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Analysis of Water Pollution in Gumel Local Government Area, Jigawa State, Nigeria

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Abstract
Pollution has always been an emotive topic irrespective of whether it occurs in the air, on land or at sea. In the later help of this century much attention has been drawn to water pollution caused by human activities and industrial revolution which experience local levels of high pollution quite unimaginable by present standard. This pollution has passed great risk to the health and immediate surroundings of those involved. It impact is further aggravated by the physical zoning of industrial waste discharge regulation leading to complex problems of water pollution. The conditions characterize the existence of substance in environment in quantities which can be deteriment to the well being of plants and animals

Introduction
Water is the most indispensable asset to man. Water in environment is made up of lakes, rivers, ponds, springs, sea and ocean, these are the main sources of domestic, industrial agricultural, recreational, transportation and consumption. However, water is used in industries and production of electricity.
Aquatic plants and animals rely on water for their survival and growth, and industries cannot exist without it.
Living organism need water for their physiological activities water acts as a medium for all the biochemical reaction within plants and animals. Unlike other resources, there is no substitute for water.
Pollution is caused by mismanagement of our environment; we have poisoned the air, and soil with pollutants. We have upset natural communities of life forms in ways that are affecting us. (Lansford, 1974). Furthermore, we have reached a point at which we must protect the environment in order to help our existence. The need to provide food, water, minerals fuels and other necessities will place pressure on virtually all areas of the earth and demand the most careful planning and management of natural resources. No nation can any longer be isolated from these global pressures (General Thant, 1974).
Pollution is a Greek word which means defilement, in general sense, pollution may be defined as the accumulation of something where it not wanted (Lansford, 1974). In other words, it could be defined as the addition of materials to the environment that damages it. The materials are referred to as pollutants.
There are various types of pollutions which include water, land, air and noise among others.
Water pollutions are defined as “an enormous discharges of various materials into water bodies which include the largest volume of waster and the most toxic pollutants (Quono, 1978).
In early every part of the world, water pollution has reached a dangerous level. In Holland, for example, Rhine River is called the “sewer of Europe”. By the time the river reaches the Dutch coast, it is 20 percent sewage and industrial waste. The islet river in Russia loaded. This is because rivers became depleted of fish while the soil became less productive. Soils lose their fertility because nutrients essential to plants growth are scene while those that are toxic to plants become more available (Odu, 1977).
In Nigeria, many activities can cause wastes such as industrial wastes are form petroleum products, iron and steel, textile industries, fertilizers and pesticides. These pollutants eventually add up into rivers and lakes.
World leaders have come to recognize that, an environmental crisis exists. This awareness had led to the establishment of a well defined environmental policy control measures at local, national and international level.
An articulate environmental policy in Nigeria has emerged only in the current fourth national development plan 1981 – 1985. This relatively late development of a policy is no doubt due to the overriding concern at the early stages, development for the qualitative aspects of human requirements, more food, more water, energy among others as opposed to qualitative aspects. This policy is as a result of the establishment of environmental protection agency with the aim of protecting and developing the environment as a whole. Laws with regards to oil pollution were also formulated.
Laws pertaining to the petroleum producing region deal essentially with the problems of pollutants from the foundations of these laws are the petroleum country decrees of 1967 and the petroleum decree (decree no 5 of 1967 which amongst other things empowered the commander in charge of petroleum to make regulations of water and the atmosphere the only note worthy law in this date is the oil in the navigable water decree (decree of 1968) this decree prohibits the discharging of oil, fuel oil, lubricating oil and heavy diesel oil in Nigeria’s territorial waters including inlands water (Ikporukpo, 1985).
In spite of these policies, there is hardly any improvement on environmental problems. This is because has

undetermined the laws of environmental sanitation especially urban areas.

Justification

Surface water pollution is a fact of life which has reached an alarming proportion due to rapid population growth, increasing urbanization and industrialization process. Indeed, it is unfortunate to observe that there is a direct conflict between development on one hand and environmental population control on the other hand in many developing countries. While the former provides greater employment leading to a generally higher standard of living, the letter commands a low priority in terms of national investment. The quality of the environment in which we live, work and play affect the quality life itself and there is an obvious interaction between the two.

