EFFECT OF DOMESTIC WASTE ON THE QUALITY PARAMETERS OF A STREAM USED FOR A FISH POND, (A CASE STUDY OF KARU SITE STREAM ABUJA)

BY

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DECLARATION

I hereby declare that this project is a record of a research work that was undertaken and written by me. It has not been presented before for any degree or diploma or certificate at any university of institution. Information derived from persona communications, published and unpublished works of others were duly referenced in the text.

19/11/08

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CERTIFICATION

This project entitled **"The Effect of Domestic Refuse Dump on the Quality Parameters of a Stream Used for a Fish Pond, (Case Study of Karu Site Stream Abuja)"** by Ugwu Chigbo, Remigius Timothy meets the regulations governing the award of the degree of Bachelor of Engineering (B. ENG.) of the Federal University of Technology, Minna, and it approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

I hereby dedicate this project to my Lord and Saviour, Jesus Christ, to my wonderful parents Chief Uwgu Dominic M. and Mrs. Ugwu Celine C., my beloved sisters Augusta, Kate, Geraldine, Henrietta and Lucia, my friends Obinna, Chika, Daniel and Collins, my Guardians Mr. Obgonnaya and Arc. Ben Ejeagwu for their wonderful support and kindness towards achieving this successful dream. I pray that God blesses them and reward them richly in all their endeavours. Amen.

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All glory and adoration belongs to the almighty Father in heaven. Without him, this project would have been a mirage. A sublime tradition says, he who is ungrateful to God, will be ungrateful to man.

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ABSTRACT

Stream water quality could be expected to vary with season and flow of which could be subjected to pollution of domestic and industrial waste. Water samples from Karu site stream were collected at different points namely, the Control Point (CP), the Point of Refuse Concentration (PRC), the Mid-Point (MP), and the Point of Leaving (PL) at distances of 80 meters, 60 meters, and 80 meters from the CP respectively. Standard laboratory test were conducted based on the standards of the World Health Organization (WHO) and Food and Agricultural Organization (FAO). The analysis of tests was based on the biological, chemical and physical parameters of the stream which indicates that the DO (5.0mg/l) and BOD (1.80mg/l), nitrates (0.06mg/l) and phosphorous (0.01mg/l), and pH (6.78) and colour (60 HU) respectively. These results were compared with the WHO and FAO which lies within the permissible limits necessary for domestic use of the water and fish pond. Karu site stream as a case study of this project is not hazardous to human health even if it is not potable enough for drinking but could be used for other domestic purpose as well as fish pond.

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ABBREVIATIONS

CP: Control Point

PRC: Point of Refuse Concentration

MP: Mid Point

PL: Point of Leaving

BOD: Biochemical Oxygen Demand

DO: Dissolved Oxygen

COD: Chemical Oxygen Demand

SS: Suspended Solids

TS: Total Solids

TDS: Total Dissolved Solids

Mg/L: Milligram per litre

NTU: Nephelometric Turbidity Unit

HU: Hazen Unit

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CHAPTER ONE

1.0 INTRODUCTION

1.1 General Background

Pollution as it affects the environment is not new; they have been present on earth since the beginning of time. Pollution is said to be too much of something in the wrong place. That is the excessiveness of a required substance in an existing environment. Pollution can also be seen as the discharge by man of substances or energy into the environment which results into hazards against human health and causes harm to the living resource and to the aquatic ecosystem, or organism. Two examples to emphasize this are:

(a) The Dead Sea which is the body of water contaminated with salts by the surrounding areas, which had been washed into the sea to such an extent that life cannot exist in it.

(b) The ice, which has had a very definite effect on the environment, particularly the climate and hence on the plants and animals existing at the time. What is new is that the phenomenon of man has produced an additional factor (Bolt, 1973).

The inventiveness and the curiosity of man have eventually resulted in two complementary factors:

(i) The industrial revolution and the tremendous population expansion. In as much as localization of industry could be an advantage for economic purpose, it also carries along the hazard of environmental pollution with it.

(ii) Water borne waste presents a potential hazard to natural water systems. These wastes can contain either organic matter, which causes de-oxygenation by promoting microbial activity, or material which is directly toxic to the various life forms in the systems. Waste water from industry can be considered as being process water rather than water which has been used as a heat transfer or a transport medium, although these also will require some forms of treatment. Process waters can contain a heavy polluting load composed of an increasingly complex mixture of chemicals whose behavior towards biological systems can be very varied.

However, it remains time that the satisfactory treatment and disposal of waste depends ultimately upon the development and employment of efficient low cost process, and the enforcement of effective legislation. There is need for a nation to show great concern for the disposal of its society's waste product in a safe and environmentally acceptable manner.

In Nigeria today, wastes from domestic and industrial processes are not only being produced in ever increasing amount but also can contain toxic and poorly degradable compounds. They are stronger than the domestic sewage which many of the present treatment systems were only designed to handle. In addition the consumption of water for domestic and industrial use has increased to such a degree that nowadays it is not unusual to find that rivers receiving untreated effluents cannot give the dilution necessary for their survival as good quality water-course, a problem aggravated during dry periods.

In the vicinity of industrial plants, there may be atmospheric pollution that is transferred to the water body by setting, by direct absorption or by rainfall and other precipitations. Examples of pollutions so transferred are dust from cement factories and smelters, acids and chemicals from chemical manufacturing plants, Sulphur dioxide and acids from smelters and Phenotic chemicals from coke quench towers.

According to Sangodoyin (1991), domestic, agricultural, municipal and industrial water demands are growing rapidly throughout developing world under the combined effects of population growth, burgeoning industry and urbanization. In order to satisfy the yearning, for water supply is the exploration of all revenue to convert all available water to use and tapping of ground water at random by all and sundry.

Transfer of unfavorable releases from domestic and industrial plants through settlement, direct absorption or rainfall or other precipitation into the water body may be detrimental to human health, safety, welfare or human properties and resources organisms, hindrance to aquatic activities including fishing impairment of quality of the water used in the domestic, industrial, agricultural or recreational areas and reduction of amenities.

Generally, the reference point for the identifying and assessing pollution is the impact it has on human interest, and hence the need for the assessment of the effect of industrial effluents on surface and ground water pollution as it is in Karu-site stream area of Abuja.

1.1.1 Water Pollution

Water pollution is defined as "the addition of any substance to water or changing the water physical and chemical characteristics in any way which interferes with its use for legitimate purposes". Normally water is never pure in chemical sense. It contains impurity of various kinds [dissolved and suspended particles] these include dissolved gases such as [H_2S, CO_2, NH_3, N_2, etc], dissolved mineral such as [Ca, Mg, Na salts], suspended matters [Clay, Silt, Sand, loam, etc] and even microbes.

These are natural impurities derived from atmosphere, catchments area and the soil. They are in very low amount and normally do not pollute water and it is potable. Polluted water are however are turbid, unpleasant, bad smelling, unfit for drinking, bathing and washing or other purposes. They are harmful and are vehicles for many diseases like cholera, dysentery, typhoid, etc.

1.1.2 Major Pollutants in Domestic Waste Water or in Surface Water

a. **Solids in Water**. This is referred to as the quantity of solid matter remaining in a water sample after drying or igniting at a specified temperature. That is, the dissolved solids and suspended solids

b. **BOD** (Biochemical Oxygen Demand) this is the most important analytical tool in water pollution control work. Since it is one of the few analyses that attempts to measure the effect of a waste under condition approximating natural stream conditions. BOD test, attempts to determine the pollution strength of waste in terms of microbial oxygen demand of a waste.

c. **COD** (Chemical oxygen Demand), which are measures of the concentration of oxygen consuming materials. The level of specific toxic materials is of course strictly controlled as are the pH, Colour, Odour, etc. Clearly the quantity of flow and subsequent dilution are also important.

d. **TOC** (Total Organic Carbon), this is a measure by catalytic conversion of organic carbon in waste water to carbon dioxide usually at a time lapse of 5 – 10 minutes, permitting a rapid estimate of the organic carbon content of waste water.

e. **TOD** (Total Oxygen Demand), which is the amount of oxygen required for the combustion of impurities in an aqueous sample at high temperature (900^0C) using a platinum catalyst.

