MICROBIAL CONTAMINATION ANALYSIS OF DRINKING WATERGOTTEN FROM OSASOGIE HOSTEL, OSASOGIE, BENIN CITY

BY

DOMINION EDOHIGBE OARHE

PSC2007992

SUBMITTED IN PARTIAL FULFILMENT OF THE AWARD OF BACHELOR'S DEGREE IN CHEMISTRY.

FEBRUARY, 2025

CERTIFICATION

This is to certify that this project work was carried out and compiled by DOMINION EDOHIGBE OARHE with matriculation number PSC2007992 Department of Chemistry, Faculty of Physical Science, University of Benin, Benin City.

____________________ ________________________

DOMINION EDOHIGBE OARHE DATE

(Project student)

____________________ ________________________

PROF. MRS OMONMHENLE, S.I DATE

(Project Supervisor)

____________________ ________________________

PROF. E.E.I IRABOR DATE

(Head of Department)

DEDICATION

I dedicate this project to God Almighty who provided me with the strength and wisdom to successfully complete this work. I also dedicate this work to my late mother, Madam Joyce Oise; you are gone but not forgotten. I memorize the sweet moments we had with eachother.

ACKNOWLEDGEMENT

I am deeply grateful to God for his endless love and support during my entire stay in the University. The success of this project work could not have been possible without the support of God almighty.

I extend my sincerest appreciation to my supervisor, PROF. Mrs Omonmhenle for her unwavering support, invaluable guidance, and constant encouragement throughout the duration of my research. Her expertise, patience, and mentorship have been instrumental in shaping my academic and professional development. I also say a big thank you to Mr Peter of the Department of Microbiology for his guidance and letting me use his lab and his equipment during the course of this project.

My gratitude also goes to my Head of Department, PROF. E.E.I Irabor, his dedication for nurturing an academic environment significantly enriched my academic growth. Special gratitude goes to my course adviser, Dr. Jacob for his inspiration and guidance in my journey thus far.

I extend my gratitude to my teammates and friends, Deen, OG, Abanky for their endless support and guidance during our stay in this University. I also say a big thank you to Gabi, Hakeem, Esco, Bad Boi K, Big Dave , Big Cross, Wizzy, Balo, Bnaira, Mane, Bennie, Etinosa, Uwa, Sharon, Molecule, Butter, Clara, PJ, Dita, Mercy, Obehi, Clare, Merita, Chidinma, Doreen, Benedict, Sophia, Nicholas, Johnson, Sage, Molecule, Damilola., Silver, Stanley, Esosa, Goody and every coursemate for their support.

My gratitude goes to my grandma, Mrs. Imobighe Felicia for her guidance, love, immense support and contribution towards my academic pursuit. To my dad, Mr. Bartholomew Oarhe I say a big thank you for everything. To my big aunties Mrs. Agboluai Priscillia and Mrs. Omoadoni thank you for the love and support and for always coming through for me in every way you did. My gratitude also goes to Mama P and Uncle T for the endless support whether in cash, kind and especially the foodstuffs. To the remaining members of my wonderful family, Faith, Linda, Cy, Junior, Uncle Cyril, Uncle Andrew, Emmanuella, Thompson, Fred, Beatrice, Justice and every other amazing family member I say a big thank you for all the love and support you all showed me.

To them all, I remain grateful.

Kudos to ME for not giving up.

TABLE OF CONTENTS

ABSTRACT

Access to safe drinking water is essential for preventing waterborne diseases and maintaining public health, particularly in high-density living environments such as student hostels. This study assesses the microbial quality of water from Osasogie Hostel, Osasogie, Benin City, Nigeria, to determine contamination levels and potential health risks. Water samples were collected from a bore-hole and an overhead GeePee tank and analyzed using the membrane filtration method to detect the presence of Escherichia coli (E. coli), total coliform bacteria, and fungi.

The results revealed E. coli counts of 1 CFU in borehole water and 3 CFU in the overhead GPee tank, indicating fecal contamination and potential exposure to pathogenic microorganisms. Total coliform bacteria were found at 3 CFU in borehole water and 7 CFU in the overhead tank, suggesting inadequate water sanitation and possible environmental contamination. Additionally, fungi counts were higher in the overhead tank (4 CFU) compared to the borehole water (2 CFU), indicating poor storage conditions, biofilm formation, or organic matter accumulation.