Of all natural environmental resources, water is the most severe threatened by pollution. Hence, water pollution control is presently a high priority in many countries and among numerous pollution agencies. It was a matter of record that sewage and industrial waste we were making rivers unsafe as aquatic habitat.

The Gumel emirate as a study area due to the large concentration of activities. The study area was also chosen because it provides an excellent background for the study of water pollution. It was observed that, inadequate social amenities and in effective sewage management system contributes to the problem of pollution in Gumel emirate.

The study of surface water pollution is important within the area as it would reveal the effect of industrial waste on plants and animals and would provide ways of disposing pollutants.

Objectives and aims

Objective

To determine the effects of industrial wastes and the wastes of human activities on surface water bodies within Gumel Emirate

Aim

i. To determine the toxic chemicals found in the polluted water of the study area
ii. To assess the effects of these toxic chemicals on living organisms found within the study area.
iii. To suggest ways of controlling water pollution

Material and methods

Location

Gumel local government is situated between latitude $12^0$20'N to $12^0$42'N and longitude $9^0$15' E to $9^0$35' E. Gumel is located in Jigawa state as one of the oldest local government in the northern part of the state. Gumel is about 148km away from the state capital Dutse.

Gumel is boarded with Maigatari local government to the north, to south-east with Gagarawa and south west with Sule-Tankarkar local government.

Analysis Carried out Include Test for

1. Ph. Level determination
2. Sulphate ion (SO_4^2)
3. Chloride ion (Cl^-)
4. Calcium Ion (Ca2+)
5. Magnesium (mg^{2+})
6. Bicarbonate (HCO3)

All of which were qualitatively tested.

Results

Ph. level

Ph level is the point of hydrogen ion index. It is measure of the degree of acidity or alkalinity of a solution. The formula for obtaining the P^h of a given solution is $P^h = -\log (H^+)$

The Ph level of the sample are given below

Table 1: Ph level

Sample	Type	Ph Level
Sample 1	Tanneries	10.0
Sample 2	Oil mills	8.0
Sample 3	Confectionaries	12.00

Going by the safety level recommended by the world health organization which is between 6.5 and 8.0, it follows that all the water sample exception sample 2 exceed the ph safety limit. This shows that waste discharge from tanneries, oil mills and confectionaries industries have high ph level and this contribute to the over use of chemicals, such as soduim sulphite calcium, carbonate (lime), ammonia Sulphite, detergent, sodium bicarbonate and other chemical that lead to high environment water pollution. Other ways of testing for the alkalinity or acidity of the sample is by checking the reaction of methyl orange and phenolphthalein in all sample solution as well as the effect on the litmus paper. This is indicated in the able 2 below;

Indicator	Tanneries	Oil mills	Confectionaries
Red litmus paper	Pale blue	Pale blue	Pale blue
Blue litmus paper	Faint red	No effect	No effect
Methyl orange	Yellow	Yellow	Yellow

The above result proved that the water samples are basic. The high alkalinity shows that the sample are dangerous for drinking, human being or animals that consumes such polluted water may be at risk.

Chloride ion test (Cl^-)

Reagent:- Nitric acid, silver nitrate, water, sample 1, 2, 3

Apparatus: - Funnel Filter paper, test tube, and conical flask

Method: - Each water sample was filtered in to clean conical flask to about 5cm3 of the filtrate from each sample water, acidity with nitric acid.

About 3cm3 of silver nitrate solution were also added.

Observation: while precipitate was observed when sample 2 was tested for chloride by addition of nitric acid and silver nitrate, sample 1 reaming unchanged while sample 3 shows brownish precipitate.

Result: while precipitate indicates the presence of chloride in sample 2 and brownish precipitate indicates the absence of chloride.

Sulphate Ion test (SO_4^{2-})

Reagent: Hydrochloride acid, chloride, water sample 1, 2 and 3

Apparatus: Funnel, filter papter, test tube, conical flask

Method: water sample were filtered to remove impurities into a clean conical flask. To about 5cm3 of the filter from each of samples water acidified with hydrochloride acid, barium chloride solution was added.

Observation: on addition hydrochloride acid to sample 3, a gas with smell of rotten egg is evolved this smell was absent in sample 1 and 2. On addition barium chloride there was no white precipitate in sample 1 and 2 respectively but while precipitate was present in sample 3.

