QUALITY ASSESSMENT OF ABATTOIR EFFLUENT ON SURFACE WATER IN AKURE SOUTH, ONDO STATE, NIGERIA.

BY

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CERTIFICATION

This is to certify that this is an original and independent research project carried out by Oladiran, M.O (WMA/12/0494) in the Department of Water Resources Management and Agro-meteorology, in partial fulfillment for the award of Bachelor of Water Resources Management and Agro-meteorology, Federal University Oye-Ekiti, Ekiti State, Nigeria

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DEDICATION

I hereby dedicate this report to the all sufficient God who saw me through the course of my study. I am also grateful to my lovely parents Mr. and Mrs. Oladiran for their financial, moral, and spiritual support and also to all my friends who assisted me morally. God bless you all in Jesus name.

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ABSTRACT

Water quality is very important in the environment, because life depends on this, it's very good to check the quality of water time to time to check the rate at which it is been degraded. The objective of this work is to determine the physiochemical and heavy metal parameter of abattoir effluent to surface water and compare the standard to WHO. Two empty bottles were used to collect sample from the surface water, GPS was used to get the geographical coordinate and samples were taken to the laboratory for Analysis. Most of the heavy metals and physico chemical parameters falls above and below the range of WHO, while some were not detected. This work provide support for the water quality and help us to know the effect and abattoir effluent in our environment.

CHAPTER ONE

1.0 INTRODUCTION

Abattoir wastewater may be define as the water that has been used in the cleaning up of slaughtered cattle, sheep, goat and pig carcasses, and the floor of slaughter hall, personnel and slaughter equipment. Abattoir waste water is characterized by presence of high concentration of whole blood of the slaughtered food animal and suspended particles of semi digested and undigested feed within the stomach and intestine of slaughtered and dressed food animals take place in an abattoir, it becomes easier to refer to the wastewater from this industrial system as abattoir wastewater. (Coker A O & Adeyemi, 2001)

Recent publications show that zoonotic disease (i.e diseases of animal that are transmissible to human and vice versa) are yet to be eliminated or fully controlled in over 80% of the public abattoir in Nigeria (olugasa et al, 2001 and Cadmus et al, 1999). Thus, they are serious environment health risk to the public. Some of these infectious diseases are tuberculosis, colibacillosis, salmonellosis, brucellosis and helminthoses. These are common examples of zoonoses prevalent in slaughtered cattle population in south western Nigeria. Official statistics indicated that between 200 and 500 heads of cattle were slaughtered per day in bodija Manicipal abattoir between 1998- 2000 (olugasa et al, 2001). Sources of water for cleaning and sanitation in this facility were borehole, wells nearby stream and rainwater collected in tanks. An approximately of 40,000 liter of water is used daily to clean up the carcasses of slaughtered animals.

There has been no sewage treatment system constructed for managing wastewater from the abattoir at bodija on Ibadan. Water thus flow along the abattoir a drainage canal only to run off somewhere along roadside and according to the slope of the topography, eventually empting into a stream, the bodija- agbowo stream in Ibadan North local Government Area of the city. domestic animals being free range and are usually part of the human dwelling homes, in Ibadan, often visit the stream, drink from it and even swim in it, especially the pigs.

However, since a subtaincial quantity of abattoir wastewater runs daily into bodijaagbowo, it is likely that the black discoloration and foul odor downstream must have come from this contact.

Moreover, since the whole blood is a rich protein medium for bacteria flora of slaughtered animal and other organism from pathological lesions on slaughtered animal tissue would suspend in the wastewater and possible multiple in the stream environment.

Surface water hydrology is one of the key driving variables in river ecosystems, it includes streams, lakes, rivers and reservoir. Among the sources of water occurring in our environment surface water is the most widely used. This makes it even more prone to environmental degradation.

1.1 Benefit of surface water includes

It can be used for domestic purpose such as washing and for bathing, because it has a tendency to cut across different cities its used a means transportation through canoe from one point to another, It also serve as a means of recreation for people to swim and move to and fro in the water, It is used for irrigation purpose to supply water to farmland, so as to improve crops growth and development, Its use to rear livestock such as chicken and other animals and serve as medium to rear aquatic organism such as fish, It's also use for consumption by human (for drinking)

With all these importance it's very necessary to take good care of our surface water, and to get the best out of it. Surface water is one of the water bodies that suffer damages as a result of both the ecological and anthropogenic or human factor. An ecological factor comes due to earthquake volcanic eruption and the most occurred one which is flooding. Flooding has caused damages to the surface water leading to destruction of the ecosystem. Anthropogenic factor includes the release of industrial waste into the water which causes the surface water to get increase in heavy metals. Another anthropogenic factor that reduces surface water quality is the release of domestic swage and industrial discharged into the surface water, water from different house hold (from the kitchen, bathroom, toilet, watching of cloth e.t.c) is dispose directly into the surface water which sometimes when there is high runoff during rainfall might convey it to place or when there is no or limited rainfall, it might remain stagnant, causing water degradation. Dumping of refuse in the storm drains can also channel the refuse to the surface water.

With the above introduction about abattoir it's very important to put into consideration its effect on the environment (water environment), the water environment we shall be talking about the surface water. The washing of slaughtered animal in stream and lakes has contributed more damage to the water environment. Pathogens survival increases has a result of this process, the water body is also susceptible to odour leading to the decrease in the in oxygen level in the surface water and ground water. In this process there is increase in the rate of nitrogen and phosphorus, this result in what is called eutrophication. Since we cannot do without having abattoir in our environment, it is necessary to check the quality of water in which this waste water disposes.

Ondo state known to be one of the state in south west Nigerian, are seen to discharge most of their waste into water without treated into surface water which can somehow fine it way into the ground water. It's very necessary to check the water quality in Ondo state so as to know the rate at which the environment is been degraded.

1.2 MAIN OBJECTIVE

- To determine the physiochemical parameter of the surface water.
- To determine the heavy metal parameter of surface water.
- To compare the results with the WHO permissible limits

1.3 JUSTIFICATION

Since environmental degradation has been the major problem facing mankind and its environment (land, air and water). Water environment has faced so many challenges due to improper use or mismanagement of the water bodies. The part of the water that suffers this degradation most is the surface water, its expose to so many things in the environment, sewage and sludge from various houses, when not properly treated or managed, it's been poured out to the neighborhood which later find its way to the stream, industrial discharged which contains some heavy metals is been dispose to the surface water which tends to reduce the quality of water, thereby causing damage to the ecosystem. Another way where by the surface water suffers degradation is the runoff from farm land which contains herbicides, fungicides and pesticides which flow into the stream and destroy the ecosystem by reducing the quality of the surface water, other related issued are caused by natural hazards such as floods which flows into the steam when there is heavy rainfall or when water cannot infiltrate. Another anthropogenic factor that causes the degradation of water is the flow of abattoir water into the stream, which contains blood and soap water which is used to wash the animal and sometimes oil, abattoir water are seen to have some physico chemical properties and contains so heavy metals, these water, when disposed also finds its way to the stream and damage the water body by reducing the quality of the water. Water from this area can cause many damage or havoc to human and animal life, people in the rural area make use of this water to bath and few people in the rural area drink this water or use it for another specific purpose. This show us the effect of abattoir water to the environment, to check the rate at which it affect man and its environment and to check to what extent can it be used when comparing with the WHO so as to know the effect and its relevant to our environment.