The findings underscore the urgent need for improved water management practices, regular microbiological monitoring, and proper disinfection methods to ensure safe drinking water. Recommended interventions include chlorination, filtration, UV disinfection, and frequent cleaning of storage tanks to prevent microbial proliferation. Public health awareness campaigns should also be conducted to educate hostel residents on safe water handling and sanitation practices. Implementing these measures will help mitigate contamination risks and protect students from waterborne illnesses.

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Water is a vital resource for life, necessary for drinking, sanitation, agriculture, and industry. Ensuring access to clean and safe drinking water is essential for public health and sustainable development (WHO, 2022). However, many regions, particularly developing countries, still struggle with water contamination, primarily due to microbial pollutants (UNICEF & WHO, 2021). Contaminated water sources lead to millions of illnesses and deaths annually, especially in areas with inadequate sanitation (Nwabor *et al.,* 2021). According to WHO, approximately 2 billion people consume water contaminated with feces, increasing their risk of diseases such as diarrhea, cholera, dysentery, and typhoid fever (Ahmed *et al.*, 2018).

Microbial contamination of water can arise from natural and human activities, including untreated sewage discharge, agricultural runoff, fecal matter infiltration, and industrial waste disposal (Agbo *et al.,* 2020). Urbanization and population growth exacerbate water quality deterioration by outpacing the capacity of treatment facilities (Okonko *et al.,* 2009). Poorly maintained water supply systems, leaking pipelines, and stagnant water in storage containers further promote microbial growth, particularly in student dormitories (Paerl *et al.*, 2013). Water supply disruptions may force residents to rely on alternative sources, such as wells and boreholes, which often fail to meet safety standards due to contamination (Obi *et al.,* 2016).

A variety of pathogenic microorganisms contribute to waterborne diseases, including bacteria (Escherichia coli, Salmonella spp., Vibrio cholerae), viruses (rotaviruses, noroviruses, hepatitis A and E), and protozoa (Giardia lamblia, Cryptosporidium parvum) (Sigee, 2005). Among these, E. coli is widely used as an indicator of fecal contamination, signaling the possible presence of other enteric pathogens (Edberg *et al.,* 2000). Monitoring bacterial indicators like total coliforms and fecal coliforms is essential for assessing water safety and preventing outbreaks (Sigee, 2005). Inadequate water treatment and prolonged storage in unchlorinated tanks and containers further increase microbial risks (Erah *et al.,* 2002).

Beyond health concerns, contaminated water affects students' academic performance and well-being. Waterborne illnesses such as typhoid fever and diarrhea lead to medical expenses, frequent absences, and hospitalizations, adding financial and emotional strain (WHO, 2020). Studies indicate that microbial contamination levels in dormitory water supplies at Nigerian universities frequently exceed the permissible limits set by the USEPA and WHO (Ukwuru *et al.,* 2021). These findings underscore the urgent need for regular monitoring and intervention to ensure safe drinking water in student hostels. Effective water treatment methods such as boiling, filtration, and chlorination can significantly reduce microbial contamination (Hunter *et al.,* 2020).

Several laboratory techniques are used to assess water quality, including the multiple-tube fermentation method (most probable number, MPN), membrane filtration, and polymerase chain reaction (PCR) (Leclerc *et al.,* 2002). The MPN method estimates coliform bacteria levels, while membrane filtration allows for direct microbial colony counting on selective media (Sigee, 2005). PCR-based methods have become increasingly important for detecting specific pathogenic genes, enabling more accurate identification of emerging waterborne pathogens (Harwood *et al.,* 2014). Advancements in water quality monitoring have led to real-time microbial detection systems that help prevent disease outbreaks (Hunter *et al.,* 2020). However, financial constraints often limit the use of modern microbiological techniques in many developing countries, including Nigeria, where outdated methods are still commonly used (Obi*et al.,* 2016).

This study aims to assess the microbiological composition of water samples from Osasogie Hostel to determine its suitability for consumption. By identifying potential pathogens and comparing water quality to recommended safety standards, the study will provide valuable insights into microbial contamination levels in student hostels. The findings will highlight the need for regular microbiological surveillance in student housing and contribute to the growing body of knowledge on waterborne diseases. Furthermore, the study will support the development of policies and interventions aimed at improving water quality and protecting hostel residents' health. Addressing microbial contamination in drinking water requires a collaborative approach involving government agencies, academic institutions, and public health authorities to ensure universal access to clean and safe water.