1.1.3 Environment Impact on Water Pollution

The adverse impact on the environment is largely due to indiscriminate and unregulated exploitation of both renewable and unrenewable resources and the use and the abuse of environment as a sink for dumping waste products from developmental activities.

Environmental pollution is a major hazard facing the world today and there is an increase in the awareness of the fact that a clean environment is necessary for smooth living and the better health of human being. Industrial pollution affects factors which may cause illness, discomfort or lack of well being among workers and community as a whole. Industrial project also bring about the contaminants ills of the environmental pollution, depletion of resource, threat to human health, dwindling of forest aesthetic nuisance.

It is also desirable to make sure that the environment around us is kept safe, clean and healthy. Due to various activities of man to the domestic field, agricultural sphere and industrial development, is the part of engineering which deals with the techniques of finding out:

(i) The causes and the various types of potential pollution.

(ii) The adverse effects of pollution and,

(iii) The control and the remedial methods of environmental pollution.

1.2 OBJECTIVES OF STUDY

i. To determine the impact of domestic waste on surface water of Karu stream in Abuja.

ii. To determine the effect of pollutants from the domestic waste on the Karu site stream used for fish pond.

iii. To examine the spatial and temporal variation on the water quality parameters of the Karu stream and applying control measures against water contamination.

1.3 JUSTIFICATION OF STUDY

The extensive control concerning land use planning contained in the town and country legislation have long contained measures providing for various forms of involvement by the general public consultation up to the holding of formal public inquiries.

The control of discharge into the inland water provides a typical example as in section 107 of control of water pollution act 1989, that makes it an offence to cause of knowingly permit the discharge into the inland waters of ;

(i) Noxious, poisonous or polluting matter and

(ii) Any trade or sewage effluent (whether or not it is potentially harmful to lives)

1.4 SCOPE OF THE PROJECT

The scope of this project will be limited to water pollution, its sources, its causes and the preventive control measures involved.

1.5 CLASSIFICATION OF WATER POLLUTION

Various types of water pollution can be broadly classified into the following major categories.

1. Organic pollutants (Biological pollutants)
2. Inorganic pollutants (Metals and Trace elements)
3. Suspended Solids and Sediments
4. Radio-active Material

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Basic Concept in Surface and Ground Water Hydrology

Surface and sub surface water flow are direct source of water supply which are open to development by man using scientific and technological skills. Surface water exists in form of streams, rivers, ponds and lakes. Nigeria is blessed with abundant surface and ground water resources. FADAMA (1982) has put the volume of water retained in the river of western Nigeria alone during seven months of rain fall at about 700billion litres. As expected surface, water is tapped for use in a variety of human activities, the broad categories being domestic, agricultural and industrial usage. In a developing environment, surface water is perhaps widely tapped because:

(i) Pipe borne and potable water is usually in short supply and sometimes restricted to urban settlement;

(ii) Stream water and ponds require a little labour effort and skill in tapping for usage.

However, quality of these sources is sometimes doubtful with many diseases being linked to their consumption.

While the flow pattern of surface water is generally known and its potential extensively appraised, ground water resources have been studied to a limited extent. Sangodoyin and Osuji (1988) offered the following explanation for this development, viz.

(a) Ground water has an indirect contact with man compared with surface water

(b) There are limitations in geology and quality

(c) In the developing countries only a fraction of this source is presently utilised due to the present state of technology.

This source is normally developed for use through wells of various types,, deep boring into the earth crust (bore hole), spring and dug out ponds. Walton (2000) has estimated that this source probably account for about one-sixth to one-fifth of all the water tapped from all sources. How ever the utilization of ground water as a source for domestic, municipal, industrial and agricultural activities continue to increase principally because of the heavy capital outlay and maintenance of surface water development, Osuji et al (1998).

One other factor which is responsible for the attention being directed to this source is improved technology manifested by deep boring in form of bore holes in India and Nigeria respectively satisfy WHO (2004) standard.

2.2 Interaction of Surface and Ground Water

Water not being stagnant moves in a definite pattern which has long been explained by scientist in terms of hydrological cycle. In this cycle both the surface and ground water continues to interact at different stages. Ground water can recharge nearby surface water and vice versa depending on the level of flowing the stream and the depth of water in the ground. The interaction is such that excessive withdrawal or usage of one source will have a profound influence on the other. One of such interaction was reported that the temperature of the water withdrawn from a production well recharged by induced infiltration of river water followed a cycle governed by the seasonal fluctuation of the river water temperature. It was further observed that the interaction of the well and nearby river is governed by some other variables amongst which the distance of the well from river, spacing of wells, pumping arte, volume, porosity and specific heat of aquifer material could be specifically mentioned. Sometimes sudden changes in the quality of a stream are reflected in the ground water as observed by Walton (2000). The same author reported that the chemical constraint of wells along a river vary slightly compared with those of the river which vary greatly.

River water quality could be expected to vary with season and flow. Generally, hardness and alkalinity values are much lower that those obtainable in normal ground water.

In recent times, certain cultural and technical practices have been adopted to increase ground water storage, one of such being the utilization of surface run off. Such practices are based on the realization of the fact that ground water emerging into surface stream channels could help in sustaining stream flow when surface runoff is low and non-existent (Todd 1999). Based on observation of the interaction between ground and surface water flow, Glover and Balmer (1990) an empirical relationship which identified soil permeability, aquifer thickness, distance between well and stream, storage coefficient and time of pumping as principal variables.

2.3 Relationship Between Water Quality and Pollutant

The level of water quality is relatively being dependent on the ultimate use to which the water will be put. Once the natural, physical, chemical and biological condition is affected, however, the water is said to be polluted, Wilber (1989). Over the years, both theoretical and experimental work has however identified the following sources of pollution of surface and ground water viz.

(i) organic waste from sewage

(ii) water weeds

(iii) synthetic chemicals and mineral substances

(iv) sediments

(v) radio-active pollution and temperature increase

(vi) bad waste management

A survey of extensive literature on ground and surface water quality indicates that most researchers consider the following parameters as being suitable to assess quality which are;

(i) pH

(ii) Conductivity

(iii) temperature

(iv) colour

(v) turbidity

(vi) odour

(vii) taste

(viii) solid contents

(ix) bacterial analysis

The later being mainly directed at detection of coli form. Most of the fine mineral pollutants are traced to the rock formation. According to Hen (1987) however, there is no clear out relationship between water quality and rock types in most areas.

2.4 Surface Water Pollution

Wollman (1996) estimated the amount of water on earth to be approximately of 2.7×10^{14} cubic meter of which 97% is ocean and therefore non-potable and only 3% is fresh water.

Water pollution when considered in its broadest context is a by product of human population and its significance is in what effect it has directly or indirectly on living populations. The pollutions are chemical (except heat) that interact with living cells; biochemical reaction alters the compound chemically and therefore physically because physical properties depends upon chemical configuration. The net result is an alteration in environmental quality.

2.5 Industrial Pollution and Pollutant

Industrial effluents have a great deal of influence on the pollution of water body. These effluents contain a variety of pollutant which can infect or alter the physical, chemical and biological nature of the receiving water body. The introduced substances depend largely on the type of industry and these include organic matter, suspended particles, dissolved solid, waste oil, detergent, metals, and inorganic material, etc.

Some of the constituent of industrial effluent and likely industrial source are as given in Table 2.1

Industrial waste is the most occurring source of water pollution in the present day and it increase yearly due to the fact that industries are increasing because most countries are getting industrialized (Rudolf, 1993).

Some industries produce or give out gases or suspended matters during their industrial processes. These materials maybe directly absorbed into water body or may be transported into water by rainfall.