CHAPTER TWO

2.0 LITRATURE REVIEW

2.1 REVIEWS OF ABATTOIR WASTE WATER

(omole, 2008)The location and operation of abattoirs are generally unregulated, aside, they are usually located near water bodies where access to water for processing is guaranteed. The animal blood is released into the flowing water (adelegan 2002). (Sangodoyin and agbawe 1992) identified improper management and supervision of abattoir activities as a major sources of risk to public health in south western Nigeria. Waste from slaughtered house typically contains fat, grease, hair. Feather, flesh, manure, grit and undigested food, blood, bones and process water which characterized high organic level (Bull et al, 1982; Coker et al., 201; Nafamda et al., 2006).

The total amount of waste of produced per animal slaughtered is approximately 35% of its weight (World Bank, 1998). In an earlier study, (verheijen et al 1996) found out that, for every 1000kg of carcass weight, a slaughtered beef produces 5.5kg of manure (excluding rumen content or stockyard manure) and 100kg of paunch manure (partially digested food). The weight of matured cow varies in size, ranging from 400kg for thin, 550 kg for moderate to 750kg for extremely fat (Hammack and Gill 2002).Scahill 2003 gave more detailed statistics on both life and dead weight of cow in the study.

Comparatively, in another study conducted by Mittal 2004, on abattoir in Quebec, Canada, typical value for range of parameters in abattoir wash down were given TS concentration (2333-8620 mg L -1); TSS (736-2099mg/l) while average level of nitrogen and phosphorus were evaluated at 6 and 2.3mg /l, respectively. Hence, abattoir effluent could increase level of nitrogen, phosphorous, total solid in the receiving water bodies considerably. Excess nutrient cause the water body to become choked with organic substances and organisms. When organic matter cause the water body to become choked with organic substances and organism. When organic matter exceed the capacity of the microorganism in the water that break down and recycles the organic matter, it encourages rapid growth, or blooms of algae, leading to transmission of pathogen to humans and cause zoonotic disease such as Coli Bacillosis, Salmonellosis, Brucellosis and Helminthes (Cadus et al., 1999) improper management of abattoir waste and subsequent disposal either directly or indirectly into river bodies portends serious environmental and health hazard both to aquatic life and human.

Abattoir waste can have adverse environment effect on water quality if the waste is directed towards a river or stream. This study is therefore, aimed at evaluating the effects of minna abattoir wastes on the receiving stream by analyzing the physical and chemical parameter of water sample taken at 3 different site: upstream at the point where, the abattoir waste meets with the stream and downstream during the wet season of 2006. The result of the water analyses showed the various range of value obtained as follows (Chukwu et al., 2008):

Tubidity (43.0, 58.0 and 55.0 FTU);

Odour (odourless, offensive and slight odour);

Total alkalinity (164.0, 104.0 and 90mg/l);

Iron content (0.91, 0.52, 0.55 mg/l);

pH value where 6.8, 8.8 and 6.8 for US, PS and DS respectively. These values are at variance with the allowable limits of the world health organization (WHO) for drinking water. The result showed that the abattoir effluent has lowered the quality of the receiving downstream.

Another case study was the assessment of the impact of abattoir wastewater discharge on the water quality of river Kaduna, Nigeria. Water samples were collected from river Kaduna at three points: 100m upstream of the abattoir discharge point, at the discharge point, and 100m downstream of the discharge point for a 6-month period (July- September in the rainy season and October-December in the dry season). Physico-chemical analyses were conducted on the collected samples in the laboratory using standard methods. The pH was within a fixed band of 6-8. The downstream 5-day biochemical oxygen demand of the receiving river water increased significantly to 75% in July and up to 192% in December. Suspended solids, chemical oxygen demand, ammonia-nitrogen, total nitrogen and total phosphorus followed a similar trend. Dissolved solids, dissolved oxygen, nitrate-N, iron, zinc and cadmium also increased appreciably. The downstream levels of these parameters were higher than their corresponding upstream values, indicating that the discharge of the abattoir wastewater into the river has negatively impacted the river water. The dilution of the waste in the river water was not enough to reduce them to acceptable levels. This research demonstrates that abattoir wastewater impacts the river water negatively.

(Magaji & Chup, 2012)An experiment was also conducted on the impact of abattoir wastes on water quality around an abattoir site in Gwagwalada. The work was premised on the fact that untreated wastes from the abattoir are discharged directly into open drainage which flows into a nearby stream. Leachates from dumped and decomposed wastes have also been observed to percolate into soil, and also flow into the stream. Water samples were collected from four points along the stream and subjected to laboratory analysis for heavy metal contents (Lead (Pb), Iron (Fe), Cupper (Cu), Cadmium (Cd), Aluminium (Al) Cyanide (Cn), Boron (B),and Nickel (Ni)., as well as some physical and chemical properties [such as pH, Dissolved Oxygen, salinity,conductivity, and Total Dissolved Solids (TDS)]. The student t –test, and the Analysis of Variance were utilized to determine variations in concentrations of the analyzed properties. It was discovered that most of the analyzed properties of the water such as: pH (5.75), Filterable Solid (0.06), DO (5.15), TDS (153.75), Cd. (0.11)Cu(0.25)B (0.14) are still below the nationally and internationally accepted limits. Despite that, continuous discharge of these wastes into thestream however, may in no distant time, pose a threat to human health. The paper thus concludes by recommending that a mechanism be put in place for the treatment of these abattoirwastes before they are then properly disposed.

2.2 HEAVY METAL IN ANIMAL VITAL ORGAN

(C. Milam & Jang, 2015) Some physico-chemical characteristic and heavy metal properties in some Nigeria rivers, streams, and waterways showed high concentration of some heavy metals (Asonyeet al., 2007). High levels of metals were found in beef and mutton as a result of contaminated soil and animal feeds (Sabir SM and Khan SW., 2003) It was observed that metal accumulation in cattle raised in a serpentine-soil area was related to the concentrations of the metals in soils and forage (Miranda et al, 2009). Apart from being in contact with polluted soil environment and grazing on contaminated, exposure to heavy metals can also be as a result of contaminated feeds. Cases of heavy metal contamination in meat products during processing have also been reported (Santhi et al., 2008). In Nigeria cattle are free grazing and drink water from ditches, streams, rivers and other possible contaminated water sources. They graze along runways and other sites that might have been contaminated with toxic substances hence the risk to exposure to high levels of contaminant. These metals accumulate in the organs and other tissues.

2.3. EFFECT OF THE METAL ON ANIMALS

Heavy metals contamination poses a threat due to their toxicity; bioaccumulation and bio magnifications in the food chain (Demirezen et al., 2005). They are transferred to man and animals through diet and other routes (Arslan et al., 2011). Although contamination of animal feed by toxic metals cannot be totally avoided given the prevalence of these pollutants in the environment, the contamination needs to be minimized so as to reduce both direct effects on animal health and indirect effects on human health . Exposure of livestock to either high levels of toxic metals (Cadmium and lead) or less than optimal levels of the essential microelements (Copper, Cobalt, and Zinc) can trigger adverse effects such as reproductive impairment, physiological abnormalities, behavioral modification and even death. Depressed appearance, blindness, grinding of teeth, muscular twitching, snapping of eyelids, and convulsive seizures are some of the signs of heavy metal poisoning in cattle caused by lead. Lead has a particular affinity for bones and causes osteoporosis; it also enters the liver and kidney. It interferes with manganese, iron metabolism and may cause anaemia. Cadmium, which is a highly toxic metal, causes necrosis by accumulating especially in liver and kidney. Cobalt are also toxic metals at higher levels and is a major constituent of Vitamin B (Cyano Cobalamin) which enhances formation of red blood cells and its deficiency causespernicious anaemia (Adebayo et al,. 2009). Copper occurs in food in many chemical forms and combinations, which affects its availability to the animal. It is known to be essential at low concentrations for both human and animals but it is toxic at high levels (Brito et al., 2005). Zinc is an essential element in human diet. Too little Zn can cause problems; however, too much Zinc is harmful to human health. Recently, the increasing demand of food safety has stimulated research regarding the risk associated with consumption of meats contaminated by heavy metals. In this study, a research was carried out to investigate the presence and level of heavy metal in the heart, intestine, stomach, kidney and liver of cattle slaughter at Yola abattoir. This gave an insight on the presence or absence of heavy metals in cattle meat found in our markets. Though meat is a very important human food, there is need to monitor the level of metal in animal tissues so as to assess the effect on animal health and the safety of animal product in human nutrition.

