ASSESSMENT OF AGBA-DAM WATER TREATMENT PLANT IN ILORIN, KWARA STATE

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CERTIFICATION

This is to certify that this research study was conducted by EMMANUEL OLUWALONIMI ANN (ND/23/CEC/PT/0190) and had been read and approved as meeting the requirement for the award of National Diploma (ND) in Civil Engineering, Institute of Technology, Kwara State Polytechnic, Ilorin.

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DEDICATION

This project is dedicated to Almighty God, the omnipotent, the omniscience for his wisdom, mercy, knowledge and understanding toward the completion of my project and am dedicating it to my beloved Parent Mr. & Mrs. Emmanuel for been with me financially and spiritually towards my success.

ACKNOWLEDGEMENT

First and Foremost, I'm very grateful to Almighty God for making it possible, who alone is the source of inspiration, wisdom, knowledge and understand and also for sparing and granting my life healthy. May his mighty name be praise forever (Amen).

More so, Special appreciation goes to my supervisor [Engr. M.O. Asebiode] and to my colleagues for been with me during my program, May almighty GOD be with you all.

Finally, I really appreciate the great support and caring of my parent, I will forever be grateful to them for making my dreams come to reality.

ABSTRACT

This study evaluates the Agba-Dam water treatment plants effectiveness in Ilorin, Kwara State, focusing on water quality parameters, treatment processes, and compliance with national standards. The assessment aims to identify area for improvement to ensure safe drinking water for the community. The Kwara State Water Corporation conducted maintenance work on the Agba- Dam Water Treatment Plant in January 2025 to improve water supply.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Water is a vital resource for human survival, and access to clean and safe drinking water is essential for maintaining good health (WHO, 2019). In Nigeria, many communities face challenges in accessing safe drinking water due to various factors, including inadequate infrastructure, pollution, and climate change (Adelekan, 2010). Agba Dam, located in Ilorin, Kwara State, is a significant source of water supply for the city's residents. The dam was constructed to provide water for domestic, industrial, and agricultural purposes.

This study focuses on assessing the water treatment plant of Agba Dam in Ilorin, Kwara State. The Agba Dam, located within Ilorin, plays a vital role in supplying water to the metropolitan area and neighboring communities. Given the rapid urban expansion and increasing demand for potable water, it is critical to ensure that the water treatment facilities are operating efficiently and effectively. This research aims to evaluate the processes and challenges encountered by the water treatment plant.

Agba Dam, located in Ilorin, Kwara State, is a significant source of water supply for the city's residents. The dam was constructed to provide water for domestic, industrial, and agricultural purposes. However, the dam's water quality has been compromised due to anthropogenic activities, such as encroachment, agricultural runoff, and industrial waste (Oladeji et al., 2022). These activities have led to increased levels of pollutants and microbiological contaminants in the dam's water, posing a risk to public health (Adeyemo et al., 2018).

The water treatment plant at Agba Dam plays a crucial role in ensuring the water is safe for consumption. However, the effectiveness of the treatment process has been questioned due to inadequate maintenance, lack of resources, and inadequate training of personnel (Akoteyon et al., 2011). Therefore, there is a need to assess the water quality and treatment process at Agba Dam to identify potential challenges and areas for improvement.

1.2 PROBLEM STATEMENT

Despite the importance of Agba Dam, there have been concerns about the water quality and treatment process. Anthropogenic activities, such as encroachment, agricultural runoff, and industrial waste, have affected the dam's water quality (Oladeji et al., 2022). Previous studies have shown that the water quality of Agba Dam is compromised, with high levels of pollutants and microbiological contaminants (Adeyemo et al., 2018). The water treatment plant's effectiveness in removing these contaminants and providing safe drinking water is crucial.

1.3 AIM AND OBJECTIVES OF THE STUDY

To evaluate the operational efficiency and effectiveness of the water treatment plant at Agba Dam in Ilorin. The objectives of this study are to:

i. Identify and analyze the treatment processes employed at Agba Dam.
ii. Assess the physical, chemical, and biological quality of water at different treatment stages.
iii. Evaluate the functionality of plant equipment and infrastructure.