2.6 Natural Concept of Water Pollution

Reveille, (2005) observed that the fluid character of water means that the ocean and lakes fill all the earth. Regarding to the geographical facts the ocean and lakes are ultimate receptacle of the waste of land; including waste that are produce in ever increasing amount by human beings and their industries.

Long before man populated the earth, moderate amount of substances that pollute the atmosphere are being produced. Since these pollutants have been produced for millions of years and lives on earth have not disappear, this indicates that nature it self have a way of purification.

(Ciaccio, 2003) noted that the advent of man created three major water pollution problem that nature self purification process could not cope with.

1. Man extreme numbers and concentrations in the cities -- nature can handle small amount of polluting substances but in small area it can not handle the natural body waste from a large number of people.

2. Industries use large quantities of naturally occurring toxic substances such as lead and mercury, thereby creating a potential pollution problem in those areas that receive the waste discharges.

3. The third major problem due to man involves the technological production of many new synthetic substances that the naturally occurring bacterial do not find particularly edible.

2.7 Water Pollutants

Water pollution can be defined as the unfavourable alteration of the chemical, physical, and biological character of aquatic environments directly or indirectly by the act of man (by the introduction of substance or energy into the aquatic environment in such an amount as to be detrimental to his health, safety and welfare. However, water pollution are defined by Forstner, 1993) as substances that gives the unfavourable alteration which are sometimes inevitable by-product of transformation of organism activities, industries and agricultural processes and they give rise to what is referred to as **Water Pollution.**

2.8 Types of Water Pollutants

Water pollutants are categorized into two according to their case of degradation namely:

(i) Degradable Pollutants (ii) Non-Degradable Pollutants

2.8.1 Degradable Pollutants

These are substances that are introduced directly into the aquatic environment by man activities and are usually dispensable by natural means. The major disadvantage is that when the input of such materials exceeds the decomposition or dispersive capacity they result into an extreme environmental hazard.

(Forstner, 1993), Examples of such pollutants includes mainly domestic sewages, heat, thermal energy etc.

2.8.2 Non-Degradable Pollutants

In contrast to the degradable pollutants, non-degradable pollutants are those substances that are introduced directly or indirectly by man into the aquatic environment and that do not degrade or get converted into harmless or less harmful substances in which the process of their degradation magnified along the biochemical cycles. They also combine with other substances and compounds to produce more toxic substances (Diamante, 2001). Examples are mercurial salts, long chain phenolic chemicals; aluminum ions, etc are known as non-degradable pollutants.

Water pollutants can be classified on the basis of the type of pollution they cause such as physical pollutants, biological pollutants, and chemical pollutants.

2.9 Water Pollution and Environmental Health

When hazards of pollution is being considered, the focus has always been on the aspect of human health despite the fact that pollution is detrimental to human health, animals, plants, and inanimate objects.

The large accumulated evidences on the relationship between pollution and human health stems mainly from three major sources (Picford, 1980).

a. Observed results of some episodes of human exposure either accidental or experimental.

b. Result of toxicological studies on animals or humans

c. Analysis of effects based on observations and the statistical relationships to each other.

Water pollution is known to generally exert these effects via special target organs such as skin, lining of the digestive tract, upsetting of ecological balance of the water body in such a degree that man will find usefulness of the water environment vastly diminished.

The effect of pollutants on health is either directly of indirectly. It is direct when the pollutants had its effects on man or his resources through transmission via intermediaries.

Whether directly or otherwise, these pollutants usually exhibits their hazard effects when their amount in the environment is above the reference dose (RFD). A reference dose is an estimate of a daily exposure per intake (mg/kg/day) to the general human population, including sensitive group that is likely to be without an appreciable risk of deleterious effect during a life time exposure. (Frank, 1988)

Many water borne diseases are known, such as cholera, dysentery, typhoid fever, etc. These are diseases caused as a result of the consumption of polluted water by biological pollutants. A variety of viral pathogens have been recovered from human fecal waste and sewages (Lucas, 2006). Potentially all of these agents could be transmitted to man via his use of fecal and sewage contaminated drinking and recreational water.

Some practical evidence have been gathered that cancer causing chemicals are being released regularly into the water ways from municipal and industrial waste water sources. (Lucas et al 2006) outlined the main sources of carcinogen in waste water.

Table 2.1: Some Industrial Waste Constituents and Likely Industrial Sources.

SUBSTANCES	**INDUSTRIAL SOURCES**
Barium	Used industrially as a white pigment for paint, metallurgy, glass, ceramics and dyes to manufacture vulcanizing rubber
Boron	Plating industries
Calcium	Metallurgical alloying, ceramic manufacture, textile printing, chemical industries and mine drainage.
Chloride	Oil refineries and petrochemical industries.
Copper	Metal cleaning and plating baths, jewellery manufacture
Ammonia	Gas and coke manufacture, chemical manufacture
Fluorides	Chemical manufacture, fertilizer plants, petrol refining, metal

	refining, soft drinks and citrus fruit processing, gas and coke manufacture and ceramics. Plants scrubbing of gases and atomic energy plants.
Cyanides	Chemical manufacture, plating and case hardening, metal cleaning.
Sulphides	Sulphide dyeing processing, gas manufacture and viscose rayon manufacture.
Acids	DDT manufacture, brewing, textile and battery, iron and copper picking. Distilleries and fermentation plant.
Alkalis	Soft drink processing, cotton and straw, wool swirling and cotton
Sugar	Dairies, breweries, preservative manufacture, glucose and sugar factories. Chocolates and sweet industries.

2.10 Industrial Effluents of Petroleum Products

Petroleum refinery wastes containing polycyclic aromatic hydrocarbon, fuel oils, lubricating oils and cutting oil are being introduced into the lakes and rivers from garages service stations, petrochemical plants, metal working plants and ships.

Public water supply may also be contaminated by kerosene, methylated naphthalene and similar petroleum products in insecticide sprays, from rain contaminated air pollutants or from asphalted roads.

2.10.1 Coal Tar

Coal tar is contained in the effluents from gas plants, coke oven operations, tar distilleries, tar paper, plants, coal tar, etc.

2.10.2 Pesticides, Herbicides and Soil Sterilants

A new source of concern is that halogenated hydrocarbons with toxic qualities are formed as a result of the chlorination of the waste water effluent or treated water drawn from rivers heavily contaminated with organics. Zonn (1990) identified over 50 chlorinated hydrocarbons in chlorinated domestic waste water effluent in United State of America (U.S.A). Alan (1994) observed that the chlorination of polluted river water in the Netherlands produced compound such as chloroform, carbon tetrachloride (CCl_4) and traces of other halomethanes and haloethanes.

2.11 Air Pollution and Water Source

Ross (2000) wrote that the chemical process industries contribute only a small part of the total pollution problem, pollution from process industries at times poses problems more complex than pollution from other areas. But the magnitude of the air pollution from the automotive exhaust and central power station boilers and water pollution from raw sewage dumped into streams, lakes, and oceans greatly exceeds pollution caused by process industries.

The gaseous waste from any processing operation may take a variety of forms. It may contain particular matters in a size range from submicron particles from almost any size that would be carried in gas stream at the velocity in the exit pipe or duct. There are almost infinite numbers of contaminated particles discharged to the atmosphere from industrial processes. These materials can be generally classified according to the following categories;

a. **Ducts** – particulate matter in range of 1 – 43 micron.

b. **Fumes or aerosols** – Colloidal or particles below 1 micron in average diameter.

c. **Gases** – Substances composed of a single molecule or an aggregate of several loosely bound molecules having great freedom of movement.

Some of the more common air pollutants in these three size categories are listed in Table 2.2 Naturally, each manufacturing operation has different air pollution problems.