2.4. EFFECT OF HEAVY METLAS TO HUMAN HEALTH

(Simone & Maria, 2012)Lead (Pb), cadmium (Cd), mercury (Hg) and arsenic (As) are widely dispersed in the environment. These elements have no beneficial effects in humans, and there is no known homeostasis mechanism for them (Draghici et al., 2010; Vieira et al., 2011). They are generally considered the most toxic to humans and animals; the adverse human health effects associated with exposure to them, even at low concentrations, are diverse and include, but are not limited to, neurotoxic and carcinogenic actions (ATSDR, 2003a, 2003b, 2007, 2008; Castro-González &Méndez-Armenta, 2008; Jomova&Valko, 2011; Tokar et al., 2011).

2.4.1 LEAD

Lead as a toxicologically relevant element has been brought into the environment by man in extreme amounts, despite its low geochemical mobility and has been distributed worldwide (Oehlenschläger, 2002). Lead amounts in Deep Ocean waters is about 0.01-0.02 μg/L, but in surface ocean waters is ca.0.3 μg/L (Castro-González & Méndez-Armenta, 2008). Lead still has a number of important uses in the present day; from sheets for roofing to screens for X rays and radioactive emissions. Like many other contaminants, lead is ubiquitous and can Food is one of the major sources of lead exposure; the others are air (mainly lead dust originating from petrol) and drinking water. Plant food may be contaminated with lead through its uptake from ambient air and soil; animals may then ingest the lead contaminated vegetation. In humans, lead ingestion may arise from eating lead contaminated vegetation or animal food be found occurring as metallic lead, inorganic ions and salts (Harrison, 2001). Lead has no essential function in man. In humans, about 20 to 50% of inhaled, and 5 to 15% of ingested inorganic lead is absorbed. In contrast, about 80% of inhaled organic lead is absorbed, and ingested organic Pb is absorbed readily. Once in the bloodstream, lead is primarily distributed among blood, soft tissue, and mineralizing tissue (Ming-Ho, 2005). The bones and teeth of adults contain more than 95% of the total body burden of lead. Children are particularly sensitive to this metal because of their more rapid growth rate and metabolism, with critical effects in the developing nervous system

(ATSDR, 2007; Castro-González & Méndez-Armenta, 2008). The Joint FAO/ World Health Organization Expert Committee on Food Additives (JECFA) established a provisional tolerable weekly intake (PTWI) for lead as 0.025 mg/kg body weight (JECFA, 2004). The WHO provisional guideline of 0.01 mg/L has been adopted as the standard for drinking water

2.4.2 CADMIUM

The use of cadmium by man is relatively recent and it is only with its increasing technological use in the last few decades that serious consideration has been given to cadmium as a possible contaminant. Cadmium is naturally present in the environment: in air, soils, sediments and even in unpolluted seawater. Cadmium is emitted to air by mines, metal smelters and industries using cadmium compounds for alloys, batteries, pigments and in plastics, although many countries have stringent controls in place on such emissions (Harrison, 2001).

Cadmium accumulates in the human body affecting negatively several organs: liver, kidney, lung, bones, placenta, brain and the central nervous system (Castro-González &MéndezArmenta, 2008). Other damages that have been observed include reproductive, and development toxicity, hepatic, haematological and immunological effects (Apostoli&Catalani, 2011; ATSDR, 2008). The Joint FAO/WHO has recommended the PTWI as 0.007 mg/kg bw for cadmium (JEFCA, 2004). The EPA maximum contaminant level for cadmium in drinking water is 0.005 mg/L whereas the WHO adopted the provisional guideline of 0.003 mg/L.

2.4.3 MERCURY

Mercury is one of the most toxic heavy metals in the environment (Castro-González &Méndez-Armenta, 2008). Man released mercury into the environment by the actions of the agriculture industry (fungicides, seed preservatives), by pharmaceuticals, as pulp and paper preservatives, catalysts in organic syntheses,in thermometers and batteries, in amalgams and in chlorine and caustic soda production (Oehlenschläger, 2002; Zhang & Wong, 2007). Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus (ATSDR, 2003b).

Because of the extreme health effects associated with mercury exposure, the current standards for drinking water were set by EPA and WHO at the very low levels of 0.002 mg/L and 0.001 mg/L, respectively (WHO, 2004a).

2.4.4. ARSENIC

Arsenic is a metalloid. It is rarely found as a free element in the natural environment, but more commonly as a component of sulphur-containing ores in which it occurs as metal arsenides. Arsenic is quite widely distributed in natural waters and is often associated with geological sources, but in some locations anthropogenic inputs, such as the use of arsenical insecticides and the combustion of fossil fuels, can be extremely important additional sources. Arsenic occurs in natural waters in oxidation states III and V, in the form of arsenous acid (H3AsO3) and its salts, and arsenic acid (H3AsO5) and its salts, respectively (Sawyer et al., 2003).The toxic effects of arsenic depend specially on oxidation state and chemical species, among others. Inorganic arsenic is considered carcinogenic and is related mainly to lung, kidney, bladder, and skin disorders (ATSDR, 2003a). The toxicity of arsenic in its inorganic form has been known for decades under the f· owing forms: acute toxicity, subchronic toxicity, genetic toxicity, developmental and re ·oductive toxicity (Chakraborti et al., 2004), immunotoxicity (Sakurai et al., 2004), bioche· ·al and cellular toxicity, and chronic toxicity (Mudhoo et al., 2011; Schwarzenegger al., 2004). Drinking water is one of the primary routes of exposure of inorganic arser (Mudhoo et al., 2011; National Research Council, 2001). Ingestion of groundwater w elevated arsenic concentrations and the associated human health effects are prevalent in s·v·ral regions across the world. The JECFA established a PTWI for inorganic arsenic as 0.015 mg/kg body weight (FAO/WHO, 2005, JECFA 2004). Organo-arsenic intakes of about 0.05 mg/kg body weight/day seemed not to be associated to hazardous effects (Uneyama et al., 2007).