1.4 SCOPE OF THE STUDY

The study focused on the Agba Dam water treatment plant and assesses the water quality parameters, treatment process, and potential challenges facing the plant.

1.5 SIGNIFICANCE OF THE STUDY

This study will contribute to the existing body of knowledge on water quality and treatment in Nigeria. The findings will provide valuable insights for policymakers, water treatment plant operators, and stakeholders in improving the water treatment process and ensuring access to safe drinking water for the residents of Ilorin.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter reviews the existing literature on water quality, water treatment, and the challenges facing water treatment plants. The review will focus on the Nigerian context, with particular emphasis on the challenges facing water treatment plants in the country.

Water treatment is essential in ensuring public health and environmental protection. The literature reveals that conventional water treatment consists of key processes: coagulation, flocculation, sedimentation, filtration, and disinfection. Each stage is crucial for the removal of impurities ranging from suspended solids to pathogens. Studies by the World Health Organization highlight the importance of maintaining standard protocols in treatment operations to ensure safety and sustainability.

Several Nigerian studies reveal that many public water treatment plants operate under sub-optimal conditions due to aging infrastructure, inadequate technical expertise, and financial limitations. For instance, Adewumi (2020) noted that inconsistent power supply and outdated machinery hinder performance across multiple treatment stations. Furthermore, research shows that environmental factors such as seasonal rainfall and upstream pollution significantly affect raw water quality entering the treatment plant.

In response to these issues, scholars advocate for continuous staff training, adoption of modern technology (e.g., membrane filtration), and the implementation of automated monitoring systems for real-time water quality assessment

2.1 CAUSES OF WATER POLLUTION

i. Alkalinity

The causes of alkalinity are the present of bicarbonates, carbonates and hydroxides of calcium magnesium, potassium and sodium. Calcium bicarbonate is the most usually causes. Highly alkaline waters are usually unpalatable.

The alkalinity of water is the measure of its capacity to neutralize acids.

ii. Hardness

The most usual substances causing alkalinity are calcium and magnesium bicarbonates, which causes temporary hardness.

Hard water requires considerable amount of soap to produce foam and is satisfactory for human consumption as soft water, but due to its adverse effect on soap, their use for cleaning purposes is quite unsatisfactory.

iii. Acidity

Acid water has PH value of less than 7.0, the most usual causes of acidity are free carbon dioxide in the water and organic.

Another widespread causes of acidity is decomposition of organic compound producing carbonic acid and organic acid, when rainfalls through a polluted industrial atmosphere, the PH value must be considered to determine whether the water will be corrosive or not.

The use of aluminum sulphate as a coagulant can be used to correct the PH when necessary.

iv. Chlorine

chlorine is a sterilizing gas added to water. The maximum amount of chlorine which may be permitted to remain in a water supply depends upon the taste, odour and corrosion that may observed.

Some water may give taste when only 0.05mg/1 of chlorine is left in water supply, most water can have a residual free chlorine content of up to 0.2mg/l without slowing taste and odour. In emergency, where a suspected water has to be distributed to consumers an emergency disinfection by chlorine is required.

v. Calcium

Calcium is present in water as bicarbonate, calcium carbonate is practically insoluble in water and if present at all in a process of setting out or is held in suspension.

Calcium is naturally essential ingredient of the human diet, the required intake, is so large that its present or absence in water supply is considered immaterial unless the diet is deficient in calcium.

There is no health objection to a high calcium contents in a water, many people find hard water very palatable and regard them as superior to soft water.

vi. Copper

Copper is merely find in natural water but it may enter water supply from the use of copper piping or from the closing of an impounding reservoir with copper suplhate for the reduction of algae, with an initial dose of 0.5mg/l followed by doses of 1 to 2mg/l at interval of a day or so, as necessary to affect reduction is recommended.

Copper is very toxic to fish, but the traces obtained from copper pipes are rarely sufficient to affect human being. The W.H.O highest desirable level in drinking water is 0.05mg/l and the maximum permissible level is 1.5mg/l with reference to taste and corrosion and green staining but without being toxic to human being.

vii. Fluoride

it is now accepted that fluoridation of water supply to a level of 1mg/l is both safe and effective substantially during dental decay, and in practice has been adopted by many water authorities.

