). According to them millions of lives can be saved if clean water is made available for the people and sanitation facilities provided. Inadequate provision of these services has burdened the world with water borne diseases. These diseases include: cholera, diarrhoeal diseases, dysentery, typhoid, poliomyelitis, hepatitis A. Public health literatures in past 20 years has identified unsafe water poor sanitation as a leading cause of Childhood diarrhoea. (Ezeh, Agho, Dibley, Hall, & Adrew, 2014). Society for Gastroenterology and Herpetology in Nigeria (SOGHIN) documented high prevalence rate of Hepatitis B and C with 19 million people affected with this silent killer lately in Nigeria. This is pertinent that Nigeria is still noted for the highest number of childhood deaths in Africa (UNICEF/WHO, 2012). In 2014 UNICEF the approximated number of under 5 years that dies from diarrhoea were 150,000. The effects are many and varied. Approximately 14,000 deaths per day as been recorded as a result of Water pollution causes. This is mostly in developing country due to contamination of drinking water by untreated sewage (Owa, 2013), also added that highly polluted rivers have obnoxious smell and contain little or no flora or fauna.

### **Impact on Agricultural**

Excess Plants nutrients: like nitrogen, phosphorus and other substances that sustain the growth of aquatic plant life causing algal bloom and excessive weed growth. This affect the physical characteristic of water making it to have odour, taste and sometimes colour. Ultimately, the ecological balance of a body of water is altered. Also Sulphur dioxide and nitrogen oxides causes acid rain that lowers the PH value of soil and emission of carbon dioxide cause ocean acidification, the ongoing decrease in the PH of the Earth's Oceans as CO<sub>2</sub> becomes dissolved (Owa, 2013).

### **Impact on Ecosystems**

The impact of water pollution is adversely felt in the ecosystem. According to Shiklomanov, (1997) water pollution issues threaten the health of rivers, lakes, estuaries, coastal systems and a marine resource is global. The threats results from eutrophication, toxics (pesticides, POPs), heavy metals, acidification and siltation. This results in ecosystem dysfunction, loss of biological diversity, alteration of aquatic habitats and contamination of downstream and marine ecosystems. Globally the impacts is similar in polluted aquatic ecosystems, but the effect is most near centres of human activities (Kraemer, Choudhury, & Kampa, 2001).

### **Impact of Industrial Pollutant**

Heavy metal deposited in water poses serious health and environmental problem due to absorption of the pollutants inside water or associated food. Nickel, manganese and chromium were found in the respondent blood sample with concentrations exceeding the limits permitted by WHO believed to be water-based or occupational (Ibeto & Okoye, 2010). 400 children from seven villages around Gummi and Bukkuyum Local Government areas of Zamfara state, were reported death from Lead poisoning within six months in 2010 (Galadima, Garba, Leke, Almustapha, and Adam, (2011).

### **Socio-Economic Impact**

Economic development has also causes negative changes in physical and social environments with associated adverse impacts on the health and safety of people. Urbanization and industrialization, is bring in huge deposit of toxic pollutants into the environment; polluting water fresh waters and causing enormous economic losses, for instance marine pollution. This have reduced daily beach attendance by users, number of beach trips, lost expenditures,

with remarkable decreases in satisfaction and enjoyment resulting from beach users. Economic losses from recent marine pollution events associated with recreational activities are enormous (Niu, & Yu, 2017). Thus need for water purification. The purification cost more especially water from nutrient polluted water bodies. More money is spending to clean up algae blooms and other pollutants for water activities to take place (Enviropo 2014). In developed countries, investments in water pollution abatement and control may double to 250 US\$ per capita per year by 2025 and most likely consumers instead of polluters will pay most of these costs (Kraemer, Choudhury, & Kampa, 2001). Also as a result of the pollution, there is depletion of oxygen affecting fishes and fishing negatively. People are skeptical of fish gotten from polluted water resulting in reduction of purchase and costing fisheries to lose revenue (Enviropo 2014).

### **Water Pollution Prevention and Control**

Experiences have shown that preventing pollution is less expensive than treating symptoms of pollution or cleaning up polluted sites and water bodies. The most efficient reasonable approach to water pollution prevention is to prevent the production of wastes that require treatment. Thus, measures should minimize wastewater in-plant refinement of raw materials and production processes, recycling of waste products, should be considered over the traditional end-of-pipe treatments (Helmer, & Hespanhol, 1997). Regulation and monitoring or taking control measures through reducing waste.

#### **Prevention measure includes:**

- 1) **Sewage treatments:** there should be effective sewage treatment process to treat domestic water properly and make it environmental safe. Contaminated water should handle in such a way that it does not mixed with the environment. Human and animal excreta should be prevented from get in water source through construction
- 2) **Treatment of wastes before discharge:** Factories should treat their effluent wastes; toxic material must be treated chemically and converted into harmless materials before disposing it. Recycling of treated water should be encouraged.
- 3) **Prevention of river water pollution:** every effort should be made to prevent river water pollution. Since river water cannot be cleaned easily by natural process, external substances should not be discharged into the water.
- 4) **Treatment of drainage water:** The water in drainage system should be treated properly before they are introduced into reservoirs.
- 5) **Strict adherence to water laws:** Laws and legislation relating to pollution should be strictly followed by all.
- 6) **Routine cleaning and testing of ponds, lakes and wells:** there should be routine cleaning and testing of Ponds, lakes to and wells to ensure is safe for human use
- 7) **Sanitation and Self hygiene:** Sanitation Self hygiene must be maintained.
- 8) **Public Awareness:** awareness on effect of water pollution should be created and public health educated on water pollution.

### **CONCLUSION**

Water pollution is a major environment problem globally; mostly in developing country including Nigeria. Majorly water pollution is from human activities and industrial waste. The dumping of these untreated waste into water bodies have pose a serious threat to all lives and the entire eco-system. The availability and safe water always have played an important role in

determining the quality of life and sustained development. Therefore there is an urgent need to create awareness and educate people on the pressing environmental challenges.

#### **RECOMMENDATION**

1. Community Environmental education should establish and be giving regularly
2. Water pollution control should be a subset of water resources management with continuous monitoring potential polluters.
3. Government at all levels should establish a pollution monitoring agencies and enforcement institution that will ensure human activities are environmental friendly.
4. All should industries should recycle waste generated.



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