2.4.5. IRON

(Monisha & Blessy, 2014)is the second most abundant metal on the earth's crust (EPA, 1993). Iron occupies the 26th elemental position in the periodic table. Iron is a most crucial element for growth and survival of almost all living organisms (Valko*et al.*, 2005). It is one of the vital components of organisms like algae and of enzymes such as cytochromes and catalase, as well as of oxygen transporting proteins, such as hemoglobin and myoglobin (Vuori, 1995). Iron is an attractive transition metal for various biological redox processes due to its inter-conversion between ferrous (Fe^{2+}) and ferric (Fe^{3+}) ions (Phippen*et al.*, 2008). The source of iron in surface water is anthropogenic and is related to mining activities. The production of sulphuric acid and the discharge of ferrous (Fe^{2+}) takes place due oxidation of iron pyrites (FeS_2) that are common in coal seams (Valko*et al.*, 2005). The following equations represent the simplified oxidation reaction for ferrous and ferric iron (Phippen*et al.*, 2008): A wide range of harmful free radicals are formed when the absorbed iron fails to bind to the protein, which in turn severely affects the concentration of iron in mammalian cells and biological fluids. This circulating unbound iron results in corrosive effect of the gastrointestinal tract and biological fluids. An extremely higher level of iron enters into the body crossing the rate-limiting absorption step and becomes saturated. These free irons penetrate into cells of the heart, liver and brain. Due to the disruption of oxidative phosphorylation by free iron, the ferrous iron is converted to ferric iron that releases hydrogen ions, thus increasing metabolic acidity. The free iron can also lead to lipid peroxidation, which results in severe damage to mitochondria, microsomes and other cellular organelles (Albretsen, 2006). The toxicity of iron on cells has led to iron mediated tissue damage involving cellular oxidizing and reducing mechanisms and their toxicity towards intracellular organelles such as mitochondria and lysosomes. A wide range of free radicals that are believed to cause potential cellular damage are produced by excess intake of iron. The iron produced hydrogen free radicals attack DNA, resulting in cellular damage, mutation and malignant transformations which in turn cause an array of diseases (Grazulevicieneet *al.*, 2009).

2.4.6. CHROMIUM

Chromium is present in rocks, soil, animals and plants. It can be solid, liquid, and in the form of gas. Chromium compounds are very much persistent in water sediments. They can occur in many different states such as divalent, four-valent, five-valent and hexavalent state. Cr (VI) and Cr (III) are the most stable forms and only their relation to human exposure is of high interest (Zhitkovich, 2005). Chromium (VI) compounds, such as calcium chromate, zinc chromates, strontium chromate and lead chromates, are highly toxic and carcinogenic in nature. Chromium (III), on the other hand, is an essential nutritional supplement for animals and humans and has an important role in glucose metabolism. The uptake of hexavalent chromium compounds through the airways and digestive tract is faster than that of trivalent chromium compounds. Occupational sources of chromium include protective metal coatings, metal alloys, magnetic tapes, paint pigments, rubber, cement, paper, wood preservatives, leather tanning and metal plating (Martin & Griswold, 2009). (Schroeder *et al.*1970) reported that cigarettes contained 390 g/kg of Cr, but there has been no significant report published on the amount of chromium inhaled through smoking. When broken skin comes in contact with any type of chromium compounds, a deeply penetrating hole will be formed. Exposure to chromium compounds can result in the formation of ulcers, which will persist for months and heal very slowly. Ulcers on the nasal septum are very common in case of chromate workers. Exposure to higher amounts of chromium compounds in humans can lead to the inhibition of erythrocyte glutathione reductase, which in turn lowers the capacity to reduce methemoglobin to hemoglobin (Koutras*et al.*, 1965; Schlatter&Kissling, 1973). Results obtained from different *in vitro* and *in vivo* experiments have shown that chromate compounds can induce DNA damage in many different ways and can lead to the formation of DNA adducts, chromosomal aberrations, sister chromatid exchanges, alterations in replication and transcription of DNA (O'Brien *et al.*, 2001; Matsumoto *et al.*, 2006).

2.5. REVIEW ON PHYSICO CHEMICAL EXPERIMENT

(AftabBegum et al.2005) studied various physico-chemical parameters and analysis of untreated fertilizer effluent. His result revealed that the parameters like EC, TDS, TSS, BOD, COD and ammonia are high compared to permissible limits of CPCB (1995), and fungal analysis showed the presence of 15 species isolated on Malt Extract Agar (MEA) medium thereby indicating the pollution load of the effluent. (DeyKallol et al.2005) studied various physio-chemical parameters on the samples drawn from the river Koel, Shankha and Brahmani. It was observed that dilution during rainy season decreases the metal concentration level to a considerable extent. However the enrichment of these metals by bio-magnification and bioaccumulation in edible components produced in water is accepted to produce a remarkable effect on the water of the river Brahamani which is of deep public concern.

Pawar Anusha et al.(2006) has studied the bore well and dug well water samples from a highly polluted industrial area Nacharam. Sample were collected and analysed for physicochemical parameters by adopting the standard methods for examination for water and waste water. The analyzed samples obtained a high values, compared with drinking water standards. Poonkothai and Parvatham (2005) had been studied physico-chemical and microbiological studies of automobile wastewater in Nammakkal, Tamil Nadu, India indicated that the values for physico-chemical parameters were on the higher side of permissible limits of BIS. Microbiological studies revealed the presence of bacteria at high concentration and these organisms serves as indicators for pollutants. (Rokade and Ganeshwade 2005) showed high fluctuations in the physico-chemical parameters indicating the intensity of pollution. The pH ranged from minimum of 6.6 to maximum of 8.4, chlorides from 132.5 to 820.4mg/l, hardness ranged from 74 to 281 mg/l, CO2 from 2.1 to 5.09, BOD from 4.437 to 112.432

Mg/l, sulphates 0.192 to 5.12 mg/l, nitrates 0.5 to 1.012. The minimum pH value of 6.3 mg/l was found during winter season and maximum of 8.93 mg/l in summer. The pH shows general decline from upstream to downstream. CO_2 was found to maximum in summer reaching up to 55.44 mg/l and reduced to a minimum of 2.28 mg/l during rainy season. From the data collected it can be concluded that the inverse relationship, which is known to exist between pH and CO2, is not existing in the present investigation (Sawane 2006).

Sharma Madhavi et al. (2005) studied ground water quality of industrial area of Kishangarh for various physicochemical parameters seasonally without and after addition of marble slurry in different proportions. From the study it is clear that these parameters increase with the addition of marble slurry leading to deterioration of the overall quality of the groundwater. (Singhal et al.2005) study reports on the treatment of pulp and paper mill effluent by Phanerochaetechrysosporium and the same has been compared at two different pH 5.5 and 8.5. At both the pH, colour, COD, lignin content and total phenols of the effluent significantly declined after bioremediation. However, greater decolourisation and reduction in COD, lignin content and total phenols were observed at pH 5.5. Chavan et al. 2005) was carried out investigation to study the different organic pollutants present in the Thane creek water. The creek water shows high values of BOD and COD along with 15 phenolic compounds, detergents, alcohols, ether and acetone, which are harmful to aquatic life. The origin of this pollutants is mainly from the entry of effluents from surrounding industries.

Gupta et al (2009) were analyzed water samples from 20 sampling points of Kaithal for their physicochemical characteristics. Analysis of samples for pH, Colour, Odour, Hardness, Chloride, Alkalinity, TDS etc. On comparing the results against drinking water quality standards laid by Indian Council of Medical Research (ICMR) and World Health Organization (WHO), it is found that some of the water samples are non -potable for human being due to high concentration of one or the other parameter. Thus an attempt has been made to find the quality of ground water in and around Kaithal City town, suitable for drinking purposes or not. Basawarajsimpi et al.(2011) studied monthly changes in various physico chemical parameters of Hosahalli water tank in shimoga district Karnataka. Study shows that all parameters are within the limit and tank water non polluted and it can be used for domestic, irrigation and fishery purpose.