Result: the gas evolved and the white precipitate in sample 3 indicates the presence of sulphide and the absence of gas and white precipitate in other samples shows that sulphide was not present in them.

Calcium ion Test (Ca^{2+})

Reagent: ammonium oxalate solution

Apparatus: Water sample 1, 2, 3, test tube, funnel, filter paper, conical flask

Method: filter each of the water sample 1, 2, 3 to about 5cm3 of each filtrate. Add ammonium oxalate solution

Observation: on testing for calcium ion, white precipice was formed with sample 1 no precipitate was formed with sample 2 and 3

Magnesium ion Test (mg^{2+})

Reagent: ammonium oxalate solution

Apparatus: Water sample 1, 2, 3, test tube, funnel, filter paper, conical flask

Method: filter each of the water samples to about 5cm3 of each filtrate; add ammonia solution and disodium, hydrogen, phosphate solution. Allow to stand for some time.

Observation: on testing for magnesium, white precipitate formed with sample 1 and no precipitate formed with sample 2 and 3.

Result: white precipitate indicate the presences of magnesium in sample 1. The absence of white precipitate in sample 2 and 3 shows that magnesium is not present in them.

Bicarbonate ion (HCO^{3-}_3)

Reagent: ammonium oxalate solution

Apparatus: Water sample 1, 2, 3, test tube, funnel, filter paper, conical flask

Method: filter each of the water sample 1, 2, 3 to each of the filter add magnesium

Observation: white precipitate was formed with sample 1 no precipitate with sample 2 and 3

Result: white precipitate shows the presence of both in sample 1 and its absence in sample 2 and 3.

Table 3: Summary of Test

	Sample 1	Sample 2	Sample 3
Acidity/alkalinity	Basic	Basic	Basic
Chloride ion	Absent	Present	Absent
Sulphate ion	Present	Absent	Absent
Calcium ion	Present	Absent	Absent
Magnesium ion	Present	Absent	Absent
Bicarbonate ino	Present	absent	Absent

Discussion and conclusion

Ph level: litmus paper was used to determine the ph level of each solution. It may be blue or red, and ranges from

0 to 14.

In acid solution, blue litmus paper turn red, while in alkaline solution red litmus paper turns to blue. It turns to a different color according to the strength of an acid or alkaline solution. With this kind of indicator paper the color is compared with a chart attached to the litmus paper which gives a number against each color. If the ph of a liquid is less than 7, the liquid is acidic; if it more than 7 the liquid is alkaline. If the ph is 7 liquid is neural.

However, from the analysis carried out on the water samples, sample I reading 10.0, sample 2, 8.0 and sample 3, 12.0. it shows that the water samples are a basic but sample 2 which is 8.00 fall within same limit. It was accepted that ph level higher than 8.0 are tolerable to vegetables, some crops that are below this level which tend to resists this abnormality of alkalinity of the soil appears weak and stunted growth. Fruits, vegetables and other plants have changed their natural state due to the alkalinity of the soil. The soil colour test also revealed that the soil is made poor, resulting in low crop yield in Gumel emirate. In fact, the color of the soil which is mostly brownish in the area has changed to dark brown as a result of industrial wastes from the industries. It was also observed that most crops grown in this area tend to wilt when it was not watered regularly. This indicates low water retention capacity, and composition of soil around the area.

Sulphate ion ($SO4^{2-}$)

Research analysis indicates the Sulphate ions were seen in sample 1. This means that, if there is a high concentration of sulphate in the water body then such water body is automatically having an adverse effecting plants and animals. Moreover, it accelerate the acidic nature of soil, resulting in the wilting and death of crops which are not acidic tolerant. Secondly, any water containing high concentration of sulphate ion cannot be used for irrigation. Higher content of sulphate ion, lead to poor development of xylem tissue in plant. Its effect on livestock when taken is equally dangerous.

Baffa (1985), described the manner in which domestic animals like cows, sheep and goat were drying, is due to the content those animals had with industrial effluence. Effluence discharged from tanneries, confectionaries, oil mills, and other industries. However, water with high suphate concentration drains in to the public water, it attributed the death of these animals to the carefree attitude of the people for leaving their livestock to feed indiscriminately in and around the area. Water contaminated with suphate ion has been proved to be poisonous to animals. These poisoned animals when eaten by man could have disastrous effects on man.