Table 2.2 Particle Sizes of Various Materials

Source: (Analytical Particles of Air Pollution by Meryer G. – 2007)

PARTICLES	CATEGORY	SIZE
Limestone	Dust	1 – 50
Ply ash	Dust	0.50 – 50
Paint pigment	Dust	0.5 – 10
Zinc oxide	Fume	0.01 – 0.50
Oil smokes	Fume	0.05 – 1.0
Aluminium chloride	Fume	0.10 – 1.0
Chlorine	Gas	-
Sulphur chloride	Gas	-
Hydrogen sulphide	Gas	-

2.12 Industrial Effluent Characteristics

The volume and strength of industrial waste are usually defined in terms of units of production and the variation in characteristics by a statistical distribution (Ross, 2000). The magnitude of this variation will depend on the diversity of products manufactured and of process operations contributing waste. Some of these characteristics are undesirable and need control before discharging into the municipal stream. This however, depends on the nature of industry and the project uses of the water of the receiving streams.

These may be summarized as follows:

i. **Soluble Organic** - Causing depletion of dissolved oxygen.

ii. **Suspended Solids** – This will impair the normal aquatic life of the stream

iii. **Trace Organics** – When receiving water is to be as a potable water supply, phenol and other organic discharge in industrial wastes will cause taste and odours in the water.

iv. **Heavy Metals, Cyanide and Toxic Organics** – These deleterious to aquatic life usually have present hints for discharge.

v. **Colour and Turbidity** – This present aesthetic problem, though may not be deleterious to water. In some industries, economic methods are not presently available for colour removal.

vi. **Nitrogen and Phosphorous** – These are released into ponds and lakes through industrial effluents and they are highly undesirable since they promote eutrophication and stimulates undesirable algae growth.

vii. **Oil and Floating Materials** – They produce unsightly conditions.

viii. **Volatile Materials** – They can produce and create air pollution problem under certain chemical environments.

2.13 Chemical Pollution of Water by Industry

Chemical pollution usually results from deposition of industrial effluents into the water body, water runoff over land to which agricultural chemicals had been applied, dissolution of air pollutants into the water body, seepage of domestic waste and / or industrial waste into the ground water. Sangodoyin (1993) noted that pesticides are a potential source of contamination and water pollution close to the point of application, though the concentration was small. He was of the opinion that the break down of the applied chemicals in the soil or volatilization during the interval between the time of application and the occurrence of rainfall accounted for the fact that the pollution detected was small.

The discharge of small metals into the water environment such as lead, mercury, arsenic, etc has a great polluting effect on the aquatic environment. There are various cases of water pollution disasters. These disasters are usually associated with a particular type of pollutant. Some of the pollutants of renowned cases of disasters are pesticides, mercury, cadmium, lead, arsenic and oil.

2.13.1 Pesticides Disasters

There was a case of intoxication by Endrin which resulted in a major fish kills in Mississippi and Alhaleya River in U.S.A. About 330 deaths was also recorded in Turkey due to consumption of seed grains that have been treat with hexachlorobenzene and so many death in Colombia after eating food contaminated with paraffin (Reveille, 2005 revised edition).

2.13.2 Mercury (Pollution) Disaster

Mercury has an inherent toxicity to living forms. Mercury salt and organic mercurial derivatives have long been used as bactericides, algaecides, and fungicides because of their toxic properties. Large quantities of mercury are also used in the chlorine alkali industry as the cathode in the electrolysis process to produce sodium – mercury amalgam. Some of the discharges from this process contain mercury, mercuric chloride and metallic chloride and metallic mercury (Frank, 1988).

In Northern Iraq (1959) and central Iraq (1961) when farmers and their families ate bread from alkyl mercury treated wheat that was given to them for planting, they died of it. Sweden recorded a lot of birds and predators death due to mercury poisoning (Patrick, 1994).

2.13.3 Cadmium Pollution Poisoning

Contamination of aqueous environment by cadmium appears to be less wide than that of mercury; nonetheless, it has hazardous effects on human – beings. In 1947, an unusual and painful diseases of "rheumatic" nature was discovered in the case of 44 patients fro villages on the bank of Jinzn River in Japan. These diseases became known and were attributed to the chronic cadmium poisoning, (Fredrick, 1989).

2.13.4 Lead Pollution Disasters

The amount of lead in the earth crust is about 15 part per million (ppm), (Morton, 1996). 250 cases of lead intoxication from water consumption were recorded in Leipzig (Germany) during the summer of 1930. Lead is present in various products (e.g. pipes, ammunition, solder, paint, petrol), but because of its high toxicity many of its uses have been discontinued. The major source of lead in the environment is the use of lead as a petrol additive. Atmospheric pollution by lead has caused considerable concern in the past and many countries have phased out the use of lead in petrol. However, lead already in the environment is cycled through the biogeochemical cycle, and lead originally released into the atmosphere has ended up in surface and ground waters.

Lead can cause damage to the nervous system and the kidneys and it is a suspected carcinogen. Children exposed to high lead levels are particularly at risk. Lead in the environment is generally present as inorganic Pb^{2-}

2.13.5 Arsenic Pollution

Health problems related o the intake of drinking water containing high concentration of arsenic have been encountered in some regions of Taiwan, Argentina and Chile noted by (Jerome, 1974).

Peripheral vascular disorders with gangrene and skin changes as well as skin cancer have been reported. Long term intake of drinking water from Artesian well wit concentration of 0.3 – 0.6 mg/l was associated with an increased incidence of skin cancer in these areas.

2.13.6 Chloride

Chloride is a major ion in surface water and in wastewaters and its concentration in natural waste varies widely. High levels of chloride are found in seawater and water from saltwater lakes, while mountain streams generally have low levels. Estuarine water is strongly influenced by mixing with seawater and it has intermediate chloride concentrations. Domestic waste contains considerable quantities of chloride due to its presence in urine, and in the past, test for chloride were used to detect contamination of ground water by waste water.

Chloride is not considered as being harmful to human health. Levels of chloride in water supplies are limited to 250mg/L as at higher concentration chloride imparts a salty taste which makes the water unpalatable, and the WHO guideline for drinking water is set at this value. High chloride concentrations are harmful to plants; some damage may occur at levels as low as 70-250Mg/L.

2.14 Health and Water Quality

The current water supply situation in both urban and rural settlements of Nigeria as noted in a paper by Sridhar and Omisakin (1985) is far from being adequate. The inadequate supply has also affected the quality of water taken by the people.

Early all the parameters as presented in the several reports fall below the international standards. This development is not however peculiar to Nigeria. In Asia, WHO (2001) report indicated that water borne diseases accounted for 60% and 40% of morbidity and mortality respectively. Several researchers have also reported significant relationship between unwholesome water and the incidence infection like typhoid, cholera and dysentery. (Pascod et al, 1994) also noted that in areas where surface water is used for domestic purposes, particular attention must be paid to the fact that the water may be an active vehicle for the transmission of schistossomiasis. In the use of polluted stream water for livestock and irrigation, WHO (1998) report indicated that there is a risk of cattle infection with the larvae of the beef tape worm, *Taemia saginsta*. This will indirectly affect human health.

Further relationship between chemical constituents of water and human health is briefly summarized in the following table. Notable researchers associated with the discovery of these relationships have also been indicated. Apart from the physical and chemical characteristics, the microbiological quality is also important. Bacteria (including pathogens) are usually present in water. Through Wagner and Iaonoix (1999) observed that groundwater is likely to be free of pathogenic bacteria. Coli form bacteria above contain acceptable levels indicates the presence of increased number of pathogens.

2.15 Water Pollution Control via Legislation

Water pollution can be controlled by taking care of water pollutants. Some of these pollutants are refuse, solid waste, sludge, sewage and metals dumped into river or stream leached into the ground water. Solid waste management is a major environmental problem in Nigeria (Sridhar et al 1985). Different types of refuse abound in Abuja city. Oluwande (1985) classified them as follows: Cabbage (maize husks and cocoa leaves), Rubbish (solid waste material, ashes, dust and dead animals). The first attempt at controlling pollution should therefore focus on the storage of the refuse. Various studies on various refuse storage facilities which can be adopted in a developing environment are detailed in Omisakin (1985) and Oluwande (1994).