Water samples were collected from river Kaduna at three points: 100m upstream of the abattoir discharge point, at the discharge point, and 100m downstream of the discharge point for a 6-month period (July- September in the rainy season and October-December in the dry season). (Terrumun Kenneth Kwadzah, 2015) Physicochemical analyses were conducted on the collected samples in the laboratory using standard methods. The pH was within a fixed band of 6-8. The downstream 5-day biochemical oxygen demand of the receiving river water increased significantly to 75% in July and up to 192% in December. Suspended solids, chemical oxygen demand, ammonia-nitrogen, total nitrogen and total phosphorus followed a similar trend. Dissolved solids, dissolved oxygen, nitrate-N, iron, zinc and cadmium also increased appreciably. The downstream levels of these parameters were higher than their corresponding upstream values, indicating that the discharge of the abattoir wastewater into the river has negatively impacted the river water.

2.6. PERMISSIBLE LIMITS OF PARAMETERS

The permissible limits of parameters in potable water by world health organization (WHO) is given in Table 2.1

Table 2.1 permissible limits of physico chemical properties and heavy metal in water by world health organization (WHO).

S/N	PARAMETERS	WHO permissible limit
1	Appearance	Clear
2	Colour	15.0 TUC
3	Odour	Unobjectionable
4	Turbidity	5.0
5	Ph	6.5-9.5
6	Conductivity (us/cm)	1200
7	Total dissolve solid, (mg/l)	100
8	Total alkalinity, (mg/l)	100
9	Total hardness (mg/l)	100
10	Calcium hardness, (mg/l)	**NS**

11	Chlorine (mg/l)	250
12	Calcium (mg/l)	NS
13	Nitrate (mg/l)	50
14	Magnesium(mg/l)	30
15	Manganese (mg/l/)	0.05
16	Total iron (mg/l)	0.3
17	Chromium (mg/l)	0.05
18	Zinc (mg/l)	3.0
19	Cadmium (mg/l)	0.003
20	Copper (mg/l)	2.0
21	Arsenic (mg/l)	0.01
22	Lead (mg/l)	0.01

CHAPTER THREE

3.0. MATERIAL AND METHODOLOGY

3.1. Description of study area

The study was carried out at Akure south, Ondo state, Nigeria which is lies between latitude of7° 10'Nand longitude of5° 05'E

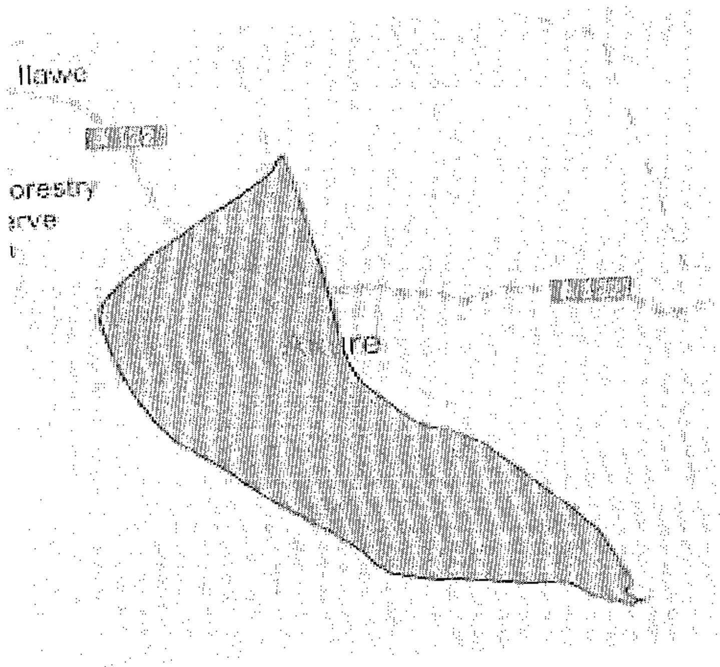

Figure 3.1. Map of Akure south.

