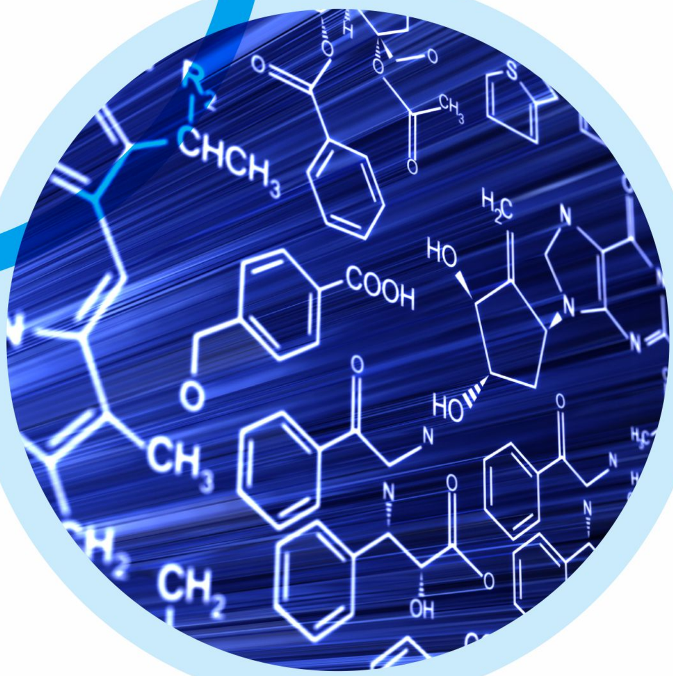

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Research Article
Water Pollution: Causes and Effects in Bomadi Town, Bomadi LGA, Delta State

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Abstract
Background and Objective: Water is difficult to obtain in Bomadi and its supply is unreliable in the sparsely populated area of the Niger-Delta Region. Water pollution in the area resulted from the wrong siting of well/borehole close to sewage tank and dumping of refuse/sewage in the water. This study identified various water sources, causes and effects of pollution based on evaluated physico-chemical and biological characteristics. **Materials and Methods:** The primary sources of data include an oral interview and water chemical analysis while the secondary data are published works in journals, textbooks, etc. Six sample point sources from river, well and borehole was analysed based on the international standard procedure of water collection, storage in a dried disinfected bottle and immediate refrigeration. These are analysed in government-approved laboratories with equipment different types of equipment. **Results:** The water chemical analysis in Bomadi present various substances within, above and below WHO acceptable limits. Substances found from the analysis include pH, copper, Ca, Mg, Fe, Pb, Cd and Zn, the anion value of carbonate (0.01 mg L^{-1}), bicarbonate (6.30mg L^{-1}), sulphate (10.15 mg L^{-1}) and nitrate (5.55 mg L^{-1}) are obtained. **Conclusion:** Based on health data from the general hospital and oral interviews conducted, the health problems associated with polluted water in the area are heart and kidney, poor blood circulation, gastroenteritis, respiratory illnesses, complications in childbirth, damage to the nervous system, skin lesions, vomiting, cholera, and damage to the nervous system amongst others.

Key words: Pollution, water, environment, oil companies, sewage, refuse, oil spills

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Water is the lifeblood of the ecosystem, normally wasted, polluted and the rate of change is too minimal compared to its production. There are many ways in which water intended for human consumption can get polluted that include, location of wells and boreholes close to sewage tank as well indiscriminate dumping of refuse and sewage in water and on land. Moss[1] stated that it impacts the system as a whole that is it has physical impacts such as drainage modification of the river channels, catchment area and soil nutrient as it percolates.