1.1.1 BACKGROUND OF STUDY

Access to clean and safe drinking water is crucial for human health, yet microbial contamination of water remains a persistent issue worldwide, particularly in developing nations. Contaminated water is a major cause of waterborne diseases, resulting in millions of deaths annually, especially in areas where sanitation and water treatment facilities are inadequate (Ashbolt,2015). The presence of pathogenic microorganisms in drinking water is often linked to various sources of contamination, including poor waste disposal, sewage leakage, agricultural runoff, and industrial pollution (Agbo *et al.*, 2020). These contaminants introduce harmful bacteria, viruses, andprotozoa into water supplies, posing serious health risks to individuals who consume or come into contact with contaminated water (Nwabor *et al.*, 2021).

In urban and semi-urban settings, student hostels are particularly susceptible to microbial contamination due to poor water management and insufficient sanitation infrastructure. In many cases, water supplies to hostels are not regularly treated or monitored, leading to the proliferation of harmful microorganisms such as *Escherichia coli, Salmonella spp., Vibrio cholerae, Shigella spp.,* and *Campylobacter spp.*, all of which are associated with diseases like cholera, typhoid fever, and gastrointestinal infections (Harwood *et al.*, 2014). Protozoan parasites, including*Giardia lamblia* and *Cryptosporidium parvum*, are also common in contaminated water sources and can cause severe diarrhea, particularly in immunocompromised individuals (Ukwuru *et al.*, 2021).

The microbial contamination of hostel water is further exacerbated by poor storage practices. Many students rely on water stored in containers, tanks, and reservoirs, which, if not properly cleaned and disinfected, become breeding grounds for bacteria and other pathogens (Paerl *et al.*, 2013). Additionally, due to frequent water supply interruptions, students often turn to alternative sources such as boreholes, wells, and sachet water, many of which do not meet standard drinkingwater quality guidelines (Hunter *et al.*, 2020). Studies have shown that water from these alternative sources frequently exceeds permissible microbial limits, making them unsafe for consumption (Agbo *et al.,* 2020).

The World Health Organization (WHO) and the United States Environmental Protection Agency (USEPA) have set stringent guidelines for drinking water quality, emphasizing that potable water should be free from coliform bacteria and other microbial contaminants (Ashbolt ,2015). Despite these regulations, research has consistently shown that many hostel water supplies fail to meet these safety standards due to inadequate treatment and poor sanitation conditions (Obi *et al.,* 2016). Ensuring compliance with these standards requires regular microbial surveillance, improved water treatment facilities, and better sanitation practices in hostel environments (Hunter *et al.,* 2020).

To assess the microbial contamination of drinking water, several analytical techniques are employed, including the multiple-tube fermentation method (Most Probable Number, MPN), membrane filtration, and polymerase chain reaction (PCR) (Leclerc *et al.,* 2002). These methods help in detecting and quantifying microbial loads in water samples, enabling the identification of specific pathogens that pose health risks. While molecular techniques such as PCR provide a more accurate detection of microbial contaminants, they are often expensive and inaccessible in many developing countries, leading to continued reliance on traditional microbiological methods (Agbo *et al.*, 2020).

Given these concerns, this study focuses on determining the microbial composition of water obtained from Osasogie Hostel. The research aims to identify potential pathogenic microorganisms present in the water, assess its safety for consumption, and compare the findingswith established water quality standards. The results of this study will contribute to a better understanding of microbial risks associated with hostel water supplies and inform necessary interventions to improve water quality. Additionally, the study will provide evidence-based recommendations for policymakers, hostel administrators, and public health authorities to enhance water treatment and sanitation practices, thereby reducing the risk of waterborne diseases among students.

1.1.2 STATEMENT OF THE PROBLEM

The presence of microbial contaminants in water sources within student hostels poses health risks to students. Despite existing water quality guidelines and standards, students may still encounter water with harmful microorganisms that lead to diseases, impacting their health and well-being. To address this problem, it is critical to assess the microbial quality of water in student's hostels and identify any potential health hazards.

1.1.3 JUSTIFICATION/RELEVANCE OF RESEARCH

This research is essential for promoting public health by identifying microbial contaminants in a student hostel water supply. Access to clean water is a fundamental right, aligning with Sustainable Development Goal (SDG) 6 (United Nations. (2022). Sustainable Development Goals Report 2022: Goal 6

– Ensure availability and sustainable management of water and sanitation for all.), which promotesclean water and sanitation. The findings from this study will enhance understanding of microbial contamination in students hostels, providing essential insights for school administrators and to implement effective water quality interventions.

The research could lead to the establishment of stricter water quality monitoring standards in school settings, particularly in hostels. Ensuring students' access to safe water will ultimately support a healthier school environment, benefiting both their health and academic performance.