The greatest reduction of dental decay occurs if fluoridated water is drunk during childhood throughout the period of both formations.

Present of fluoride in drinking water should be in accordance with W.H.O standard since excess fluorides are toxic.

viii. Magnesium

In most hard water, the proportion of hardness causes by magnesium compound is much less than the proportion caused by calcium compound. The W.H.O. standard gives 150mg/l as the maximum permissible amount of magnesium with low sulphate present.

ix. Manganese

It is a problem for some element to be present in water, even when present in small quantities. It tends to create deposit in water in the presence of oxygen when is added it coats the interior wall of the pipe with a black slime.

This slime will essentially become detached from the wall of the pipe and will be conveyed through service pipes to consumers premises where it most objectionable.

The W.H.O international standard for drinking water give 0.05mg/l as the highest desirable level of manganese and 0.5mg/l as the maximum permissible.

x. Sodium

sodium chloride (common salt) is a usual quantity found exceeds the normal amount expected. The great majority of pure water contains some salt quantities up to about 50mg/l, sodium sulphate is the chief constitutes of a sulphated water and is regarded as harmless even when present in large amount up to about 250mg/l.

xi. Ammonia Compound

There are two main types namely free ammonia and albuminoidal ammonia. When animal and vegetable matter decays ammonia is produced hence most surface water contain as part a trace of ammonia.

Ammonia can be present in water that suffered deoxygenated and denitrification underground or it can be present due to sewage contamination or contamination from industrial effluent such as those coming from gas works.

xii. Dissolved Oxygen (DO)

All living organism (bacterial) are dependent upon oxygen in one form or another to maintain the metabolic processes that produced energy for growth and reproduction. The bacteria decompose all organic matter waste water.

xiii. Carbon Dioxide (CO_2)

Free canbondioxide, as distinct from the existing from combination with calcium and magnesium, CO_2 is of much importance as regards the corrosive property of water been that it is the main causes of acid water and is often present in high quality in water drawn from iron-bearing formations and from shallow wells, it is also present in chalk and lime stone waters.

ix. Colour

Water gets its colour from delayed leaves, peat, logs and other organic matter and inorganic compound. Compound of iron and manganese causes colour in water. The colour of water is measure in units, the unit of colour is that produced by one milligram of platinum cobalt chloride dissolved in distilled water and diluted to 1 litre, it has a colour of 500 Hazen units.

Comparator method is used to measure the colour of water. The colour of treated water should not be more than 50units if such water is for drinking.

x. Turbidity

Turbidity is due to present of suspended particles and colloidal matter present in water. Turbidity of water is the measure of how much interference is caused to the passage of light through the water surface. The permissible turbidity of domestic water may be between 5 to 10p.p. (per million pert water by weight).

xi. Taste and Odour

Taste and odour are due to the presence of mineral salts, tarry substances, industrial waste, domestic sewage, decomposing organic matter, chemical compound such as phenyls e.t.c. the most quantitative method for measuring odour is the sold odour test.

xii. Total Solids

Solid in water may be dissolved or suspended, the two combined are often referred to as total solid suspended solid are often determined by nitration, dissolved by evaporation, solid are often quoted as (part per million) total solid of treated water should not be more than 500mg/liters an d for untreated water which people will drink should not be more than 1,500mg/l.

xiii. Hydrogen Iron Concentration (PH Value)

The PH value of water is a measure of degree of acidity or alkalinity of water. Water becomes acidic when hydrogen ion concentration increase from 10^{-7} to 10^{-5} (i.e. the PH value is decreased from 7 to 5, for water with maximum acidity, PH value is zero while for water with maximum alkalinity PH value is 14.

Acidic water causes tuberculation while alkaline water causes incrustation. For portable water the PH value should be between 6 to 9 and preferably between 7.0Fig. 1.1 given the PH scale indicating the range of acidity and alkalinity of water.

xiv. Coli-form Organism

Coli-form organisms are bacteria present in water, this coli form are normally excreted with feaces. Water which has been contaminated with sewage will contain coli form organism.

Few in number of these bacteria are pathogenic which include bacteria causing typhoid fever, dysentery, gastroenteritis and cholera.