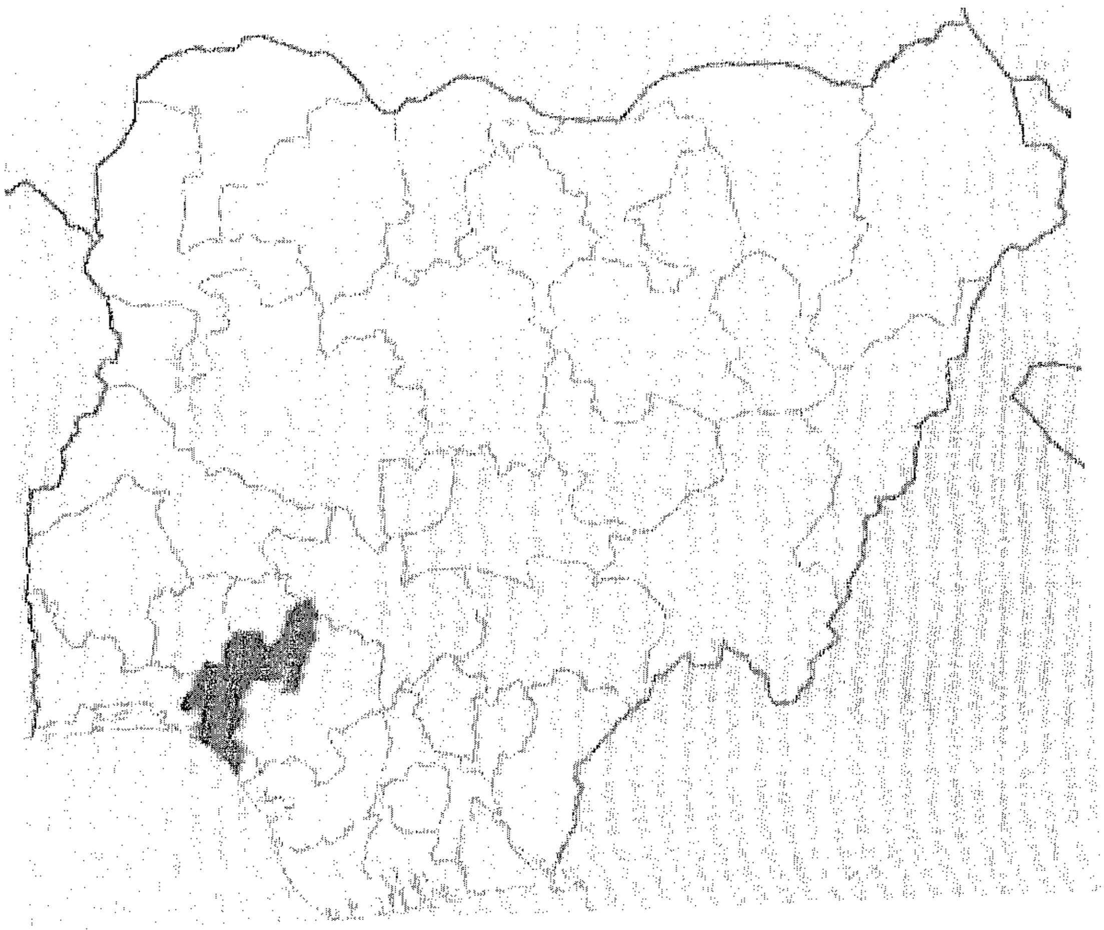

Figure 3.2. Map of Nigeria showing Ondo state

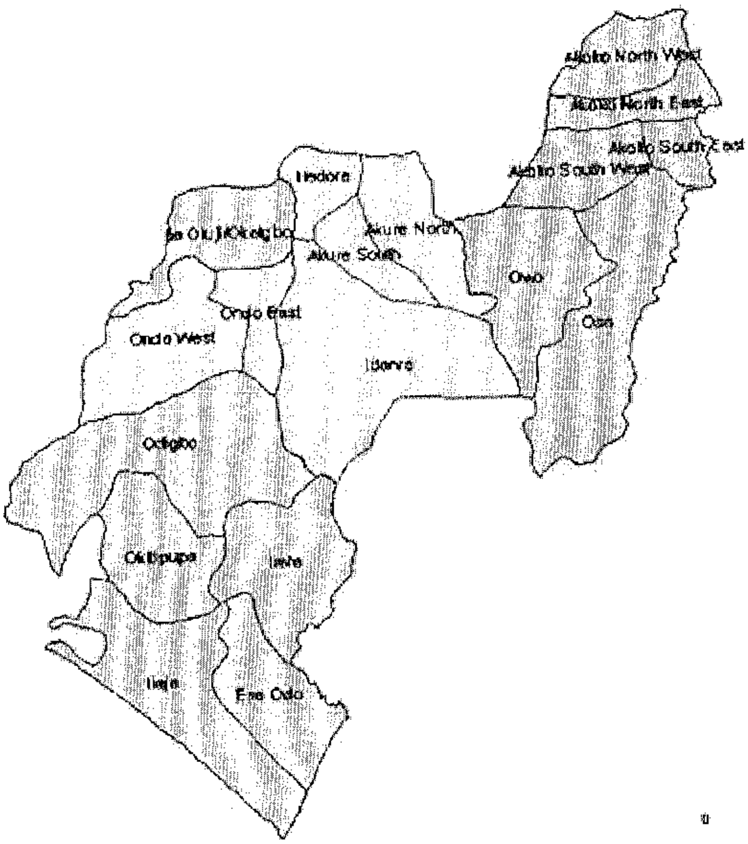

Figure 3.3. Map of Ondo state

3.2. SAMPLING TECHNIQUE

Samples were collected from two different places at Akure south west of ondo state, namely oluwatuyi abattoir and araromi(oyarubulem) abattoir. Samples were collected at the abattoir with five- liters bottle on 23rd of May 2017 triplicates. Global Positioning System (GPS) was used to determine the geographic positions of these abattoirs. The plastic sampling bottles were thoroughly washed with detergent and rinsed with distilled water until is acid free. Water were collected by Deeping the plastic bottles inside the abattoir stream water and was covered immediately. Samples were kept inside fridge and were taken to the lab for analysis on the 27th of May 2017.

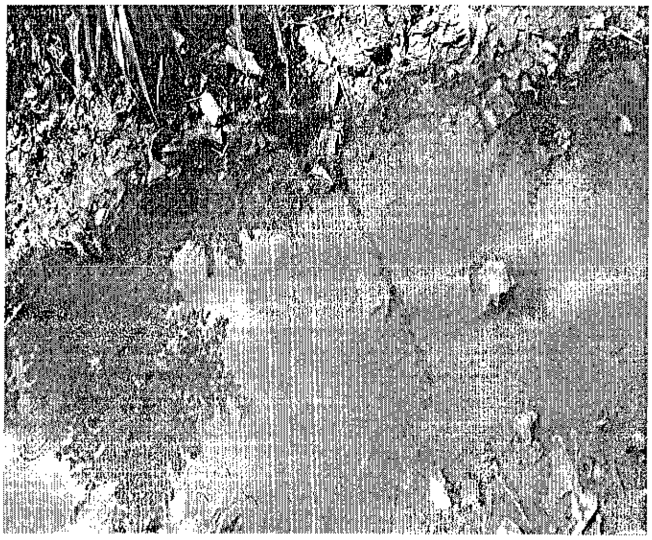

PLATE 3.1 Oluwatuyi Sampled location

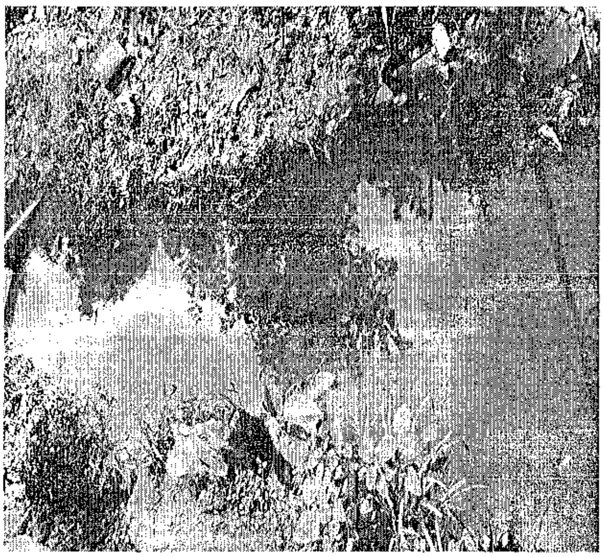

PLATE 3.2. Oluwatuyi location 2

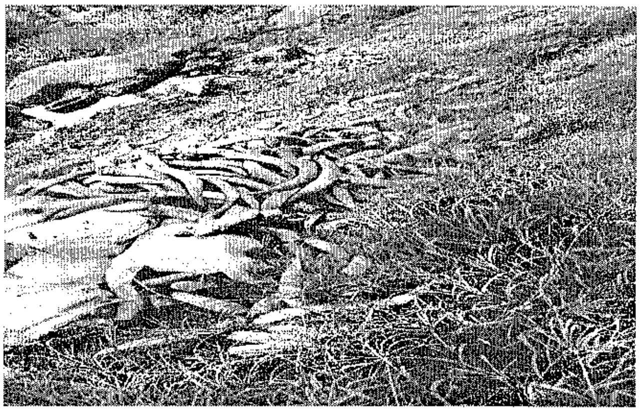

Plate 3.3 Abattoir area

Plate 3.4 flow of water to sampled locatio

3.3. SAMPING PROCEDURE

- Two empty bottles were taken to the two different locations.
- Bottles were properly rinsed with distill water before taken the sample.
- Five -liters of the sample was collected for each sample.
- GPS was used to get the geographical position of the sampling point.
- Samples were taken to the laboratory for analysis.

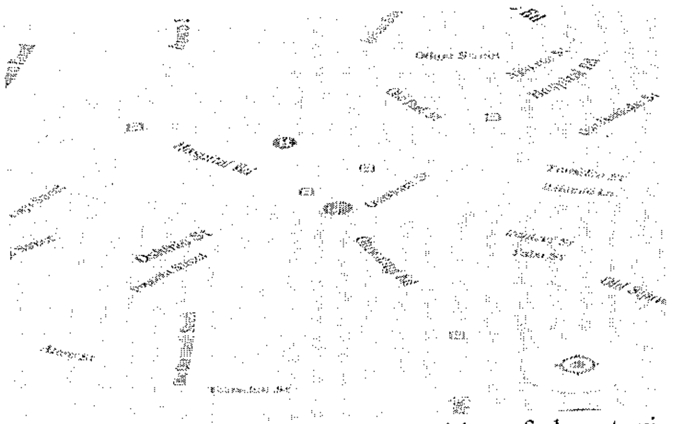

Plate 3.5 geographical position of oluwatuyi

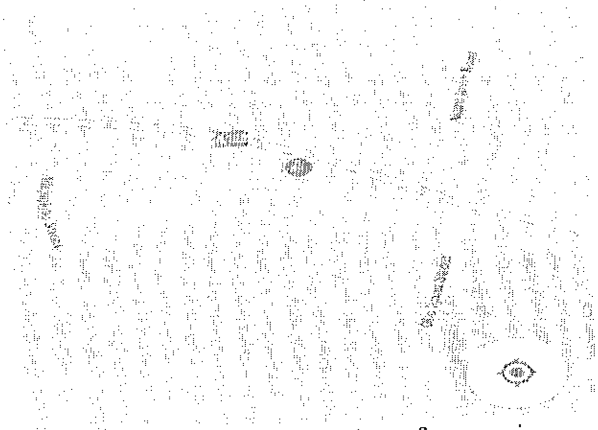

Plate 3.6.Geographical location of araromi

The location and the geographical coordinates

Table 3.1

Location	geographical coordinates
Araromi (oyarubulem)	7° 16' 58" N 5° 11' 14" E
Oluwatuyi	7° 14' 20" N 5° 11' 48"E

3.4.0. How to determine physico-chemical analysis of the water samples

Standard methods was recommended by relevant authorities such as World Health Organization (WHO), United State Environmental Protection Agency (US- EPA) was employed for the preparation of reagents and determination of all water quality parameters.