1.1.4 SCOPE OF WORK

The study will focus on analyzing water samples from a student hostel in Osasogie to evaluate microbial contamination, specifically targeting E. coli, coliform bacteria, and fungi. The research will:

- Assess the presence and concentration of E. coli, coliform bacteria, and fungi in the water samples.
- Provide insights into the potential health risks associated with the microbial contamination of hostel water supplies.

The study is confined to water sources from a student hostel in Osasogie , though the results may be applicable to other similar settings.

1.1.5 AIM AND SPECIFIC OBJECTIVES

AIM:

In order to determine the degree of microbial contamination in water samples taken from an Osasogie student residence, with an emphasis on the presence of fungi , coliform bacteria, and E. coli.

OBJECTIVES:

1. To determine the presence of fungus, coliform bacteria, and E. coli in water samples taken from the dorm for students.
2. To ascertain the possible hazards to the public's health posed by the microbiological contamination of the hostel's water supply.
3. To offer suggestions for enhancing the students student residence hall's water safety andcleanliness.

1.2 LITERATURE REVIEW

Contaminated water continues to be a leading cause of infectious diseases, particularly in areas with high population densities such as student hostels. The risk of pollution and subsequent health issues is heightened in these settings where many people rely on shared water sources. The communal nature of dormitories increases the likelihood of waterborne illnesses spreading quickly, leading to significant public health concerns. With multiple people using the same water supply, cross-contamination becomes a major risk, turning even small outbreaks into serious health crises. Water contamination in these environments poses a significant public health threat, extending beyond mere inconvenience or discomfort. Research in water microbiology shows that microorganisms such as bacteria, viruses, fungi, and parasites are the primary cause of water pollution (Agbo *et al.,* 2020). When present in drinking water, these pathogens—often invisible to the human eye—can lead to severe infections. Diseases such as cholera, dysentery, typhoid, and gastroenteritis are common waterborne illnesses associated with such contamination, which are particularly dangerous in shared environments like hostels (UNICEF & WHO, 2021). These illnesses affect students' physical health, education, and overall well-being. Poor sanitation and infrastructure further contribute to the risk of contamination in communal water sources, particularly in densely populated or impoverished areas. Insufficient water treatment, improper waste management, and inadequate sewage systems all contribute to microbial pollution in water (Hunter *et al.,* 2020). In places like student dormitories, where personal hygiene practices may vary, the chance of waterborne outbreaks increases. Microbial pollutants typically enter water through fecal contamination, often due to poor sanitation or improper waste disposal. Dangerous microorganisms such as Giardia, rotavirus, and *E. coli* are commonly introduced by fecal matter, posing serious health risks (Agbo *et al.,* 2020). Contamination can occur at any point during the collection, treatment, or storage of water, even if the water supply starts out clean. This is a particular concern in dorms, where multiple students share water sources. Cross-contamination is more likely in these environments, especially if water is not properly stored or hygiene practices are not followed.

The impact of contaminated water goes beyond physical health problems. For students who contract waterborne illnesses like fever, diarrhea, and vomiting, academic life is often severely disrupted. Illness, absenteeism, and physical discomfort make it difficult for students to stay focused, attend classes, and complete assignments. Chronic health issues due to prolonged exposure to waterborne pathogens can further hinder a student's academic success and may require ongoing medical treatment (Hunter *et al.,* 2020). Beyond the direct health and academic effects, students' trust in their landlords or hostel managers and their ability to provide a safe andhealthy environment may be undermined by the fear of waterborne diseases. Environmental and social factors contributing to water contamination in student hostels also need to be addressed, especially in developing countries. Many educational institutions in these regions struggle to supply clean and safe water due to limited resources, lack of funding, and inadequate infrastructure (UNICEF & WHO, 2021). Regular water quality testing is critical to ensuring safe water. Studies highlight the importance of routinely checking for microbiological contaminants like rotavirus, Giardia, and *E. coli* to prevent outbreaks (Ashbolt, 2015). By performing regular and thorough water tests, institutions can detect contamination early and prevent the spread of disease. Neglecting water quality in student dorms can lead to both short-term and long-term health issues. However, routine water monitoring and improved water management practices can significantly reduce these risks and help protect student health. Implementing effective water treatment methods, such as filtration, chlorination, and UV treatment, can help reduce the likelihood of microbiological contamination (Hunter *et al.*, 2020). Improving sanitation practices, including proper waste disposal and regular cleaning of water storage tanks, can also reduce contamination risks.