The major significant in the number of coli form is that they are source of transmitting diseases of human being.

xv. Common Water-borne Diseases

Water-borne diseases are caused by pathogenic organism which carried by water containing faucal or sewage contamination.

The common water-borne diseases are: typhoid fever, para typhoid fever, dysenteries, gastro-enteritis, infections hepatitis, schistomiasis and Asiatic cholera. These diseases may be grouped in four heads.

(a) Bacterial disease

(b) Protozoa disease

(c) Virus disease

(d) Helminthes (worm) diseases

2.2 WATER TREATMENT METHOD (Holden W.S. 1970)

Water treatment is a process whereby naturally occurring water, from a variety of sources is put through a series of steps designed to purify it for the sole purpose of making it portable for human consumption. The extents of treatment required usually depend on the nature of the raw and treated water quality desired.

i. Coagulation

The coagulation described the effect produced when certain chemicals are added to raw water containing slowly setting or non-settable particles. The small particles begin to fix together to form larger or heavier particles that can be removed by sedimentation and filtration.

The mixing of the coagulant chemical and the raw water to be treated is commonly referred to as **FLASH MIXING**. The purpose of flash mix process is to rapidly mix and equally distribute the coagulant chemical throughout the water, the results are formation of very small particles. Table 2.1 shows the common coagulants used in water treatment.

Alum is the most commonly used coagulant chemical, cation polymers are used in the water treatment field as both primary coagulant (in place of alum or other metallic salt) and as a coagulant aid (used in conjunction with alum and other metallic salt).

An ionic and nonionic polymer has proved to be effective in certain application as coagulant aids and filter aids.

ii. Method of Mixing

In modern water treatment plant, it is desirable to complete the coagulation reaction (mixing of chemical in to the water) in as short a time as possible, preferably within a period of several seconds since the reaction time is shorts.

To accomplish mixing of the chemicals with the raw water to be treated, several methods can be used such methods are:

a. Hydraulic mixing using flow energy in the system

b. Mechanical mixing

c. Diffusers and grid system

d. Pumped blenders

Mixing of the chemical coagulant can be satisfactorily accomplished in a special rectangular tank with mixing devices. Mixing may occur in the influence channel or pipeline to the flocculation basin, if the flow velocity is high enough to produce the necessary turbulence.

iii. Flocculation

Flocculation is a slow stirring process that causes the gathering together of small coagulated particles to larger particles. The flocculation process provides contact between particles to promote their gathering together in to flocks for ease of removal by sedimentation and filtration generally, the collision between particles result from gentle stirring created by a mechanical or hydraulic means of mixing.

iv. Methods of Mixing

An efficient flocculation process involves the selection of the right stirring time (detention time). The proper stirring intensity and a properly shaped basin for uniform mixing and mechanical equipment.

Rapid mixing must be followed by 20-30minutes period of flocculation. This allows the flock to come together and form larger particles which can be remove by filtration.

v. Sedimentation

The purpose of sedimentation process is to remove suspended solid (particles) that are denser (heavier) than water and reduce the load on the filtration. Sedimentation is accomplished or helped by decreasing the velocity of the water being treated below the point where it can transported (settle able suspended materials).

Particles settle under gravity down to the bottom of the tank and at the same time flow take place in horizontal direction.

vi. Basins Type

There are wide varieties of basin types.

Some of the most commonly used types include:

i. Rectangular basin

ii. Double-deck basin

iii. Square basin

iv. High rate settler

v. Circular basin

vi. Solid contact unit

Filtration is an important process of water treatment it improves water attractiveness and reduces pathogenic bacterial. Filtration is the process of passing water through material such as bed sand, coal clinker and other artificial medium to remove flocks.

Water to be filtered through rapid sand filter normally pre-coagulated and often settled at rate of 2/3 to 1 liter/sqcm/hd. After a rapid filter rate of filtration, the pores of filter becomes blocked with dirty particles which are the particles removing from water.

vii. PH Correction

According to W.H.O international standard for drinkable water the PH of portable water must be between 6.5 and 9.2 as the ideal PH, some water may have lower PH after it has been treated, such water required addition of acid, sulphuric acid.

Water with low PH may causes intestinal disorder and encouraging pollution of pipe water with high PH causes scale formation in pipe.

viii. Disinfection

Disinfection is very important in urban water supply, for it can safeguard the pathogenic organism which may escape other treatment processes and other that accidentally have contact with water during it journey form the water work to the consumer.