There is evidence in this literature to show that ground and surface water qualities can be improved with good legislation. The legislation consists of various laws, Acts and decrees on either ground or surface water. In England and Wales, ground and surface water comes under control of regional water authorities set up under the water act of 1973. These authorities have power under the rivers prevention of pollution Act 1951 and 1961 and the control of pollution Act 1974 to prevent and control pollution. In the same country, the royal commission on sewage disposal also adopted 30:20 standards as the conventional efficient quality standard to be discharged into streams in order to prevent high pollution.

In Nigeria there are edicts at states level enacted to prevent and control water pollution. One of such is the edicts making it mandatory for each house in Abuja to have a refuse bin. Contravening of these may lead to payment of N10, 000 fines or a month detention in police custody. However it appears the edicts are not strictly enforced. Residents of Abuja dump refuse into street and streams with out any regards to the law. This act by some unconcerned members of the society has generated some controversy. One of the streams affected by this practice is the Karu-site stream in Abuja.

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 Area in Study

Officially Abuja Municipal Area Council (AMAC) is the capital city of Nigeria. It is located in the centre of Nigeria, within the geographical region of the guinea savannah and of the coordinate's 9°N 10°E/ 9, 10 in the Federal Capital Territory (FCT). Abuja is a "planned" city, as it was mainly built in the 1980s and later became Nigeria's capital with a population of about 1,236,567.

Karu town is located at the eastern boundary of Abuja with a population of about 400,000 of which a very high proportion working in Abuja. Karu, is built to house the capital's civil servants and lower income families. This places it within the region of high demand of urban expansion while on the other hand, its benefits from increased temperature activity, the fact that it serves as a dormitory for workers in the Abuja city means that it is under pressure to provide the requisite residential service for its population.

Consequently, Karu faces a problem of overcrowding, rapid and uncontrollable rate of urban growth as well as the inadequate provision or urban utilities and services, hence increase in waste production.

Karu stream gets its catchment's source from a spring running from underneath a rock which flows through a valley and meanders its way, stretching down valley from old Karu to Nnyanya in Nassarawa state. Along the channel of Karu stream are other natural eroded channels forming distributaries from the main stream, when during the raining season, the stream washes waste materials from other eroded channels which are introduced into this stream, causing water pollution and creating gullies. During the raining season the water level of the stream rises and turbulence increases, making the stream water filled with dirt, suspensions and cloudy color. But in the dry season, the flow of the stream is laminar and gentle and the turbidity is of good standard (clear to visibility).

It was also observed that Karu stream support a good number of aquatic animals like fish, crabs, frogs, water rat, and some other creature living close to the stream like snakes and birds. The presence of trees and shrubs along the Karu stream channels make the temperature within the region really cool and well habitable for both human and other aquatic organisms. There are some settlements along this stream side, which in some part, refuse disposals are usually dumped into the stream, which brings about the pollution of the stream and rendering it hazardous to human and aquatic health.

At the down stream of Karu site stream is a fish pond and vegetable gardens. The fish farmer pumps water from this stream to breed his fish. From the farmers past records during my project investigations, before more settlements were built in the area along the stream side, the water from the stream have always been used without treatment and have no harmful effect on the fish when consumed. This is of a reason, because the stream also supports some naturally existing fish in the stream as well.

3.2 Sampling

At the Karu stream, samples were taken from four different points of 80 meters before the point of domestic waste concentration. At this point it is termed the Control Point (CP). This is a point where there is no pollution coming from any refuse disposal. The water is flowing down stream from the source i.e. under a rock (spring water) in Karu. The next point of water sample collection is at the Point of Refuse Concentration (PRC). This is where there is a major refuse dumping from residing settlers along the stream. The other points of sample collection are the Mid Point (MP) and the Point of Leaving (PL). The Mid Point (MP) is the point between the PRC and the PL. The MP is about 60 meters from PRC and 50 meters to PL Point of Leaving.

Special plastic containers were used to collect water from the stream. Necessary precautions were closely adhered to, and these include cleansing of the sampling apparatus and addition of preservative where necessary. Samples were properly labeled to differentiate samples collected from different locations along the stream.

These points include:

(i) Control Point CP

(ii) Point of Refuse Concentration PRC (80 meters from CP)

(iii) Middle Point (60 meters away from the PRC)

(iv) Point of leaving (80 meters from MP)

3.3 Sampling Containers, Methods of Sampling and Apparatus

Newly bought containers were used for the collection of samples from the stream site. The containers were thoroughly washed with detergents and rinsed with distilled water and kept unopened until the moment of water sample collection, this is done to avoid any contamination from atmospheric pollution dispersal. Finally water samples were collected from the Karu stream, sealed in the container and sent for testing and analyzing.

The reagents used in the course of this project were prepared by the International Institute of Tropical Agriculture (IITA), Ibadan, Oyo state.

The apparatus used for the analysis are thermometer, BOD stopper bottles, indicators and reagents, pipette, conical flasks, electronic analytic weigh balance, desiccators, crucibles, pH meter, spectrophotometer, conductivity meter etc.

3.4 Examination of Water Samples

The parameters examined includes pH, Temperature, Total Alkalinity, Hardness, Calcium ion, Chloride, Nitrate, Sulphide, Iron, Manganese, Turbidity, Dissolved Oxygen, and Colour.

(a) **Determination of pH**

Lovibond 1000 comparator was used. Other materials include pH disc and two test tubes. The test tubes were thoroughly rinsed with distilled water and the pH disc was inserted into the comparator. 10ml of the collected water sample was put into the test tubes while 10 drops of Bromothymol Blue was added. The two test tubes were placed in the comparator until a clear colour was obtained. The reading of the disc was recorded as the pH of the sample.

(b) **Determination of Total Solid (TS)**

100ml of the water sample was measured into a porcelain crucible in a water bath and heat to a temperature of 100^0C and cooled in a desiccator to a room temperature, after which the crucible was measured. The weight of the Total Solid content of the water sample was obtained by difference.

$$TS(Mg/l) = \frac{(A-B)}{Vol.of\ sample} x1000$$

Where;

A = weight of crucible before heating

B = weight of crucible after evaporation

(c) **Determination of Suspended Solid (SS)**

A glass fiber filter was placed on a watch glass and wetted for better performance. Both were placed in oven and heated at 135^0C for an hour, cooled, desiccated and weighed.

$$SS = \left(\frac{A-B}{Vol.of\ Sample}\right)10^6$$

Where;

A = weight of filter paper + watch glass + residue

B = weight of filter paper + watch glass (ml of sample = 100ml)

(d) **Determination of Dissolved Solid (DS)**

Dissolved solid can be calculated from the total solid and suspended solids.

TS = DS + SS

DS = TS – SS

Where; TS = Total Solid

DS = Dissolved Solid

SS = Suspended Solids

(e) **Determination of Temperature (^{0}c)**

The ambient temperature of the water samples from the different points were taken during sampling with the aid of Thermometers.

(f) **Determination of Alkalinity (Titrimetric Method)**

50ml of water sample was obtained using a pipette and released into a beaker. 3 drops of methyl orange indicator was added to the sample after a thorough mix of the sample with 3 drops of sodium trioxosulphate Na_2SO_3. This was titrated against 0.02M of H_2SO_4. The reading on the burette was recorded.

Total Alkalinity$(Mg/l) = Ax20$

A = Reading on the burette.

(g) **Determination of Tptal Hardness**

Into 50ml of the water sample, 2ml of ammonium buffer solution was added in a conical flask. A small quantity of eriochrome Black T was then added. This was properly shaken until the colour changed to purple. This was titrated against 1.0M of EDTA (ethylene-diamine-tetra-acetic acid). The titre value was obtained when the colour changed to light blue.

Total Hardness $(Mg/i) = Ax20$

Where; A = reading on the burette.

(h) **Determination of Calcium Hardness**

50ml of water was pipette into a conical flask. 2ml of NaOH was then added to the sample and some quantity mercury oxide was also added which gave a light EDTA solution until the colour changes to purple. The volume EDTA used was recorded.

Calcium Hardness $(Mg/l) = Ax20$

A = Vol. of EDTA (Ethylene-Diamine-Tetra-acetic Acid) used.