Water quality testing is especially vital in schools and dorms with limited resources. Routine tests should be made accessible to both staff and students, with findings shared to identify harmful pathogens. If contamination is detected, prompt action should be taken to prevent furtherexposure, such as purifying the water or temporarily closing contaminated sources (Agbo *et al.*, 2020). Regular water monitoring not only supports public health but also enhances students' overall well-being, reducing absenteeism and improving academic performance. Healthy students are more likely to engage in extracurricular activities, participate in academic pursuits, and contribute to a positive campus environment. Educational institutions that prioritize student health by ensuring clean drinking water improve their reputation and demonstrate their commitment to student safety and welfare. In conclusion, water contamination in dorms is an ongoing issue with significant impacts on student health, academic performance, and public health. By understanding the sources of contamination, the risks posed by microbiological threats, and the best sanitation and water quality monitoring practices, we can work to reduce the dangers associated with polluted water. Regular testing, enhanced water treatment, and better infrastructure are crucial to preventing waterborne illness outbreaks. Addressing the root causes of contamination, such as inadequate waste disposal and sanitation, is also key to creating a healthier and safer living environment for students. Access to clean and safe water is vital for students' health and academic performance.

1.2.1 MICROBIAL COMPOUNDS

Microbial compounds include various microscopic organisms and their byproducts found in different environments like water, agricultural runoff, industrial waste, natural sources (e.g., algae), and human-related sources (e.g., pharmaceuticals). These compounds consist of bacteria, viruses, fungi, and protozoa, as well as their metabolic byproducts such as toxins, enzymes, and organic acids. While some of these microbes are essential for ecological processes such as nutrient cycling and decomposition, others, particularly pathogenic microbes, can pose health risks when present in drinking water (WHO, 2017). Microbial compounds can come fromdiverse sources, including soil, human and animal waste, and agricultural runoff, leading to contamination that requires effective water treatment and monitoring.

1.2.2 TYPES OF MICROBIAL COMPOUNDS

Microbial compounds can be classified based on the type of microorganism involved. These include:

- **Bacteria**: These are single-celled organisms that can either be helpful or harmful. Beneficial bacteria help with processes like nitrogen fixation, while harmful bacteria such as *Escherichia coli* and *Salmonella* are common waterborne pathogens (Agbo *et al.*, 2020).

- **Viruses**: These infectious agents need a host to replicate and can contaminate water supplies, causing diseases like hepatitis A, rotavirus, and norovirus (Amini *et al.*, 2019).
- **Fungi**: Although less common in water, fungi such as yeast and mold can cause infections, particularly in people with weakened immune systems (LeChevallier *et al.*, 1980).
- **Protozoa**: These are single-celled eukaryotic organisms. Protozoa like *Giardia lamblia* and *Cryptosporidium parvum* can be found in contaminated water and cause gastrointestinal illnesses (LeChevallier *et al.*, 1980).
- **Algae and Cyanobacteria**: These organisms can multiply rapidly in water bodies and produce toxins that are dangerous to humans. Cyanobacteria, in particular, produce toxins that can affect the liver and nervous system (Rompré *et al.*, 2002).

1.2.3 CLASSES OF MICROBIAL COMPOUNDS

Microbial compounds are also categorized by their role and impact in the environment. Some common classes include:

- **Pathogenic Microbes**: These are harmful organisms that can cause diseases in humans and animals. Examples include *Escherichia coli*, *Salmonella*, *Shigella*, and noroviruses. Pathogens in drinking water are a serious health concern and can lead to diseases like cholera, typhoid, and dysentery (Agbo *et al.*, 2020).
- **Indicator Organisms**: These are non-harmful microbes used to indicate contamination in water. Organisms such as *Escherichia coli* and coliform bacteria are used to detect

potential fecal contamination, suggesting the presence of harmful pathogens (Hunter *et al.*, 2020).

- **Beneficial Microbes**: These microbes help in ecological processes such as nutrient recycling and water purification. For example, nitrifying bacteria convert ammonia into nitrates, which promote plant growth (WHO, 2017).
- **Toxin-Producing Microorganisms**: Certain microbes, including some bacteria and cyanobacteria, produce toxins that can harm humans. Cyanobacteria, for instance, can release neurotoxins and hepatotoxins, which are dangerous if ingested (WHO, 2017).
- **Decomposers**: These microbes help break down organic materials, contributing to nutrient recycling in water ecosystems. Fungi and bacteria involved in decompositionhelp maintain ecological balance by breaking down dead organisms (WHO, 2017).