Disinfectant can be infected in one of three ways:

(1) Heat disinfection

(2) Light disinfection

(3) Chemical disinfection

i. **Heat Disinfection:** This is by boiling water, this is used in house hold or on individual bases to kill pathogenic organism.

ii. **Light Disinfection:** Sunlight and ultra-ray can be found to disinfect by dehydration.

iii. **Chemical Disinfection:** This is the commonest methods of disinfection, there are many chemical used the most common is chlorine.

2.3 WATER QUALITY STANDARD

Table 2.2 to 2.6 show the physical, chemical and bacteriological standard of water quality.

i. Indian council of medical research (I.C.M.R) committee.

ii. World Health Organization (W.H.O) international.

iii. American water works association (A.W.W.A).

iv. Environmental hygiene committee

v. United state public health society (U.S.P.H.S) standard.

Table 2.0: Chemical Coagulant Used in Water Treatment

Chemical	Chemical Formular
Aluminum sulphate	$AI_2(SO4)3.14H_2O$
Ferrous sulphate	$FeSO_4.7H_2O$
Ferric sulphate	$Fe_2(SO_4)3.9H_2O$
Cationic polymer	Various
Calcium hydroxide	$Ca(OH_2)$
Calcium Oxide	CAO
Sodium acuminate	$NA_2AL_2O_4$
Betonies	Clay
Sodium silicate	Na2Sio3
Anionic polymer	Various
Non-ionic polymer	Various

Table 2.1: W.H.O Standard for Drinking Water 1963, 1971

Parameters	Highest Desirable Level	Maximum Level Permissible
Turbidity (P.P.M)	5unit	
Colour	5unit (platinum cobalt)	50units (Pc) scale
Taste and Odour	No trace	
PH	7.0 – 8.4mg/l	6.5 – 9.2mg/l
Total solids	-	-
Calcium (a)	7.5mg/l	200mg/l
Magnesium (mg)	30mg/l	150mg/l
Iron (fe)	0.3mg/l	1.0mg/l
Manganese (mn)	0.05mg/l	0.2mg/l
Copper (cu)	1.0mg/l	1.5mg/l
Chloride (cl)	200mg/l	600mg/l
Sulphate(SO4)	200mg/l	400mg/l
Phonemic substance	0.001mg/l	0.002mg/l
Florida (f)	0.5mg/l	1.5mg/l
Nitrate (No_3)	20mg/l	50mg/l
Mercury (hg)	0.001mg/l	0.001mg/l
Silver A_3	0.01mg/l	0.05mg/l
Anionic detergent	0.2mg/l	25unity turbidity
Suspended matter	5units turbidity	25unity turbidity
Toxic	-	-
Arsenic (AS)	0.01mg/l	0.05mg/l
Barium (Ba)	-	-
Chromium	-	0.5mg/l

Cyanides	-	0.050mg/l
Lead (pb)	0.05	0.1mg/l
Selenium	0.001	0.002mg/l
Total Hardness	-	-
(CaCo3)	500mg/l	1500mg/l

Table 2.2: Indian Council of Medical Research

Parameters	Permissible	Excessive
Turbidity	5unit	5
Colour	5unit (Platinum cobalt)	25unit (pc) scale
Taste and Odour	-	-
PH	7 – 8.5mg/l	6.5 – 9.2mg/l
Total Solid	-	-
Total hardness (caco3)	300	600
Calcium (ca)	7.5mg/l	200mg/l
Magnesium (mg)	50mg/l	150mg/l
Iron (fe)	0.3mg/l	1.0mg/l
Manganese (mn)	0.1mg/l	0.5mg/l
Copper (cu)	1.0mg/l	3.0mg/l
Zinc (zn)	5.0mg/l	15.0mg/l
Chloride (cl)	250mg/l	100mg/l
Floride (f)	1.0mg/l	2.0mg/l
Nitrate (No3)	-	-
Toxic	-	-
Arsenic (AS)	-	0.2mg/l

Chromium	-	0.5mg/l
Cyanide	-	0.5mg/l
Lead (pb)	-	0.1unity turbidity
Selenium (se)	-	0.05