The importance of this study includes identification of the various water sources, causes and effects of pollution to evaluate their physico-chemical and biological characteristic. The analysed substances in water samples are identified using international standard laboratory equipment and procedure. Also, oral interviews, documented medical records of the people in general hospital, revealed the health problems associated with pollution in the area. Abraham and Susan[2] worked in the industrial mining and processing area of Kilembe, Western Uganda whose activities from 1956-1982 leftover 15 Mt of cupriferous and cobaltiferous pyrite dumped within a mountain river valley in addition to mine water that is pumped to the land surface. This study assessed the sources and concentrations of heavy metals and trace elements in Kilembe mine catchment water. Multi-element analysis of trace elements from point sources and sinks were conducted to include mine tailings, mine water, mine leachate, Nyamwamba River water, public water sources and domestic water samples using ICP-MS. The study observed mean concentrations (mg kg^{-1}) of Co (112), Cu (3320), Ni (131), As (8.6) in mine tailings which are significantly higher than world average crust and are eroded and discharged into water bodies within the catchment. The underground mine water and leachate contained higher mean concentrations (μg L^{-1}) of Cu (9470), Co (3430) and Ni (590) compared with background concentrations (μg L^{-1}) in uncontaminated water of 1.9, 0.21 and 0.67 for Cu, Co and Ni, respectively. Over 25% of household water samples exceeded the UK drinking water thresholds for Al o f 200 μg L^{-1}, Co exceeded Wisconsin's (USA drinking) water thresholds of 40 μg L^{-1} in 40% of samples while Fe in 42% of samples exceeded UK thresholds of 200 μg L^{-1}. The study also revealed natural processes of weathering to have contributed to Al, Fe and Mn water contamination in a number of the public water sources.

The polluted water in River Forcados due to refuse dumps and wastes are likened to those in New Delhi, India water bodies as stated by Ahmed and Ismail[3] and Malaysia by Ab Razak *et al.*[4]. The specified pollution includes those wastes from industries (like mining and construction), food processing, radioactive wastes from power generating industries, domestic/agricultural wastes and various microbiological agents for the decay of substances. Ab Razak *et al.*[4] worked on drinking water review on heavy metal, application of biomarker and health risk assessment focus in Malaysia and concluded that health policymakers should provide mechanisms for encouraging researchers, especially environmental health professionals, by prioritizing national research into water quality and pollution to encourage them to conduct studies on the wellbeing of the people. Also, Ramandeep *et al.*[5] observed that humans recognize this fact and still polluting the rivers, lakes and seas. Subsequently, the population is slowly infested but surely harming the planet where organisms are dying off. Domestic water supply is greatly affected so is our ability to use water for recreational and other purposes.

The rationale of the study is to identify several challenges confronting different water supply sources, sanitation and safe drinking water in Bomadi for the water to be purified to remove physical, chemical and biological pollutants as identified by analysis. The research study is therefore conducted to look for more reliable and cheaper ways to purify water at affordable cost, Adesiyan *et al.*[6] examined the concentrations and human health risk factors of 5 heavy metals (manganese (Mn), arsenic (As), chromium (Cr), cadmium (Cd) and lead (Pb)) in selected rivers in Southwest Nigeria. Heavy metals determination was carried out by atomic absorption spectrophotometry, after digestion with a di-acid mixture 9:4 (v/v) (nitric acid and perchloric acid). All rivers had higher concentrations of the 5 heavy metals in the dry season except for As, in Dandaru (0.012 mg L^{-1}) and Asejire (0.016 mg L^{-1}). Manganese was observed to have the highest mean concentration in all the 5 metals collected in the rainy and dry seasons across sampled rivers. Observed generally is the annual mean concentration of metals that followed order: Mn>Cr>Cd>Pb>As in the selected rivers. The human health risk assessment showed that the hazard index and hazard quotient for ingestion of water for Cd and As in the sampled rivers were higher than the acceptable limit of 1.0, indicating Carcinogenic Risk (CR) via direct ingestion of water. The CR via ingestion for As in all of the sampled rivers were found to be above the remedial goal target of 1×10^{-6}. The recorded values for Chronic Daily Intake (CDI) were higher for Cr and Mn in all 4 sampled rivers. Thus, the study showed that As is a driver for carcinogenic risk through ingestion in all of the sampled rivers compared to other metals.