(i) **Determination Magnesium Hardness.**

The result obtained from the difference between the total hardness and the Calcium hardness will give the value of magnesium hardness.

Total hardness – calcium hardness = Magnesium Hardness (mg/l)

(j) **Determination of Calcium Ion.**

The volume of EDTA used in the determination of Calcium Hardness is multiplied by 8.

$Ca^{2+} = A \times 8$

A = Vol. of EDTA used.

(k) **Determination of Chloride**

To 100ml of water sample, 1.5ml of potassium Dichromate (indicator) was added in a conical flask. It was then titrated against standard silver nitrate solution. The colour changes from yellow to orange colour.

Chloride mg/l = $A \times 5$

A = Vol. of $AgNO_3$ used.

(l) **Determination of Nitrate**

Reagent: Ammonium hydroxide and phenyldisulphoric acid.

Procedure: To the residue obtained from total solid experiment, 2ml of phenyldisulphoric acid was added and scraped with glass rod. The solution was poured into 50ml standard flask and crucible and the glass rod was rinsed with distilled water and transferred back into the standard flask. 6ml ammonium hydroxide solution was then added and filed up to mark with distilled water. The solution was left for about 15 minutes in order to allow for colour development. The resulting colour was read with the use of 100% transmittance at a wavelength of 410 of a spectrophotometer. The result obtained was used to obtain the corresponding concentration of Nitrate ion on a standard transmittance.

(m) **Determination of Iron**

Reagent: Fe-AH (14404) Thioglycollic acid, two test tube and indicator.

Procedure: The test tubes were filled with water sample to reach the mark at the test tube. To one of the sample, 8 drops of Fe – AH (14404) Thioglycollic acid wad added. The detector is then used to compare the colour of the content of the test tube. The reading was obtained at appoint when the colour of the two test tube was the same.

(n) **Determination of Manganese**

Reagent: Mn – 2A hydroxyl ammonium chloride and form aldehyde and two test tubes.

Procedure: The water sample was collected into the two test tube to mark point. 4 drops of Mn – 2A was added to one of the samples and allowed to stay for 2 minutes and the colour was compared with the use of Manganese detector until some colour was obtained in the test tube. The reading was recorded as the manganese content of the water sample.

(o) **Determination of Turbidity**

Turbid meter was used to obtain the turbidity of the water sample.

This was done by obtaining a sample of water into a test tube. The turbid metre was standardized and the reading of the water sample was done. the reading on the meter was recorded as the turbidity in NTU.

(p) **Determination of Dissolved Oxygen**

250ml of water sample was obtained into a conical flask while 2ml of Manganese sulphate and 2ml of alkali iodide (NaOH) were added. The mixture was properly mixed, shaken and left for 2 minutes for complete reaction. 2ml of concentrated sulphuric acid (H_2SO_4) was again added and shaken. 20ml of the sample was then measured into another conical flask. 0.025M of sodium thiosulphate in the burette was then titrated the solution until a pale straw colour was obtained. 2ml of freshly prepared starch indicator was added and titration continued, the presence of starch turn the solution into blue and the blue become colourless at end point. The titre value was recorded.

(r) **Determination of Chloride Demand**

200ml of water samples was collected into 3 beakers and to the three samples, Milton solution was added at 0.4ml, 0.6ml and 0.8ml respectively. This was allowed to stay for 30minutes. 10mls from each of the samples was collected and 10 drops of ortho-toludine was applied to determine chlorine residuals using comparator with respect to standards. The chlorine demand of the sample was obtained by using the sample that corresponds to standard 2ppm limit. This was multiplied with the concentration of the standard Milton solution and the chlorine residual limit 2ppm was subtracted from it.

(s) **Determination of Colour**

A little quantity of the water sample was collected into small test tubes and the colour was compared using a special glass Colour disc of a Lovibond Nesslenger. The result obtained was in **Hazen Unit** (HU)

CHAPTER 4

4.0 RESULTS AND DISCUSSIONS

4.1 Quality of Stream Water Samples

The results obtained from the stream characteristic at the Control Point (CP), Point of Refuse Concentration (PRC), Middle Point (MP) and the Point of Leaving (PL) is shown in the Table 4.1 below.

Table 4.1 Characteristic of Karu Site Stream
Source: -Result Obtained From the IITA Laboratory Test in Ibadan – 2008

S/N	PARAMETERS	CP	PRC	MP	PL
1	Distance (m)	-	80	140	220
2	Ph	6.78	6.91	6.95	6.97
3	Colour (HU)	60	156	137	90
4	Turbidity (NTU)	20	35	20	20
5	Temperature (°C)	24	22	22	23
6	Conductivity (μohms/cm)	185	501	402	395
7	Total Solid	124	193	296	359
8	Suspended Solid	56	110	93	81
9	Total Dissolved Solid (TDS)	68	83	203	278
10	Biochemical Oxygen Demand (BOD)	1.80	2.95	2.89	2.76
11	Dissolved Oxygen (DO)	5.0	5.10	7.0	7.0
12	Carbon Oxygen Demand (COD)	15.71	55.7	24.60	23.80
13	Total Alkalinity	150	357	212	192
14	Magnesium hardness	37	165	97	48
15	Calcium Hardness	80	186	116	64
16	Total Hardness	112	351	213	117
17	Iron	0.5	2.6	1.2	0.8
18	Manganese	0.03	0.14	0.14	0.12
19	Chloride	112	147	111	109
20	Nitrate (NO_3)	0.06	0.33	0.21	0.03
21	Phosphate (PO_4)	0.010	0.022	0.018	0.013

CP = Control Point
PRC = Point of Refuse Concentration
MP = Middle Point
PL = Point of Leaving

Note: All units are in Mg/L except Ph and where it is otherwise stated

Table 4.2 Suggested water-quality criteria for aquaculture hatcheries or production facilities. Catfish (black) quality standards with modification for fresh water situations. Concentrations are in ppm (Mg/L). (Source: Modification from Wedemeyer, 1998; Piper, etc al. (Larsen), 2000)

Chemical	Upper Limits for Continuous Exposure and/or Tolerance Ranges
Ammonia (NH3)	0.0125 ppm (un-ionized form)
Calcium	4.0 to 160 ppm (10.0-160.00 ppm d)
Carbon dioxide	0.0 to 10 ppm (0.0-15.0 ppm d)
Chlorine	0.03 ppm
Chloride	70 – 250 ppm
Copper[c]	0.006 in soft water
Hydrogen sulfide	0.002 ppm (Larsen - 0.0 ppm)
Iron (total)	0.0 to 0.15 ppm (0.0-0.5 ppm d)
Ferrous ion	0.00 ppm
Ferric ion	0.5 ppm (0.0-0.5 ppm d)
Lead	0.03 ppm
Magnesium	(Needed for buffer system)
Manganese	0.0 to 0.01 ppm
Nitrate (NO_3)	0.0 to 3.0 ppm
Nitrite (NO_2)	0.1 ppm in soft water, 0.2 ppm in hard water
Nitrite-nitrogen	0.03 and 0.06 ppm nitrite-nitrogen
Nitrogen	Maximum total gas pressure 110% of saturation
Oxygen	5.0 ppm to saturation; 7.0 to saturation for eggs or broodstock
Ozone	0.005 ppm
pH	6.5 to 8.0 (6.6-9.0d)
Phosphorus	0.01 to 3.0 ppm
Total suspended and settleable solids	80.0 ppm or less
Total Alkalinity (as CaCO3)	10.0 to 400 ppm (50.0-4.00.0 ppmd)
Total Hardness (as CaCO3)	10 to 400 ppm (50.0-400.0 ppmd)
Temperature	21 – 24 ^{0}C
Zinc	0.03-0.05 ppm

4.1.1 pH

The pH at Control Point was lower than that at the Mid Point which then increased towards the Point of Leaving. Almost a constant value is obtained down stream. The increased from the Mid Point is due to the refuse dump into the stream by a mini refuse dump site at a point before the Point of Leaving.