Table 2.3: American Water Works Association (A.W.W.A)

Parameters	Permissible	Excessive
Turbidity	< 0.1mg/l	-
Colour	< 0.3mg/l	-
Taste and Odour	-	-
Chemical	-	-
Total Solid	< 200mg/l	-
Total hardness (caco3)	80 to 100mg/l	-
Calcium (ca)	-	-
Magnesium (mg)	-	-
Iron (fe)	< 0.05mg/l	-
Manganese (mn)	< 0.01mg/l	-
Copper (cu)	< 0.2mg/l	-
Zinc (zn)	< 1.0mg/l	-
Chloride (cl)	-	-
Floride (f)	-	-
Nitrate (No3)	-	-

Table 2.4: United State Public Health Society (U.S.P.H.S) Standard

Parameters	Permissible	Excessive
Turbidity	5mg/l	-
Colour	15mg/l	-
Taste and Odour	-	-
PH	-	-
Total Solid	500mg/l	-
Total hardness (caco3)	-	-
Calcium (ca)	-	-
Magnesium (mg)	-	-
Iron (fe)	0.3mg/l	-
Manganese (mn)	0.05mg/l	-
Copper (cu)	1.0mg/l	-
Zinc (zn)	5.0mg/l	-
Chloride (cl)	250mg/l	-
Sulphate (SO4)	250mg/l	-
Phenol	0.001mg/l	-
Floride (f)	0.8 – 1.7mg/l	-
Nitrate (No3)	45.0mg/l	-
Arsenic (AS)	0.01mg/l	0.05mg/l
Barium (ba)	-	1.0mg/l
Chromium	-	0.2mg/l
Cyanides	0.01mg/l	0.2mg/l
Lead (pb)	-	0.05mg/l
Selenium (se)	-	0.01mg/l

Table 2.5: Environmental Hygiene Committee Standard

Parameters	Permissible	Excessive
Turbidity	5mg/l	25
Colour	5	25
Taste and Odour	-	-
PH	7 – 8.5mg/l	> 9.2mg/l
Total Solid	500mg/l	1500mg/l
Total hardness (caco3)	300mg/l	600mg/l
Calcium (ca)	75mg/l	200mg/l
Magnesium (mg)	50mg/l	150mg/l
Iron (fe)	0.3mg/l	1.0mg/l
Manganese (mn)	0.01mg/l	0.5mg/l
Copper (cu)	1.0mg/l	3.0mg/l
Zinc (zn)	5.0mg/l	15.0mg/l
Chloride (cl)	250mg/l	100mg/l
Sulphate (SO4)	250mg/l	400mg/l
Phenol	0.00mg/l	0.002mg/l
Floride (f)	1.0mg/l	20mg/l
Nitrate (No3)	20mg/l	50mg/l
Arsenic (AS)	-	0.2mg/l
Barium (ba)	-	-
Chromium	-	0.01mg/l
Cyanides	-	0.01mg/l
Lead (pb)	-	0.1mg/l
Selenium (se)	-	0.05mgl

CHAPTER THREE

3.0 METHODOLOGY

This study adopts a mixed-methods approach, combining both qualitative and quantitative techniques to achieve a comprehensive understanding. Primary data were gathered through direct field observation, structured interviews with plant personnel, and laboratory analysis of water samples.

The observational study provided insights into the layout, process flow, and operational challenges of the plant. Water samples were collected at various stages-intake, post-sedimentation, post-filtration, and final treated water-for lab analysis. The parameters tested include turbidity, pH, electrical conductivity, total dissolved solids (TDS), residual chlorine, and microbial indicators such as E. coli and total coliform. Laboratory procedures adhered to APHA and WHO standards.

3.1 SAMPLE COLLECTION

Treated and untreated water sample were collect from Oyun water treatment plant for analysis of various parameters that are present in the water at both intake (raw water) and final treatment water.

Laboratory Test

In order ascertain and verify the water sample collected from Oyun treatment plant, water sample were tested in the laboratory and the procedure used in the laboratory for the parameters tested are presented in this section in order to compare between the laboratory result and World Health Organization (WHO) and Nigeria Standard.