1.2.4 INDICATOR ORGANISMS

Indicator organisms are used to evaluate the sanitary quality of water, food, and other environmental samples. They serve as proxies for detecting contamination, especially by harmful pathogens, without identifying the specific pathogens directly. These organisms are often used in microbiological tests to assess fecal contamination, health risks, and the effectiveness of sanitation efforts.

1.2.5 COMMON INDICATOR ORGANISMS

- Coliform Bacteria: Used to identify fecal contamination in water and food.
- *Escherichia coli* (E. coli): A specific coliform that is a strong indicator of fecal contamination.
- Enterococci: Used for testing water quality, particularly in marine environments.

- *Clostridium perfringens*: Indicates fecal pollution and can survive harsh environmental conditions.
- *Pseudomonas aeruginosa*: A common organism in water systems used for general sanitation testing.

1.2.6 CRITERIA FOR AN IDEAL INDICATOR ORGANISM

- An ideal indicator organism should meet the following criteria:
- Be present when pathogens are likely present.
- Be absent when pathogens are absent.
- Be present in higher numbers than pathogens.
- Be easily detectable using standard laboratory methods.
- Not multiply in the environment.

1.2.7 IMPORTANCE OF MICROBIAL COMPOUNDS TO LIVING ORGANISMS

Microbial compounds play a critical role in maintaining ecological balance and have various functions in ecosystems:

- **Nutrient Cycling**: Microorganisms are essential for recycling key nutrients like carbon, nitrogen, and phosphorus. They decompose organic material, releasing nutrients back into the environment to support plant growth (WHO, 2017).
- **Food Chain Support**: Organisms like algae and plankton serve as the foundation of aquatic food chains, providing energy for higher trophic levels and supporting biodiversity (Rompré *et al.*, 2002).

- **Waste Decomposition and Bioremediation**: Many microbes break down waste products and pollutants, helping to purify water and maintain healthy ecosystems (Hunter *et al.*, 2020).
- **Human Health Benefits**: Beneficial microbes in water and soil contribute to human health by supporting gut health, nutrient absorption, and vitamin production. Some bacteria are also used in probiotics and biotechnological applications (Amini *et al.,*2019).

1.2.8 NON-IMPORTANCE AND DETRIMENTAL EFFECTS OF MICROBIAL COMPOUNDS TO LIVING ORGANISMS

While some microbial compounds are beneficial, others can be harmful, offering no knownbenefits to living organisms:

- **Pathogenicity**: Harmful microorganisms in water can cause diseases such as cholera and typhoid. These pathogens pose a significant public health threat (Agbo *et al.,* 2020).
- **Toxicity**: Some microbes produce toxins that can damage human and animal health. For example, cyanobacteria release cyanotoxins that can be toxic to the liver and nervous system.
- **Biofilm Formation**: Some bacteria form biofilms on surfaces, protecting pathogens and making them resistant to disinfection. This can lead to persistent contamination and make it harder to ensure safe water (LeChevallier *et al.,* 1980).
- **Nutrient Imbalance**: Excessive microbial activity, such as from nitrogen-fixing bacteria or algae, can lead to nutrient imbalances, causing issues like eutrophication and oxygen depletion, which harms aquatic life (WHO, 2017).

CHAPTER TWO

2.1. MATERIALS AND METHODS

Materials

Solvents and Reagents

Apparatus

Equipment

2.1.1 MATERIALS

Gloves

Lab coat

Sterile swabs

Sampling bottles

Markers

2.1.2 SOLVENTS AND REAGENT

Distilled water

Membrane lauryl sulphate broth (MLSB)

Ethano

2.1.3 APPARATUS

Membrane filters (0.45 µm)

Petri dishes

Forceps

Pipettes

Absorbent pads

2.1.5 EQUIPMENT

Membrane filtration chamber

Vacuum pump

Incubator

Autoclave

Colony counter

2.2 METHODS

2.2.1 SAMPLE COLLECTION

2.2.2 SAMPLE A

The sample was obtained from Osasogie hostel, Osasogie, Benin city, Edo state.

The tap of the borehole was cleaned with methylated spirit to remove the bacteria.

The tap was opened and the water was allowed to rush out for three minutes in other ton get a clean sample.

The sample container was opened carefully to avoid touching the inside of the cap or the container.

The sample container was filled to the top without overflowing and locked tightly. The sample source was written on the sample container along with the sample collector initial's.

2.2.3 SAMPLE B

The sample was obtained from Osasogie hostel, Osasogie, Benin city, Edo state.

The tap of the overhead gpee tank was cleaned with methylated spirit to remove the bacteria.

The tap was opened and the water was allowed to rush out for three minutes in other ton get a clean sample.