Kirschner *et al.*[7] research on human faecal pollution was demonstrated as the primary pollution multiparametric monitoring of microbial faecal pollution to reveal the dominance of human contamination along the Danube River. Animal faecal pollution was of minor important consideration. This study demonstrated the application of host-associated genetic microbial source tracking markers together with the traditional concept of microbial faecal pollution monitoring based on SFIB that significantly enhances the knowledge of the extent and origin of microbial faecal pollution patterns in large rivers. It, therefore, constitutes a powerful tool to guide target-oriented water quality management in large river basins. Water pollution was negatively associated with health outcomes and the common pollutants in industrial wastewater had differential impacts on health outcomes for which small the effects were stronger for low-income respondents according to Igwe *et al.*[8].

There are many ways in which water intended for human consumption can get polluted. Water pollution affects man and his environment are affected naturally, deliberate or accidental contamination of drinking water is attributed to water-borne diseases that kill millions of people per year. That, over 70% of the planet is covered by ocean, sea, river and stream and people act as if the bodies of water serve as a limitless dumpsite for wastes, raw sewage, garbage and spills. This will no doubt overwhelm the diluting capacity of the oceans for which coastal water is eventually polluted. Water pollution in Bomadi town resulted from the sitting of wells and boreholes close to sewage tank, dumping of refuse and sewage in the water that results in seepage to pollutes underground and surface water. The main objective of this research is to identify the sources of water pollution in Bomadi, evaluate their physico-chemical and biological composition/characteristics, causes and effects of water pollution and ascertaining compliance with WHO standards and determine the various sources, causes and effects of water pollution in Bomadi to proffer solution and make a recommendation on the problems emanating from water pollution in the area.

MATERIALS AND METHODS

Study area: Bomadi is a settlement in Delta state that serves as headquarter to Bonadi LGA. It is located on latitude 5°05' and 15°13' North of the equator and longitude 50°45' and 50°55' East of the Greenwich meridian. It is bounded North by Ughelli LGA on the West by Burutu, on the East and South by Patani LGA. It has to mean annual rainfall with double maxima in July and September, a hiatus (break) in August, with a pattern in the hinterland of high values above 2,500 mm e.g., Patani and Warns (3,100 mm). Most of the areas are marshy as it experiences a tidal rise of 12-14 m as most of the area is subjected to inundations (floods) for the greater part of the year. The research work was finally carried out at Hydrology Laboratory, Delta State University Abraka, from March, 2019-August, 2020.

Oral interview: This study is concerned with the causes and effects of water pollution in Bomadi. The oral interview revealed that the major causes of water pollution in the area are factors of wrong locating of boreholes close to sewage tanks, pit toilets, dump sites and dumping of refuse and sewage into water bodies. Also, the effects of water pollution in the area are identified with inherent scarcity problems as truck-loads of sachet water are supplied from neighbouring Delta and Rivers States on daily basis due to shortage of water supply within Bomadi. This is manifested in price hikes as a sachet of water (50 Cl) costs N20 in Bomadi and N10 in the neighbouring state as the cost implication is a 100% increase of what is obtainable in the states.

The other major problem associated with water pollution is human diseases reported in Bomadi General Hospital. These include the heart and kidneys of patients adversely affected by polluted water that is consumed regularly. Other health problems associated with polluted water are poor blood circulation, skin lesions, vomiting, cholera, malaria, fever, typhoid fever chronic headache, gastroenteritis and damage to the nervous system.

Sample points: Water samples for this study were collected from the following sample points: River Forcadoes, Ayama well, Amatebe well, GRA well, borehole 1 and 2 in Bomadi. There is temporal consideration when the water samples were collected. This is when the water is not highly concentrated due to extreme evaporation in the dry season or highly neutralized from much rainwater during the wet season, respectively. To this end, 4 samples were collected bi-weekly for 3 months for each of the 2 seasonal periods, on which, the average sampled values at a particular point source are derived for representative samples taken from the entire chemical analysis.