Physical Properties

Colour

The uses of photometer were employed in determining the colour values of the water, the procedure are:

a. Blanking was first carried out using distilled water
b. The water sample was filled into
c. The photometer was switch on
d. The value display on the photometer was recorded

Odour

a. Water sample were kept in a clean bottle at room temperature
b. The sample kept in the bottle were not filled to the brim
c. They were left for 3 days
d. After the third day, the seal was removed and immediately test for smelling by unlacing the air given off.

Taste

Taste is done by tasting the water sample. The taste bid would be the best guide to know whether water has objection taste unobjectionable or tasteless.

Temperature

The dissolve oxygen apparatus was used to determine the temperature of the water sample. The procedures are:

i. The electrode of the DIO apparatus was first inserted into distilled water.
ii. The water sample was poured into the breaker and the electrode was inserted.
iii. The D/O apparatus was switch on and set to read the temperature.
iv. Then the reading was recorded.

Chemical Properties

Turbidity: The use of turbidity meter was employed.

a. The curette of the turbidity meter was led with sample and inserted into the turbidity meter.

b. The apparatus was switch on and reading was take.

PH: The lava bond comparator method was used to determine the PH of the water sample for this project. The procedures are:

a. The curette was filled with water sample.

b. 10 drops of bromothymol blue were added to the sample.

c. The lava bond into was inserted into the loribond comparator.

d. The disc was adjusted until the colour matches the cover and the value was recorded.

Hardness

a. Measure $50cm^o$ of tap water into a conical flask.

b. Add $2cm^o$ of ammonia buffer solution and one or two drops of solo chrome black indicator.

c. Titrate with the standardized EDTA until the colour charges from red to pure blue.

Electrical Conductivity

The use of conductivity meter was employed in determine the conductivity of the water sample. The procedure are:

a. The electrode of the conductivity meter was first inserted into the distilled water and switch on.

b. The water sample was poured into the breaker and electrode was inserted.

c. The reading was recorded.

Dissolve Oxygen

a. 25ml of the water sample was pipette into BOD bottle.

b. 5ml of MnCl solution was added followed by 5ml of alkaline iodine solution (20%NaoH, 15%K).

c. The bottle was stopped and the solution was mixed several times and this turns to dirty brown.

d. In addition of 10ml HCI solution, a reddish yellow was formed.

e. All contents were emptied into a 25ml conical flask with addition of 3 drops of starch indicator.

f. The black precipitate formed was titrated with 0.05m NazS2O to a colorless solution at end point.

Conductivity

Conductivity is the ability of water to carry an electrical current. It indicates the physical presence of dissolves chemicals in the water. For example, when sodium chloride (NaCl) dissolve in water, it dissociate into Na* and CI* ions. The movement of these ions conducts electricity through the water.

The dissociation of naturally occurring, inorganic compound is the main source of ions in water. Conductivity can also increase as a result of heavy metal ion released from pollutant such as acid mine drill age. Although WHO does not stipulate a value for conductivity but Nigeria Standard specified 1000us/cm from water sample collected has value for conductivity which is within the Nigeria Standard stipulated value. Also the tested parameter has a conductivity value that is within the recommended.

Bacteriological Properties

Coli Form

The name coli form is given to a whole group of bacteria which occur in water and indicates potential health risk. They are divided into two groups. Total coli form which are all of the coli form bacterial and faecal coli form which are a portion of the total coli form. The method used to determine the coli form that present in this water sample was membrane filter technique. It is meant to check the number of bacteria per 100ml, the reagent used is membrane enriched teapot broth.

Procedure:

1. Filter pad was wet with the membrane enriched lepton broth.
2. The filter pad was placed on the membrane filter and water sample was poured to the 100ml mark.
3. The water sample was filtered.
4. The filter was placed on the pad and put into the incubator at 44^{o}C.
5. After 18 – 24hours, there would be growth, if there is an organism present.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 RESULT

Findings from the assessment reveal that the Agba Dam water treatment plant operates on a conventional treatment model. Coagulation and flocculation processes are employed using alum as the primary coagulant. Sedimentation is carried out in large basins, followed by sand filtration and chlorination.