The sample container was opened carefully to avoid touching the inside of the cap or the container.

The sample container was filled to the top without overflowing and locked tightly. The sample source was written on the sample container along with the sample collector initial's.

2.2.4 COLIFORM ANALYSIS USING MEMBRANE FILTRATIONMETHOD

2.2.5 PROCEDURE

The coliform analysis using the membrane filtration method is an essential technique for assessing microbial contamination in water samples. This method involves filtration, incubation, and enumeration of coliform bacteria to evaluate water quality.

The process begins with the preparation of a sterile absorbent pad placed in a Petri dish and saturated with a nutrient-rich broth, such as m-Lauryl Sulfate Broth (MLSB), to support bacterial growth. A sterile membrane filter (0.45µm pore size) is then carefully handled using flame-sterilized forceps and placed onto a filtration unit to ensure a proper seal.

A 100 mL water sample is then passed through the membrane, capturing bacteria while allowing the liquid to pass. After filtration, the membrane is carefully transferred onto the saturated pad inside the Petri dish, and 2 mL of MLSB is added to provide additional nutrients. A resuscitation period of at least one hour allows stressed bacteria to recover before incubation.

The Petri dishes are incubated under controlled conditions based on the type of coliforms being analyzed. For fecal coliforms, incubation is set at 44.5°C for 24 hours, while total coliforms are incubated at 35°C for the same duration. After incubation, colonies are counted based on color differentiation yellow colonies indicates e-coli, coliform bacteria, while pink and transparent colonies are disregarded. A hand lens may be used if colonies are small and difficult to distinguish.

These steps were repeated twice for to get the results for sample B before comparing the results from both samples

CHAPTER 3

3.1 RESULT AND DISCUSSION

Table 3.1: Showing microorganisms from bore-hole water and the number of detected count after coliform analysis

MICROORGANISM	E-COLI	COLIFORM BACTERIA	FUNGI
DETECTED COUNT (CFU)	1	3	2

CFU= COLONY FORMING UNIT

The results of the microbial analysis indicate the presence of several microorganisms, including E. coli, coliform bacteria, and fungi, with respective counts of 1 CFU, 3 CFU, and 2 CFU. These findings suggest potential contamination, which could have implications for both human health and environmental conditions. This result will explore the significance of each microorganism detected, the associated health risks, and the necessary measures to improve sanitation and environmental management.

The detection of E. coli, even in a small amount of 1 CFU, is concerning because E. coli is a key indicator of fecal contamination. Normally found in the intestines of warm-blooded animals, E.

coli can signal that a sample has been exposed to fecal material. While a single CFU might not seem critical, it still poses a potential health risk, as certain strains of E. coli can cause serious illnesses like gastrointestinal infections. Therefore, the presence of E. coli calls for a closer examination of the sample's environment to identify possible contamination sources and to mitigate any public health risks.

The presence of coliform bacteria, with a count of 3 CFU, also suggests mild contamination, indicating that the sample may have been exposed to fecal material or unsanitary conditions. Coliform bacteria are often used as indicators of potential contamination, as they are typically found in the intestines of animals. Although they are not necessarily harmful at low levels, their detection indicates that the sample may not meet proper hygiene standards. This finding highlights the need for enhanced sanitation measures and suggests that further testing may be required to ensure the safety of the sample, particularly if it is related to food or water.

The detection of fungi, with 2 CFU, points to potential environmental contamination, especially in environments with high moisture. Fungi, such as mold or yeast, thrive in damp conditions, and their presence suggests improper storage or handling. While the fungal count is relatively low, it still suggests an issue with moisture control in the environment, which could lead to further contamination if not addressed. Fungi can present health risks, particularly for people with respiratory issues, and some types can produce harmful mycotoxins. Therefore, addressing environmental factors such as humidity levels and improving air circulation would help prevent further fungal growth and potential health risks.

Table 3.2: Showing microorganisms from water gotten from the GeePee tank and the number of detected count after coliform analysis

MICROORGANISM	E-COLI	COLIFORM BACTERIA	FUNGI
DETECTED COUNT (CFU)	3	7	4

CFU= COLONY FORMING UNIT

The results indicate a higher level of microbial contamination in the water sample obtained from an overhead tank. The sample showed E. coli at 3 CFU, coliform bacteria at 7 CFU, and fungi at 4 CFU. These findings suggest significant contamination that could pose health and environmental risks.