Methodology

Equipment used for sample collection: The equipment used for the collection of water samples and the analysis include sample bottle containers, Atomic Absorption

Spectrophotometer (AAS)-Chinese Instruments, Model AA320N, China pH meter (Hannah Instruments Model H196107, England), conductivity meter (Hannah Instruments Model EC215, England), Dr. 400 spectrophotometer (B.Scientific Instruments Model 721D, England), dissolved oxygen meter (Swingfield Medicals, Model PHS-3E, England), Thermometer (Hannah Instruments, Centring Model B2, England), Oven (SOL Instruments, Model 400 T LG, Korea), Hot Plat (SOL Instruments, Model NU-1 LG, Korea, Magnetic stirrer (Hannah Instruments Model HY-HS11, England), Desiccators (B. Scientific Instruments, Model BRC-1, England) and Weighing device/Evaporating dishes (OHAUS, Models AR223CN and CN-003V, USA., filter papers 9 12.50 mm (Paper Filter Company, Lagos, Nigeria), volumetric flasks (various capacity), burettes 50 cm, pipette (various sizes), conical flask (various sizes), measuring cylinder, separating funnel, funnels glass fibrepaper 9 3.3 cm diameters), wash bottles, glass rods, drying dishes, white rubber kegs, distilled, deionized water and dissolved oxygen bottles. The glasses and bottles are supplied by Nigeria Bottling Chemical Company, Lagos, Nigeria.

Chemicals: The chemicals used are obtained from the following sources:

BD 1+chemical pole, England: -$MnSO_4$ H_2O-magnesium tetraoxosulphate (vi) monohydrate Na^+-sodium hydroxide pellets, 36% HCl-Hydrogen chloride, 635 HNO_3-nitric acid, phenolphthalein indicator, $Na_2S_2O_3$ $5H_2O$-sodium pentahydrate and $NaNO_3$-sodium nitrite.

May and Belier chemicals, Dagenham, England: -98% H_2SO_4 sulphuric acid, H_2O_2-hydrogen peroxide, $K_2Cr_2O_7$-potassium chromate dried at 103°C for 2 hrs, starch solution, KFH_2O, potassium monohydrate, KOH-potassium hydroxide chloroform, KI-potassium Iodide.

The parameters tested for include: PH, temperature, total dissolved solid, total use, total hardness, bicarbonate, nitrate, sulphate, calcium, iron, lead, cadmium, copper, zinc, magnesium and total coliform count.

Sample collection: The water sample containers (white rubber kegs) were cleaned with $2HNO_3$, (Trioxonitrate V acid), acetone and distilled or deionized water, thereafter the containers were air-dried. The procedure was followed to remove traces of adhering elements or contaminants in samples. On arrival from collection sites, the samples were at once refrigerated between 0-4°C.

RESULTS

The methods of physical, chemical and biological analysis of the water sample follow the UN analytical methods in a government-approved laboratory (Timiebi Technical company, Bomadi/Ughelli). The chemical characteristics of water are numerous. Most substances that dissolve in and react with water are used as chemical water quality characteristics tests. Hundreds of other chemicals might be tested for or monitored but only the most relevant few are routinely carried out for time and cost-effectiveness and also, because of exorbitant cost in such analysis in Nigeria. But, the availability of abundant supply of water from surface or underground sources is one of the major factors influencing the pattern of portability and industrial location in the country. Table 1 shows the result of laboratory water samples analysis of data collated fo r the various samples. The analysed water data specified the various substances found and their implications are further presented side by side with WHO reference standards for easy reference and comparison are presented in order of sample points listed viz: (1) River Forcados, (2) Ayama Well, (3) Ametebe Well, (4) GRA Well, (5) Bomadi Borehole I and (6) Bomadi Borehoedts summarised as follows: Turbidity (34.10 mg L^{-1}), DO (38.0 Ca (200) 1500 mg L^{-1}), 12007 mg L^{-1}) and Zn (15.0 mg L^{-1}), carbonate (0.01 mg L^{-1}) and nitrate (5.55 mg L^{-1}).

Within WHO acceptable: Temperature (28.20°C), hardness (4.00), total coliform (Nil).

Below WHO acceptable standard limits: TSS (3.00 mL), salinity (38.50 mg L^{-1}), pH (4.65 mg L^{-1}), copper (1.50 mg L^{-1}), bicarbonate (6.30 mg L^{-1}) and sulphate (10.15 mg L^{-1}).