However, the pH values remained within neutral (permissible) limit. The values are 6.78, 6.91, 6.95, and 6.97 of CP, PRC, MP, and PL respectively. From the table above the pH level for the world standard for a cat fish to survive in a fresh water pond is given as 6.5 – 8.0 which shows that Karu stream can support the survival of a cat fish (black)

4.1.2 Temperature

Water temperature is sensitive to atmospheric temperature. It is influenced by the Sun's energy, water depth, water circulation, pump motor heat, and heat from other mechanical devices. Water temperature directly impacts the level of dissolved oxygen retention. A water temperature exceeding 24^{0}C can inhibit the ability of fresh water to retain an acceptable level of dissolved oxygen. From the result obtained and for fish surviving condition is acceptable at 22^{0}C – 24^{0}C

4.1.3 Colour

At the control Point, since the samples were collected before the raining season the stream water was clear in physical appearance. At the PRC, due to the refuse disposed into the stream and is undergoing constant decomposition reaction, the stream colour seem to be cloudy. A mini water fall outlook is present between the PRC and MP by gentle slope nature of the stream and this is responsible for the rapid velocity increase of the stream water and in turn responsible for the turbulence produced at this point. This occurrence explains the increase of colour unit between these two points. The colour units began to reduce due to gentle movement of water beyond the Mid Point and as such allowed some sedimentation along the line. The stream exhibited self purification characteristics and at the Point of Leaving, the clear nature of the stream returned.

4.1.4 Total Solid

The quantity of suspended and dissolved solid of the stream was noticed to be lower at the CP and later increased at the PRC and down the stream till to the Point of Leaving. This is due to the presence of refuse dump site and direct dumping unto the stream which increased the solid content of the stream. This phenomenon could be responsible for the foul smell produced by the stream.

4.1.5 Alkalinity

The alkalinity level was lower at the CP that is, (150mg/l) and later increased at PRC (357mg/l) and reduces from MP to PL at 212mg/l to 192mg/l respectively. The reduction was noticed immediately after the PRC. This sharp reduction can be deduced as due to dilution effect of the stream's self purification characteristics. This shows a good surviving condition for the catfish having a world standard of 10 – 400 ppm.

4.1.6 Total Hardness

The total hardness is lower than the level of alkalinity which is an indication that the stream also contains less of some other metallic ions aside Calcium and Magnesium. However the result from the stream, PRC (351mg/l) to MP (213mg/l) indicates a high content of Calcium and Magnesium which reduces at the Point of Leaving PL (117mg/l). Direct discharge of effluents by some house hoods may be responsible for this high quality of Calcium and Magnesium. This

shows a good condition for a catfish to survive as compared with the world standard of 10 – 400 ppm.

However, the quality of the stream presented as regard to the hardness make it not good for washing because it will consume a lot of both bathing and washing soap.

4.1.7 Chloride

The chloride content was higher at the PRC (147mg/l) than at the CP (112) and later slightly dropped between MP and PL, the domestic effluent discharge into the stream is responsible for the high change from CP to PRC and at MP. As the water would have been very diluted before PL, the site of refuse and direct dumping would not allow more than 2mg/l reduction at PL to give 109Mg/l.

4.1.8 Nitrate

The chief source of nitrogen for plant nutrition is nitrate. The nitrate value increased from CP to PRC and reduced again at MP and PL. This is due to the entrance of domestic effluents into the stream and later refuse site down stream.

However, the reduction is due to self purification of the river as it moves downward with assistance of dilution as it continuously flows.

4.1.9 Phosphate

Phosphate, like the nitrate are essentially required by living organisms, however it can be considered a pollutant if present in high concentrations under specific environmental conditions. From the result there was a reduction from PRC (0.022mg/l) to the PL (0.013mg/l). This contributed to the reduction of water plants and gives rise to the easy flow of water along the

stream. The values obtained show a good comparism to the surviving condition of the catfish in Karu site stream used for fish pond. That is, world standard for tropical catfish 0.01 – 3.0 ppm

.1.10 Dissolve Oxygen

From CP to PL, the dissolved oxygen kept increasing. DO are always available when the organic solid contents are minimal. There are various activities that result in increasing production of DO and this include turbulence and increase in flow velocity and this activities result in re-aeration of the liquid. This phenomenon is made possible due to the fact that there is a gentle slope outlook present at the location of the karu site stream.

.1.11 Manganese

Manganese is essential for nutrition in both human and animals. The values from the result obtained are 0.03, 0.14, 0.14, and 0.12 Mg/L from the CP, PRC, MP, and PL of the stream respectively. The proposed objective value of manganese by WHO (2004) is 0.01Mg/L and maximum acceptable limit is 0.05Mg/L. the manganese content of the river is above required limit this could be as a result of discharged effluents into the stream by some of the house hoods settler within the area.

.1.12 Biological Oxygen Demand (BOD)

This is the amount of oxygen necessary to decompose organic matters in a unit volume of water. From the result obtained it is shown that at the CP, BOD is 1.80Mg/L which increased at PRC, 2.95Mg/L and later reduces from MP to PL, 2.89Mg/L and 2.76Mg/L respectively. This is of the reason of high microbial activities at the PRC than at CP and then lesser of the microbial activities from MP to PL as the stream flows along.

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stream. The values obtained show a good comparism to the surviving condition of the catfish in Karu site stream used for fish pond. That is, world standard for tropical catfish 0.01 – 3.0 ppm

4.1.10 Dissolve Oxygen

From CP to PL, the dissolved oxygen kept increasing. DO are always available when the organic solid contents are minimal. There are various activities that result in increasing production of DO and this include turbulence and increase in flow velocity and this activities result in re-aeration of the liquid. This phenomenon is made possible due to the fact that there is a gentle slope outlook present at the location of the karu site stream.

4.1.11 Manganese

Manganese is essential for nutrition in both human and animals. The values from the result obtained are 0.03, 0.14, 0.14, and 0.12 Mg/L from the CP, PRC, MP, and PL of the stream respectively. The proposed objective value of manganese by WHO (2004) is 0.01Mg/L and maximum acceptable limit is 0.05Mg/L. the manganese content of the river is above required limit this could be as a result of discharged effluents into the stream by some of the house hoods settler within the area.

4.1.12 Biological Oxygen Demand (BOD)

This is the amount of oxygen necessary to decompose organic matters in a unit volume of water. From the result obtained it is shown that at the CP, BOD is 1.80Mg/L which increased at PRC, 2.95Mg/L and later reduces from MP to PL, 2.89Mg/L and 2.76Mg/L respectively. This is of the reason of high microbial activities at the PRC than at CP and then lesser of the microbial activities from MP to PL as the stream flows along.

shows a good condition for a catfish to survive as compared with the world standard of 10 – 400 ppm.

However, the quality of the stream presented as regard to the hardness make it not good for washing because it will consume a lot of both bathing and washing soap.

4.1.7 Chloride

The chloride content was higher at the PRC (147mg/l) than at the CP (112) and later slightly dropped between MP and PL, the domestic effluent discharge into the stream is responsible for the high change from CP to PRC and at MP. As the water would have been very diluted before PL, the site of refuse and direct dumping would not allow more than 2mg/l reduction at PL to give 109Mg/l.

4.1.8 Nitrate

The chief source of nitrogen for plant nutrition is nitrate. The nitrate value increased from CP to PRC and reduced again at MP and PL. This is due to the entrance of domestic effluents into the stream and later refuse site down stream.

However, the reduction is due to self purification of the river as it moves downward with assistance of dilution as it continuously flows.