Chlroide ion (Cl^-)

Chloride ion is present in sample 2 and is usually seen as a metallic salt. The high level of chloride ion in this sample, is attributed to the are insoluble, examples are malt, sorghum, hope and yeast. These organic chemicals account for high chloride ion in effluent discharge from the industries that drains into the river, ponds, that have high chloride ion content in unfit and undersible for drinking and irrigation purposes (Whilter, 1970).

The brownish color of the water is capable of scaring people away against the normal colorless quality of a good water. Water of this kind constitute health hazard both to man and animals and plants. It may leads to health risk because of the tendency of contracting water borne disease.

Studies carried out in Kano by a team from the university of Ife showed an incidence of guinea worm infection because of high concentration of chloride ion along with other in their own finding, taking Sharada and Bompai as their case studies (Godwin, 1994).

Water containing chloride ions are also capable of increasing body temperature and produce convulsion at high doses. Fisherman and other people who use water from Salatan stream in Sharada, stand a high risk of contracting the disease, other who swim through the water founder their clothes are also at a risk.

Users of such contaminated water may also be infected. This water body serves as breeding place for the viruses that transmit this water borne disease (Tabbuff, 1971).

Calcium ion (Ca^{2+})

Calcium ion was discovered in sample 1 being water sample from the tannery industry. Calcium ion water bodies are equally a health hazard. The industrial effluence containing high content of calcium ion was also found to interfere with the ecological balance of river by changing its biological oxygen demand (BOD) and introduce poison in to the water as well; moreover the blackish colored water from texture mills is potential carcinogen. Human being or animals that consume such dye stuffed water may be at risk. For example in the united state about 43, 000 birds died around the storm lake in Iowa

Plants are also affected by high content of calcium ion there by reducing the proper growth and functioning of the root tip of plants.

Magnesium ion (Mg^{2+})

With the reference to the research finding, magnesium ion was noticed in sample 1 and constitute both economic and health hazard. It produces dark stains in laundry gives an unpleasant taste to water.

Baffa Muhammad (1985) maintained that magnesium is discharged from industrial effluence, especially those from confectionary and tannery industries drink into the surrounding natural streams and rivers and this becomes a threat to aquatic animals, livestock and human beings. For this reason, the livestock that drank the contaminated water died on the sport. However, the excessive content in any water body obviously restrict,

main's ability to use this water for his domestic purpose.
Excessive magnesium ion content in any water body gives such water a cloudy and colloidal appearance which becomes unfit for drinking, and if used for irrigation purposes, it cause crop. To develop variegated leaves which hinders photosynthesis to occur in plants (Baffa, 1985)?
Moreover, the rustling of water pipe is as a result of magnesium ion. These conditions are seen around the locations of confectionaries and tannery industries where the crops and tress found here have some red patches on their leaves. For his reason the maize cultivated in the area record poor yield due to inadequate photosynthesis.

Bicarbonate (HCO^{3-})

This element was confirmed in sample 1. This accounts for the in balance of the ecosystem making the non living environment undesirable or unfit for life and threatening the health and existence of living organisms including human beings. Crops begin to develop variegated leaves which become a hindrance to photosynthesis occurrence in plant. This chemical can as well reduce the activity of enzymes which is responsible for heat synthesis.

Conclusion

This research finding, proved that, the industries in Gumel emirate with particular reference to oil mills textiles and confectionary industries produces toxic wastes which are detrimental to both plants and animals and human being a live therefore appropriate control device should be taken to prevent more of the toxic substance from getting in to Jigawa state rivers and streams.

Summary

Waste has always been a source of pollution in environment where they are found. To this and the result of this study has tries to determine the effect of waste on organism leads to the following conclusions.

1. The polluted water shows cloudy and colloidal appearance making the water unfit for drinking and irrigation purpose
2. It also has negative effecting domestic animals
3. Crops are seen developing variegated leaves which becomes an hindrances to photosynthesis occurrence in plants, this is because the water here is only tolerable to the growth of vegetables
4. The effect of this water pollution could lead to water borne disease (Imerborn, 1986).
5. The chemical substance found in the water could cause poor development of xylem tissues in plant (Demming, 1980).

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