The analysed water data specified the various substances found and their implications using the WHO reference standard of permissible limits as follow.

Total dissolved solid (TDS): The WHO standard value for TDS is 500 mg L^{-1}. The values recorded are within 7.45-20.10 mg L^{-1}, far below the acceptable limit and therefore, of no significant effect.

Temperature: There is no WHO standard value for Temperature, The temperatures of 20.10-28.20 recorded are within the temperature of the environment.

Table 1: Results of laboratory water analysis

Tested parameters	WHO's acceptable limits	River forcados	Ayama well	Amatebe well	GRA well	Borehole 1	Borehole 2
TDS (mg L^{-1})	500.00	7.45	12.75	16.50	20.10	9.25	11.65
Temperature (°C)	0.00	28.15	22.75	28.15	28.20	20.15	20.10
Total hardness (mgeqeaco3)	500.00	2.00	1.50	1.28	2.01	3.45	4.00
Turbidity (NTU)	5.00	34.10	1.67	1.12	32.40	3.16	1.17
DO (mg L^{-1})	200.00	34.15	38.50	25.50	27.00	22.40	25.45
TSS (mg L^{-1})	0.00	1.50	2.59	2.01	3.00	1.00	1.00
Salinity (mg L^{-1})	200.00	34.15	38.50	25.50	27.00	22.40	25.45
pH	7.50	3.05	4.10	4.35	4.65	3.61	3.60
Microbiology							
Total coliform CFU/100 mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metals calcium (mg L^{-1})	75	200	0.56	0.49	0.72	0.51	0.51
Iron (mg L^{-1})	0.30	1.00	<0.001	<0.001	0.21	0.21	0.21
Lead (mg L^{-1})	N/A	0.05	<0.001	0.12	<0.001	<0.001	<0.001
Cadmium (mg L^{-1})	N/A	0.01	<0.001	<0.001	0.004	0.007	0.007
Copper (mg L^{-1})	0.05	1.50	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (mg L^{-1})	5.00	15.00	0.03	0.05	0.04	0.03	0.03
Magnesium (mg L^{-1})	50.00	150.0	0.17	0.15	0.25	0.15	0.15
Anions							
Carbonate	500.00	0.01	0.01	0.01	0.01	0.01	0.01
Bicarbonate	500.00	6.30	6.10	6.00	4.00	4.00	4.00
Sulphate (mg L^{-1})	200.00	6.10	10.15	1.30	9.10	1.00	1.80
Nitrate (mg L^{-1})	0.00	0.40	0.27	0.10	0.11	1.56	5.55

Source: Timiebi Technical Company, Bomadi/Ughelli, Do: Dissolved oxygen, TSS: Total suspended solid and TDS: Total dissolved solids

Total hardness: The WHO acceptable standard value for hardness is 500 mg L^{-1}. The value of 1.28-4.00 recorded is of no significant effect.

Turbidity (NTU): The WHO standard for turbidity is 5NTU. All the values obtained for the different point values 1.12-34.10 mg L^{-1} are lower than the standard except the wells at GRA and River Forcados have 32.40 and 34.10 NTU, respectively. That show characteristic of high turbidity and therefore possess some particles in the form of colouration should be addressed by boiling and filtration.

Dissolved oxygen (DO): The value for the WHO standard is 200 mg L^{-1}. The values for all points are lower than the WHO standard with minimum and maximum values of 22.40 and 38.50 mg L^{-1}, respectively. The result implies that it will allow light to reach deeper waters and make oxygen available to fishes and other aquatic lives at the surface and at depth.

Total suspended solid (TSS): There is no WHO standard value for suspended solids. The result of the analysis shows that there are some suspended solids at different points recorded in the range of 1.00 and 3.00 mg L^{-1}.