4.1.9 Phosphate

Phosphate, like the nitrate are essentially required by living organisms, however it can be considered a pollutant if present in high concentrations under specific environmental conditions. From the result there was a reduction from PRC (0.022mg/l) to the PL (0.013mg/l). This contributed to the reduction of water plants and gives rise to the easy flow of water along the

stream. The values obtained show a good comparism to the surviving condition of the catfish in Karu site stream used for fish pond. That is, world standard for tropical catfish 0.01 – 3.0 ppm

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4.1.13 Chemical Oxygen Demand (COD)

This is the oxygen required that is responsible for the chemical changes during oxidation process of the organic matter in the water body. At the Point of Refuse Concentration (PRC) to the Point of Leaving (PL) the result shows a reduction in COD. This is due to the reduction of chemical reacting substances in water during self purification process as the stream is in a continuous flow.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

The quality of water depends on the purpose which the water is to serve or intended to serve. Although consideration of multiple use frequently arise in practice. Surface water intended for abstraction of drinking water, affluent and waste waters, irrigation water, water for animals, fresh water for bathing, amenity waters and indeed marine water are subjects to quality standards.

However, classification of the trace elements into essential, non essential and toxic group can be inaccurate and misleading as all the essential elements can become toxic at sufficient high intakes. With this important information, one can easily deduce that the presence of most of these elements and radicals in high quality especially at the point of concentration of refuse dump always dictates pollution.

The result of the sampled stream indicated that most part of the streams are not fit for drinking while some are not good for laundry purpose. Also, from the result it can be deduced that disposal of refuse dumps along stream areas should not be encouraged especially disposal of domestic and industrial waste generated by the populaces of human within the areas of the stream.

The water from the sampled stream shows some concentrated amount of major domestic pollutants as most pollution characteristics exist in adequate quality. It is however reasonable to treat the water from the stream before use.

In general, there is a pollution of surface waters due to the presence of trace elements, inorganic substances in the water. The degree of pollution as presented by this project work is not too serious as a clear evidence of self purification and other water (stream) dilation is exhibited down stream.

5.1 RECOMMENDATION

The following are recommended from the conclusion reached;

(a) The residents of Karu-site estate, Karu Abuja should be advised of the danger involved in consumption of stream water around the Karu- stream with out proper treatment.

(b) The residents of this area should also be educated on easy ways of treating water before use (i.e. boiling and filtering of water)

(c) Dumping of refuse into the stream should be discouraged.

(d) Refuse site along the stream will eventually render the stream useless for various operations such as irrigation down stream, fish pond farming. Therefore having a refuse site near a stream should be discouraged rather incinerator or disposal bins or carriages should be provided or arranged for refuse disposition.

(e) Government should sacrifice land for liquid and solid waste disposal, sanitary post where people can urinate and defisticate.

(f) There should be need for strict enforcement of pollution control legislation.

(g) Properly arranged dredging and other civil engineering works of most city stream is necessary though very costly but life saving will improve water quality and parameters of the stream for purity and potability test.

Conclusively on the study project, to an extent of accomplishment as the objectives and scope of this project being stated;

(a) To examine the water quality level of stream exposed to domestic refuse disposal.

(b) To use the data and analysis resulting from these study to recommend ways of reducing the pollution of the stream and indirectly improve the quality of nearby stream water.

In tune with this project, has thrown light into areas where future research work could be profitably resourced for.

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APPENDIX A

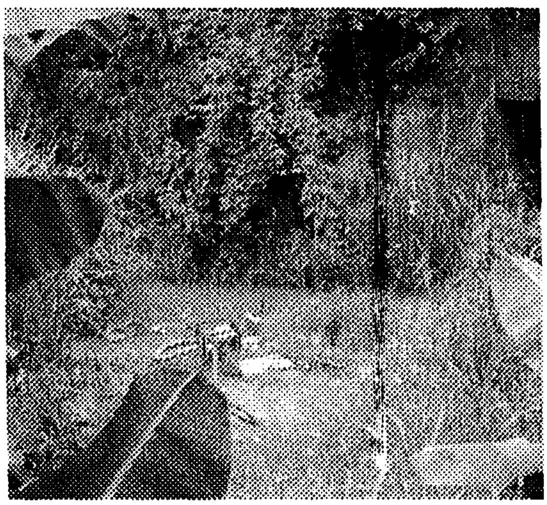
Plate A

Point of Refuse Dump Concentration

Plate B

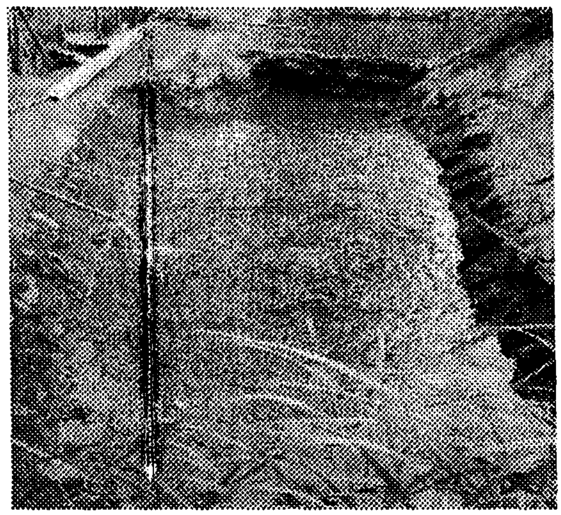
Mid Point from the point of refuse concentration and the point of leaving (about 60 meters away from the point of refuse dump concentration

Plate C



The Point of Leaving
(80 meters away from mid point
Here, the fish farmer pumps water directly into his fish ponds without much treatment)

Plate D



The fish ponds (karu site stream water is pumped into the ponds untreated)
Source: Investigation on Karu site Stream - 2008

APPENDIX B

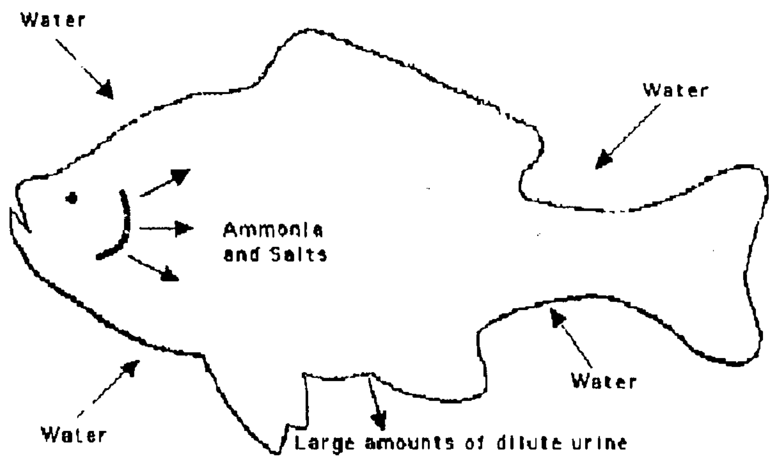


Fig 1. Direction of water, ammonia, and salt movement into and out of freshwater fish. Freshwater fish do not drink water, but excrete large amounts of dilute urine.

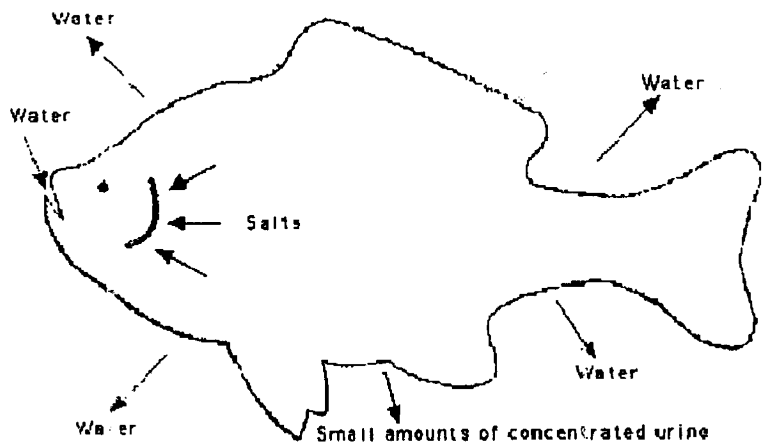


Fig 2. Direction of water, ammonia, and salt movements into and out of saltwater fish. Saltwater fish drink large amounts of water and excrete small amounts of concentrated urine.