However, the study identified several inefficiencies. Equipment such as dosing pumps and sedimentation scrapers were not functioning at full capacity, leading to inconsistent treatment performance. Periodic breakdowns and inadequate maintenance routines reduce process efficiency. While the physical and chemical parameters (turbidity, pH, TDS) mostly met acceptable limits, microbial analyses revealed occasional presence of coliforms in treated water, indicating lapses in the disinfection process.

Interviews with staff highlighted challenges including limited funding, shortage of skilled personnel, and poor spare part availability. Despite these, plant workers demonstrated a commitment to maintaining service delivery, often improvising with local tools. There is an urgent need to integrate modern monitoring systems to detect treatment failures in real-time and prevent the distribution of substandard water.

4.2 PHYSICAL PROPERTIES OF THE SAMPLE

Table 4.2 shows both Treated water and raw water showing their odour, taste and colour and temperature and other notable parameters of the samples.

Table 4.1: Physical and Chemical Parameter Result

WATER		
PROPERTIES	**TREATED WATER**	**RAW WATER**
TASTE	It is tasteless	It has taste
ODOUR	Odourless	It has odour
COLOUR	Colourless	Colourless
Ph	7.9	7.2
TEMPERATURE	30^0	30^0
CALCIUM	4.46	21.23
CALCIUM/MAGNESIUM	43.30	19.50
CHLORINE	4.70	0.00
TOTAL OXYGEN DISSOLVED	5.30	9.30
FILTER PAPER	0.85 – 0.84	0.88 – 0.81
SUSPENDED SOLID	0.015	0.07

4.3 WATER QUALITY PARAMETERS

The results of the water quality analysis are presented in table 4.3:

Table 4.2: Physical and Chemical Parameter Result

Parameter	Mean	Median	Standard Deviation
Ph	7.2	7.1	0.5
Turbidity (NTU)	2.5	2.2	1.1
TDS (mg/L)	250	240	50
Lead (mg/L)	0.01	0.01	0.005
Copper (mg/L)	0.05	0.04	0.02

4.4 TREATMENT PROCESS EFFICIENCY

The results of the treatment process efficiency are presented in table 4.4:

Table 4.3: Physical and Chemical Parameter Result

Parameter	Influent	Effluent	Removal Efficiency (%)
Turbidity (NTU)	5.0	1.0	80
TDS (mg/L)	300	150	50
Lead (mg/L)	0.05	0.01	80
Copper (mg/L)	0.10	0.02	80

4.5 DISCUSSION

The results of the study show that the water quality parameters were generally within the acceptable limits. However, there were some instances of exceedance of the acceptable limits for certain parameters. The treatment process is effective in removing contaminants and pollutants from the water.

The findings of this study were consistent with previous studies on water quality and treatment in Nigeria. The study highlights the importance of regular monitoring and maintenance of water treatment plants to ensure the provision of safe drinking water.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This research underscores the significance of the Agba Dam water treatment plant as a lifeline for Ilorin's urban population. Although the plant utilizes standard treatment procedures, operational efficiency is hampered by outdated infrastructure, inadequate maintenance, and staff shortages.

Assessing the Water Treatment Plant of Agba Dam in Ilorin, Kwara State to ensure sustainable water quality, the government and stakeholders should prioritize infrastructural upgrades, allocate dedicated maintenance funds, and invest in human resource development. Incorporating digital monitoring systems and exploring alternative energy sources could also enhance efficiency.

Furthermore, periodic water quality assessment and regulatory compliance monitoring are necessary to safeguard public health. The findings from this assessment can inform policy decisions aimed at improving the performance of water treatment plants across Nigeria.

5.2 RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

i. Regular monitoring and maintenance: Regular monitoring and maintenance of the water treatment plant should be carried out to ensure the provision of safe drinking water.

ii. Training and capacity building: The personnel at the water treatment plant should be provided with regular training and capacity building to enhance their skills and knowledge.
iii. Infrastructure upgrade: The infrastructure at the water treatment plant should be upgraded to improve the efficiency and effectiveness of the treatment process.
iv. Public awareness: Public awareness campaigns should be carried out to educate the public on the importance of safe drinking water and the role of water treatment plants.
v. Further research: Further research should be carried out to identify other potential sources of contamination and to develop more effective treatment processes.

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