Salinity: There is no WHO standard value from the result of the analysis, the values of 22.40-38.50 mg L^{-1} for all the samples from all points are less than the WHO standard. These indicate that the water from the different sampled points is of low salinity.

pH: The maximum acceptances WHO limit are 7.50 mg L^{-1}. The result of the analysis is of values between 3.05 and 4.65 mg L^{-1}. These values indicate that the water is acidic. This means that the water from the source is not good for consumption except when treated scientifically to lower this value.

Total coliform: The value of the WHO coliform standard limit is nill. The results from the analysis show nil values. These indicate that there are no microbial organisms found in the water.

Metals

Calcium: The WHO acceptable limit is 75.00 mg L^{-1}. All values for the different points are 0.49-0.72 mg L^{-1} except River Forcados with 200 mg L^{-1} that requires treatment. The other samples with values lower than the WHO standard limit indicate that there is little concentration of calcium in the water.

Iron (Fe): The maximum acceptable limit for iron is 0.30 mg L^{-1}. The results are less than 0.001-0.21 Mg except for River Forcados with 1.00 mg L^{-1}. The values indicate the minute presence of iron and therefore of no significance in most samples. River Forcados requires water treatment before usage.

Lead (Pb): The maximum acceptable limit for lead is not available. From the result of these before analysis, values of less than 0.001-0.12 mg L^{-1} are recorded for the sources. Lead presence is recorded at different water sampled points and must be treated for poisonous substance usage.

Cadmium (Cd): The maximum acceptable limit for cadmium is not available. The result of the analysis has values for cadmium from the different points is 0.001-0.007 mg L^{-1} except for River Forcados with 0.01 mg L^{-1}. This shows that there is a concentration of cadmium in the water that requires treatment before usage as cadmium is very dangerous to health.

Copper (Cu): The maximum acceptable limit for copper is 0.05 mg L^{-1}. From the result, the value of copper at the different sample points is less than 0.001 mg L^{-1} except for River Forcados with 1.50 mg L^{-1}. The values are less than the WHO acceptable limit with exception of the river that necessitates water purification. This shows that there is a tolerable little concentration of copper in most of the water samples.

Zinc (Zn): The maximum acceptable limit of WHO stands and for zinc is 5.00 mg L^{-1}. The analysed values for zinc are 0.03-0.05mg L^{-1} for all samples except River Forcados with 15.00 mg L^{-1} that requires treatment. The other samples are with values lower than the WHO standard limit indicates that there is little zinc in other water samples and of no significant effects.

Magnesium (Mg): The maximum acceptable limit for magnesium is 50.00 mg L^{-1}. The values range from 0.15-0.25 mg L^{-1} except for River Forcados with 150.00 mg L^{-1} that requires treatment. The other samples with values lower than the WHO standard limit indicate that there is little concentration of the metal in water.

Anion

Carbonate: The maximum value of the WHO standard for carbonate is 500.00 mg L^{-1}. The result of the analysis shows that the values of carbonate present in the water from different sample points are less than 0.01 mg L^{-1}. This is lower than the WHO acceptable limit and of no significant effects.

Bicarbonate: The maximum acceptable limit is 500.00 mg L^{-1}. The results of water analysis show values between 4.00-6.30 mg L^{-1} are recorded for the samples. There is a negligible quantity of bicarbonate in the water as the values from different sample points are lower compared with that of the WHO standard limit and therefore of no significant effect.

Sulphate: The maximum acceptable limit is 200 mg L^{-1}. The result of the analysis shows values between 1.00-10.15 mg L^{-1} are recorded for the samples. There is a negligible quantity of sulphate in the water as the values from different sample points are lower, compared with that of the WHO standard limit.

Nitrate: The minimum acceptable WHO standard is 0.00 mg L^{-1}. The analysis shows that there is a presence of nitrate in water samples in the area between 0.10- 5.55 mg L^{-1}. Thus, the treatment of water in this regard is necessary before usage for domestic and industrial purposes.