The electrical conductivity (EC) was measured using mercury thermometer and conductivity meters immediately after sampling. Water samples collected in the field were analyzed in the laboratory for the major ions (Ca, Mg, Cl, Na), nitrate, and iron using the standard methods. Total hardness (TH) as $CaCO_3$, Calcium (Ca^2+), and chloride (Cl) were analyzed by using volumetric methods.

Magnesium (Mg) was calculated from Total Hardness and Calcium hardness contents. Nitrate (NO_3), and iron (Fe) were determined by volumetric methods. Atomic absorption spectrophotometer was used for the determination of heavy metals in the sample.

3.4.1. Determination of total hardness by titration

Reagents: buffer solution, Erichrome Black T indicator and EDTA (ethylene-diamine-tetra-acetic acid).A measuring cylinder was used to measure fifty millimeter of abattoir sample water and 2 ml of buffer solution was added to the sample. Erichrome Black T (0.2g) indicator was added and then mixed together. The colour turned pink which indicated the end point. The burette was filled with 0.01M EDTA and the solution were titrated with EDTA until the colour changed from pink to blue. Then the reading along the burette was then taken. This procedure was repeated for other water samples.

Calculation: Total hardness = (millilitre of Titrant X 20) Mg/L $CaCO_3$

3.4.2. Determination of Chloride in Water by Argentometric Titration

Reagents: standard silver nitrate ($AgNO_3$) solution, potassium chromate (indicator)

Fifty milliliters of the sample were measured in a conical flask and 1ml of potassium chromate was added and shaken vigorously to produce a lemon greenish solution. This solution was titrated against silver nitrate ($AgNO_3$) until the colour turned from lemon green to ox blood. The reading along the burette was recorded and this analysis

Calculation: Chloride (Cl) = (Millilitres of Titrant X 10) Mg/LCl

3.4.3. Determination of Alkalinity by titration

REAGENT: 0.02N HCl and Mixed indicator

Fifty milliliters of sample was measured into a conical flask.Mixed indicator was added to give a greenish solution. The burette was filled with 0.02N HCl. The solution was titrated against 0.02N HCl until the colour turned from green to pink.

Calculation: Alkalinity = (millilitre of Titrant X 20) Mg/L

3.4.4. Determination of turbidity

Turbidity meter was used to get the turbidity

Micro processer turbidity meter that uses rays was used.

The curvette was filled with water sample to the marked point. The lower meniscus was watched out for. The curvette was wiped thoroughly with a lint free tissue. Cuvette was inserted into the chamber. It was covered and ensured that the cap points toward the LCD.

The read key was pressed and after 25 seconds the reading was taken

3.4.5. Determination of iron

Reagent: conc. HCl, NH_2OHCl solution (hydroxylamine hydro chloride, antibump granules, Ammonium acetate buffer solution and phenanthroline

50ml of sample was measured into a beaker. 2ml of concentrated HCl was added. 2ml of NH_2OHCl solution (hydroxylamine hydro chloride) was added to the solution.

2 stones of antibump granules were added. The solution was boiled until the volume was reduced to 25ml. It was then allowed to cool. It was transferred into a 100ml conical flask. 10ml of Ammonium acetate buffer solution was added. 4ml of phenanthrolineindicator was also added. The volume in the conical flask was made up to 100ml with distilled water. The colour of the solution was compared with a standard that ranges from 0.002 to 2.0 mg l^{-1}.

3.4.6. Nitrate test

Nitrate test was done used cadmium reduction column.

Reagent used: Colour developer, washing stock solution

The sample is passed through the cadmium reduction column to reduce the nitrate present to nitrite. 25ml of the sample was measured and 75ml of washing solution is added and passed through the column then collect at the rate of 7 to 10ml per minute. The first 25ml was discarded and the remainder was collected in the sample flask. 2ml of colour developer was added to the reduced sample and mixed. Between 10mins to 2 hours the absorbance was measured at 543nm against a distilled water reagent blank. The nitrate concentration was determined by comparing the absorbance with a standard nitrate graph.

3.4.7 Determination of Heavy Metals

Trace and heavy metals or the surface water samples were determined by Atomic Absorption spectro-photometer, Phoenix-986 (AAS) using appropriate wave length for each metal. The atomic absorption spectrophotometer was operated in the air-acetylene flame mode and lamps operated at the following wavelengths according to the manufacturer's instruction (Cd, 518nm; Pb, 510; Cr, 540nm; Mn, 525nm).

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

Selected physico-chemical and heavy metals in surface water at Akure south west, ondo state.

Table 4.1. Result of the sampled location under study for physico chemical parameters

S/N	PARAMETERS	Location 1 Oluwatuyi	Location 2 Araromi
1	Appearance	Highly turbid	Highly turbid
2	Colour	Dark brown	Black
3	Odour	Offensive	Offensive
4	Turbidity	922.5	1701
5	Ph	6.8	6.4
6	Conductivity (us/cm)	1066	2234
7	Total dissolve solid, (mg/l)	746	1564
8	Total alkalinity, (mg/l)	108	66
9	Total hardness (mg/l)	212	28
10	Calcium hardness, (mg/l)	168	248

For the physio chemical properties, the two sample location shows that pH fall in the range of 6.8 and 6.4, which directly means the pH of the first sampling point which is oluwatuyi was within the NAFDAC and World health organization standard while the second sampling point which was araromi deviate a bit from the normal standard which is 6.5- 8.5 and 6.5 -9.5. Anything below the WHO standard is considered to be acidic and this can be dangerous to human health for consumption.

Another parameter is the Total Dissolved solid (TDS), for the two sample location the TDS has 746mg/l for oluwatuyi and 1564mg/l for araromi, according to WHO the good palatable limit for TDS ranges from 300-600 mg/l, while the maximum permissible limit for TDS is 1000mg/l, anything above these is considered to be bad and not palatable. It shows that oluwatuyi has the permissible limit of TDS.

Alkalinity is the substance that can neutralize acid, this can be caused by the presence of bi carbonate, hydrogen ion e.t.c they help to reduce the effect of acid or the concentration of acid in water or a particular solution. For the two sampling location, ouwatuyi and araromi, the before has the alkalinity of 108mg/l while the later has 66mg/l. World health organization permissible for alkalinity is 100mg/l. This makes araromi the sampling location that falls with the permissible limit of world health organization, while oluwatuyi sampled location falls above the permissible limit of the world health organization.

Hard water has a number of advantages; it tastes better than soft water because of the dissolved mineral salts in it, helps animals to build strong teeth and bones and can be supplied in pipes made of Pb as it does not dissolve Pb, which is the case with soft water (Thriodore, 2004). Hard water also find it difficult to lather with soap, because of the magnesium and calcium ion present in the water and this remain one of the disadvantages of hard water, and it can only be solved by reaction it with caustic soda.

