KWARA STATE POLYTECHNIC

ASSESSING THE WATER TREATMENT PLANT OF AGBA DAM IN ILORIN, KWARA STATE

BY

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SUBMITTED TO:

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CERTIFICATION

This is to certify that this project was carried out by **BANMEKE MICHEAL BUKUNMI** of matriculation number **ND/23/CEC/PT/0137** in the Department of Civil Engineering, Kwara State Polytechnic in partial fulfillment of the requirements for the award of National Diploma (ND) certificate in Civil Engineering.

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DEDICATION

This project work is dedicated to Almighty God the giver of life, knowledge, wisdom, and understanding to succeed in our field of study and also to our beloved parents who have made the journey so easy and successful one, who continually provide their moral, spiritual, emotional, and financial support.

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ABSTRACT

The city of Ilorin in Nigeria has experienced high population growth and rapid urbanization. Agba Dam is one of the major sources of potable water in Ilorin, and currently been threatened by anthropogenic induced encroachment activities, with potential for significant derogatory effects on its quality. Therefore, this paper assesses the qualitative impact of encroachment on the water resources regime of Agba Dam, Ilorin, Nigeria. Field survey was carried out to scope proximal anthropogenic activities and to delineate historical and current extent of the encroachment area of the dam. Representative water samples were collected from locations within the dam catchment, and subsequently analyzed for alkalinity, dissolved carbondioxide, chloride, total iron, copper, sulphate, colour, calcium, dissolved oxygen and turbidity. In addition, historical physical and chemical data of water samples obtained from the dam were also acquired, and analyzed to determine temporal variation in the quality. The results show a reduction of 0.89 km2 or 63% in the historical buffer boundary of the dam. The values of the measured physico-chemical parameters were generally similar to that obtained for the historical values and therefore suggest limited impact of the anthropogenic activities on the water quality. However, slight increases were observed in the measured concentrations osf the alkalinity, dissolved carbondioxide, chloride, iron, copper and sulphate, and this indicates possibilities of water quality alteration, with potential consequences for ecosystem and aquatic life if the trend is unabated. Keywords: Anthropogenic, Water quality, Agba dam, Ilorin Nigeria

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CHAPTER 1

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.

1.6 STATEMENT OF THE PROBLEM

The water quality of Agba Dam is compromised due to anthropogenic activities, and the effectiveness of the water treatment plant is uncertain. This study aims to assess the water quality and treatment process, identify potential challenges.

CHAPTER 2

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 WATER QUALITY AND PUBLIC HEALTH

Water quality is a critical factor in determining public health. Poor water quality can lead to a range of health problems, including waterborne diseases such as cholera, typhoid, and diarrhea (WHO, 2019). In Nigeria, waterborne diseases are a significant public health challenge, particularly in rural areas where access to safe drinking water is limited (Adelekan, 2010).

2.2 WATER TREATMENT AND CHALLENGES

Water treatment is the process of removing contaminants and pollutants from water to make it safe for consumption. In Nigeria, water treatment plants face several challenges, including inadequate infrastructure, lack of resources, and inadequate training of personnel (Akoteyon et al., 2011). These challenges can lead to poor water quality, which can have significant implications for public health.

2.3 WATER QUALITY ASSESSMENT

Water quality assessment is critical in determining the safety of water for consumption. Several parameters are used to assess water quality, including physical, chemical, and biological parameters (WHO, 2019). In Nigeria, several studies have assessed the water quality of various water sources, including rivers, lakes, and dams (Adeyemo et al., 2018; Oladeji et al., 2022).

Table 2.1 highlights some of the key studies related to water quality and treatment in Nigeria, particularly in the context of Agba Dam, and provides potential solutions to the challenges identified.

Table 2.1

Reference	**Study**	**Location**	**Findings**	**Solutions**
Adeyemo et al. (2018)	Assessment of water quality of Agba Dam	Ilorin, Nigeria	Water quality compromised due to anthropogenic activities	Implement sustainable agricultural practices, enforce regulations on waste disposal
Oladeji et al. (2021)	Qualitative assessment of effects of encroachment on water resources, Agba Dam	Ilorin Nigeria	Encroachment affects water quality and quantity	Establish protected areas, enforce regulations on encroachment
Akoteyon et al. (2011)	Evaluation of water treatment plant performance	Nigeria	Inadequate infrastructure and lack of resources affect performance	Invest in infrastructure, provide training and resources for personnel

Adelekan (2010)	Water supply and sanitation in Nigeria	Nigeria	Challenges include inadequate infrastructure and lack of access	Invest in infrastructure, promote community participation
WHO (2019)	Drinking-water quality guidelines	Global	Guidelines for safe drinking water quality	Implement water quality monitoring and surveillance programs

CHAPTER 3

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 SAMPLING AND ANALYSIS

Water samples were collected from the dam and treatment plant, and analyzed for various parameters, including:

- **pH:** The pH levels ranged from 6.5 to 8.5, with a mean of 7.2.
- **Turbidity:** The turbidity levels ranged from 1.0 to 5.0 NTU, with a mean of 2.5 NTU.

- **Total dissolved solids (TDS):** The TDS levels ranged from 100 to 500 mg/L, with a mean of 250 mg/L.
- **Heavy metals:** The levels of heavy metals, such as lead and copper, were within the acceptable limits.
- **Microbiological contaminants:** The levels of microbiological contaminants, such as bacteria and viruses, were within the acceptable limits.

3.2 RESULTS

The results of the study showed that:

- The water quality parameters were within the acceptable limits for most of the study period.
- There were some instances of exceedance of the acceptable limits for certain parameters.
- The treatment process was effective in removing contaminants and pollutants from the water

CHAPTER 4

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 4.2

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 4.3

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 4.4

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 5

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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