DISCUSSION

The water chemical analysis in Bomadi present various substances within, above and below WHO acceptable limits. The findings indicate major problems associated with harmful substances found if polluted water is consumed regularly. Based on Health data from the General Hospital and oral interviews conducted, the health problems associated with polluted water in the area resulted in the heart and kidney adversely affected, poor blood circulation, gastroenteritis, Respiratory illnesses, complications in childbirth, damage to the nervous system, skin lesions, vomiting, cholera, and damage to the nervous system. Others are diarrhoea, dysentery, anaemia, malaria fever, yellow fever, typhoid fever, cholera, dengue, chronic headache and odour. Moreover, Kirschner *et al.*[7] further stated the various ways in which water is put to use that include industrial, farming, domestic and human consumption. They include free from organisms and chemical substances, not in large concentrations enough to adversely affect health positively. Adejumoke *et al.*[9], studied pollution effects, prevention and climate impact indicated that water environment treatment led to improved health outcomes and water is a very important resource both to man, plants and animals in water-deficient areas. This research method involves physical, chemical and biological water analysis in line with the study conducted by Joshua and Nazrul[10] on the pollution situation of Turag River in Dhaka, Bangladesh and the health problem of the surrounding residents. Owa[11] presented in this paper details on water pollution various sources, effects, control and management Rene *et al.*[12] also stated the major challenge that humanity is facing in the 21st century on water pollution are mainly groups of aquatic contaminants, their effects on human health and various approaches to mitigate pollution of the freshwater resource have been carried out. The results of the research reflect the work to ascertain the pollution situation of the Turag River in Dhaka, Bangladesh together with the health problem of the surrounding residents. Like Bomadi Rivers, the results clearly stated that the water quality of the Turag River may not be in a position to sustain aquatic life as they are also not suitable for domestic purposes. The maximum recorded values of pH, colour, turbidity, Biochemical Oxygen Demand (BOD5), Hardness, Total Dissolved Solids (TDS), Chloride (Cl^-), Carbon-Dioxide (CO_2) and Chemical Oxygen Demand (COD) are 7.1 mg L^{-1}, 625 ptcu, 97.2, 4.65, 1816, 676, 5, 15.5 and 78 mg L^{-1}, respectively. The maximum concentration of turbidity, BOD, hardness, TDS and COD found in the Turag River is much higher than the permissible limit. The study also provides medical evidence that local communities are suffering from a variety of health problems including skin, diarrhoea, dysentery, respiratory illnesses, anaemia and complications in childbirth. Yellow fever, cholera, dengue, malaria and other epidemic diseases are also found in this area. Furthermore, people are suffering from odour pollution and respiratory problems too[10].

There is no viable policy implementation on water pollution in Nigeria, hence the need for articulation of presentation by Andreea-Mihaela[13] on water pollution challenges and policies future direction in Malaysia. The reiterated the necessity of the implementation of the WHO policies to improve water quantity and quality despite the progress made in improving stream qualities in most MDC's[14].

The recommendations emanating from this work are as follows: That the government should set up a body to monitor the environment and penalize those who pollute the environment. Individuals should be educated on the possible implications of polluted water sources available to them and the dangers posed by using polluted water. There should be periodic education on the need to purify the water available to them before usage especially for potable means.

CONCLUSION

Based on the findings of this study, the following conclusions are drawn. Water pollution in Bomadi results from human activities ranging from social, domestic habits and oil spillages. The activities of man in the environment result in pollution of the water resources, health problems and shortage of potable water supply. In line with environmental protection agency, water pollution in the area degrades surface waters making them unsafe for drinking, fishing, swimming and domestic and industrial uses. However, pollution is a cankerworm that has continued to pose a serious threat to human developmental activities, in a process of not making life more meaningful. If this situation is left unchecked, it will cause more harm to the people in the area.

SIGNIFICANCE STATEMENT

The significance of this research is to generate serious concern on the causes and effects of water pollution on man, plants and the ecosystem and to establish the need to address the problem of polluted water in the area. That is, for water to be purified to avoid the danger posed by pollutants. Though water is found everywhere, the needed available quality and quantity of the specified standard for use is limited. This study will address the problem of indiscriminate disposal of the refuse dump on land and water. This research results will be presented to stakeholders in Delta State and Bomadi Local Government for the reduction of sickness related to water-borne diseases and will no doubt help to raise the living standard and the well-being of the people.

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