The odour and the appearance of the two sampled location are offensive and highly turbid, odour might come as a result of domestic water which find its ways to the surface water due to the anthropogenic factor i.e dumping of refuse in the water or the flow of blood or animal by-product of the animal being killed the flow into the surface water, this can increase the odour and the turbidity of the water of the sampled area.

Table 4.2. Result of the sampled location under study for Heavy metal parameters

S/N	PARAMETERS	Location 1 Oluwatuyi	Location 2 Araromi
1	Chlorine (mg/l)	24	30
2	Calcium (mg/l)	67.2	99.2
3	Nitrate (mg/l)	0.2	0.25
4	Magnesium(mg/l)	17.6	88
5	Manganese (mg/l/)	0.35	0.16

6	Total iron (mg/l)	2.64	1.85
7	Chromium (mg/l)	ND	ND
8	Zinc (mg/l)	0.064	0.075
9	Cadmium (mg/l)	0.345	0.348
10	Copper (mg/l)	ND	1.16
11	Arsenic (mg/l)	ND	ND
12	Lead (mg/l)	ND	ND

For the heavy metal parameters, the concentration of magnesium for the two samples location which are oluwatuyi and araromi were between the range of 17.6mg/l and 88mg/l. According to WHO, 30mg/l is the permissible limit of magnesium that should be present in water, which makes oluwatuyi the only sample location that are within the acceptable limit by WHO.

The concentration of calcium for the two samples location, oluwatuyi and araromi fall between the range of 66.7mg/l and 99.2mg/l for araromi. According to WHO, 75mg/l is the acceptable limit for calcium that should be present in the water. Araromi sample location is the only point that deviate from the limit, which makes oluwatuyi the only sample location that are within the acceptable WHO limit for calcium. Source of calcium can result from the wash of bone or deposition of bone into the water that flow into the sample point.

The concentration of chlorine of the two sampled location are 24mg/l and 30mg/l for oluwatuyi and araromi, according to WHO standard this shows a very low concentration, amount of chlorine might be caused as a result of the runoff from land (through some waste disposed on ground and the convey of some waste water from some storm drains) and its closeness to hospital, that is the oluwatuyi sampled location while for that of araromi it might be the introduction of chemical to the sample sampled location.

Concentration of nitrate of oluwatuyi is 0.2mg/l while that of araromi is 0.25mg/l. according to WHO this shows that the two sampled location Falls below the permissible limit which is 50mg/l. Nitrate in water can be cause by so many ways such as fertilizer, runoff from agricultural land e.t.c and this to area or sampled location shows that there is no agricultural land nearby which can cause a runoff from one area to another and later finding its ways into the two sampled location.

The concentrations of cadmium in the two samples were above the WHO permissible limit. Oluwatuyi having 0.345mg/l while araromi has 0.348mg/l. the permissible limit for cadmium according to WHO is 0.003mg/l. The source of cadmium might have been from erosion of natural deposits, runoff from areas into the area can lead to high increase of cadmium and if there is high deposition of waste batteries by people living in the neighborhood and this can lead to the malfunctioning of the human kidney.

The concentration of iron in the two sampled location of oluwatuyi was 2.64mg/l and that of araromi was 1.84mg/l and this two sampled location shows that they exceed the WHO standard which is 0.3 mg/l.

The concentration of lead, arsenic and chromium were not detected at the two samples location, lead and arsenic and chromium are usually found where there is industrial discharge, lead is a poisons substance that has caused the death of many, its refers to as lead poison, reason behind the two sample locations not been able to detect this metals were because there is no industrial in that geographical location that may discharge its waste and might find its way into the sample location.

CHAPTER FIVE

5.0. CONCLUSION AND RECCOMENDATION.

Conclusion

This study shows and analyze the physico chemical and heavy metals such as pH, turbidity, nitrate, total hardness of water, calcium, magnesium, chromium, copper, zinc. Total alkalinity, colour, odour, temperature, lead, electronic conductivity, manganese. This also provide support for the quality of surface water within the abattoir environment, which can be used for domestic uses and some other uses.

Study also shows that there are some heavy metals that were within the WHO standard while some do not fall within the standard. Heavy metals like lead are very significant which shows through the studied area that industries releasing heavy pollutant can't be found in the vicinity. Some other factors that contribute to the increase of the metals and some physico chemical properties are the anthropogenic and the natural factors, anthropogenic include the deposition of domestic waste into the surface water and erosion can also cause the intrusion of some unnecessary pollutant.

Recommendations

Recommendation for the possible surface water problem expose to abattoir

- Areas with high heavy metals should be reduced to the acceptable level of WHO, by treating it with the appropriate method of reducing heavy metals.
- Area that dispose abattoir water should be warned by government or should find a way of reducing the abattoir water to a level on nontoxic before discharging into the area that leads to the surface water.
- There should also be a monitoring exercise or remediation exercise to reduce some of the heavy metal and physic- chemical properties.

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APPENDIXES

APPENDIX 1: OLUWATUY SAMPLED LOCATION FOR PHYSICO CHEMICAL PARAMETERS

S/N	PARAMETERS	Bottle 1	Bottle 2
1	Appearance	Highly turbid	Highly turbid
2	Colour	Dark brown	Brown
3	Odour	Offensive	Offensive
5	Ph	6.7	6.9
6	Conductivity (us/cm)	1064	1068
7	Total dissolve solid, (mg/l)	744	748
8	Total alkalinity, (mg/l)	107	109
9	Total hardness (mg/l)	210	214
10	Calcium hardness, (mg/l)	167	169

OLUWATUYI SAMPLED LOCATION FOR HEAVY METAL PARAMETER

S/N	Parameters	Bottle 1	Bottle 2
1	Chlorine (mg/l)	22	26
2	Calcium (mg/l)	65.1	69.3
3	Nitrate (mg/l)	0.2	0.2
4	Magnesium(mg/l)	17.3	17.9
5	Manganese (mg/l/)	0.34	0.36
6	Total iron (mg/l)	2.55	2.73
7	Chromium (mg/l)	ND	ND
8	Zinc (mg/l)	0.063	0.065
9	Cadmium (mg/l)	0.343	0.347
10	Copper (mg/l)	ND	ND
11	Arsenic (mg/l)	ND	ND
12	Lead (mg/l)	ND	ND

APPENDIX 2

ARAROMI SAMPLED LOCATION FOR PHYSICO CHEMICAL PARAMETERS

S/N	PARAMETERS	Bottled 1	Bottled 2
1	Appearance	Highly turbid	Highly turbid
2	Colour	Dark brown	Black
3	Odour	Offensive	Offensive
5	Ph	6.6	6.2
6	Conductivity (us/cm)	2235	2233
7	Total dissolve solid, (mg/l)	1562	1566
8	Total alkalinity, (mg/l)	66	66
9	Total hardness (mg/l)	27	29
10	Calcium hardness, (mg/l)	246	250

ARAROMI SAMPLED LOCATION FOR HEAVY METALS PARAMETERS

S/N	PARAMETERS	Bottle 1	Bottle 2
1	Chlorine (mg/l)	30	30
2	Calcium (mg/l)	99	99.4
3	Nitrate (mg/l)	0.25	0.25
4	Magnesium(mg/l)	87.5	89.5
5	Manganese (mg/l/)	0.13	0.19
6	Total iron (mg/l)	1.83	1.87
7	Chromium (mg/l)	ND	ND
8	Zinc (mg/l)	0.075	0.075
9	Cadmium (mg/l)	0.349	0.347
10	Copper (mg/l)	1.18	1.14
11	Arsenic (mg/l)	ND	ND
12	Lead (mg/l)	ND	ND