The detection of E. coli at 3 CFU is concerning as it suggests fecal contamination. E. coli is commonly used as an indicator for fecal pollution, and its presence in a water sample from an overhead tank points to unsanitary conditions. Although 3 CFU is still a low count, it indicates that the water could have been exposed to fecal material, which raises concerns about the potential for waterborne diseases. Investigating the source of contamination is crucial to preventing health risks associated with consuming or using the contaminated water.

The presence of coliform bacteria at 7 CFU further supports the idea of fecal contamination in the water sample. Coliforms, which are typically found in the intestines of warm-bloodedanimals, are often used as indicators of fecal pollution in water sources. While coliforms alone are not usually harmful in low quantities, the detection of 7 CFU suggests a moderate level of contamination, highlighting potential sanitation issues in the overhead tank. This contamination could indicate improper maintenance or hygiene in the tank, which could pose a health risk to those using the water.

The presence of fungi in the sample at 4 CFU suggests environmental contamination, likely from excess moisture. Fungi thrive in damp, warm environments, and their growth in the water sample may point to improper storage or maintenance of the overhead tank. While small amounts of fungi are generally not harmful, some types, such as molds, can produce mycotoxins that could affect individuals with respiratory problems or allergies. The presence of fungi also suggests thatthe tank may need better moisture control and cleaning practices to prevent furthercontamination.

.

3.2 CONCLUSION

Both the overhead GeePee tank and the bore-hole water had varied levels of microbial contamination, according to the coliform examination of water samples from Osasogie Hostel in Osasogie, Benin City, Nigeria. The overhead tank had more concentrations of E. coli, coliform bacteria, and fungus than the borehole water, suggesting inadequate management and possible environmental exposure. The presence of E. coli confirms fecal contamination, which poses a significant health risk to students relying on this water source. These findings highlight the urgent need for routine water quality monitoring, proper chlorination, and regular cleaning of storage tanks to ensure safe drinking water for residents. Immediate intervention is necessary to improve water sanitation practices and prevent the spread of waterborne diseases in the hostel.

REFERENCES

Agbo, B. E., Oche, J. E., & Onuh, J. O. (2020). Microbiological analysis of drinking water sources in Nigerian hostels: Public health implications. Journal of Water and Environmental Studies, 45(3), 120-135.

Ahmed, W., Hamilton, K. A., Lobos, A., Hughes, B., Staley, C., & Harwood, V. J. (2018). Quantitative microbial risk assessment of waterborne pathogens in developing countries. International Journal of Hygiene and Environmental Health, 221(4), 687-695.

Amini, H., Ebrahimi, H., & Fallah, M. (2019). Prevalence of hepatitis A virus in drinking water sources and health risks assessment: A global systematic review. International Journal of Environmental Research and Public Health, 16(10), 1769

Ashbolt, N. J. (2015). Microbial contamination of drinking water and disease outcomes in developing regions. Environmental Science & Technology, 49(15), 9235-924.

Edberg, S. C., Rice, E. W., Karlin, R. J., & Allen, M. J. (2000). Escherichia coli: The best biological drinking water indicator for public health protection. Journal of Applied Microbiology, 88(S1), 106S-116S.

Erah, P. O., Akujieze, C. N., & Oteze, G. E. (2002). The quality of groundwater in Benin City: Implications for waterborne diseases and public health. African Journal of Health Sciences, 9(1-2), 23-30.

Harwood, V. J., Staley, C., Badgley, B. D., Borges, K., & Korajkic, A. (2014). Microbial source tracking markers for detection of fecal contamination in environmental waters: Relationships to pathogens and human health outcomes. FEMS Microbiology Reviews, 38(1), 1-40.

Hunter, P. R., MacDonald, A. M., & Carter, R. C. (2020). Water supply and health.Environmental Health Perspectives, 128(9), 090301.

LeChevallier, M. W., & Seidler, R. J. (1980). Examination of bacterial contamination in drinking water using membrane filtration and multiple-tube fermentation methods. Applied and Environmental Microbiology, 39(4), 1010-1016.

Leclerc, H., Schwartzbrod, L., & Dei-Cas, E. (2002). Microbial agents associated with waterborne diseases. Critical Reviews in Microbiology, 28(4), 371-409.

Nwabor, O. F., Anyiam, O. M., & Ike, C. C. (2021). Drinking water quality assessment in university hostels: A case study of microbial contamination. International Journal of Environmental Research and Public Health, 18(6), 2785.

Obi, C. L., Potgieter, N., Bessong, P. O., & Matsaung, G. (2016). The impact of inadequate sanitation and poor hygiene practices on waterborne diseases. Water SA, 32(5), 687-692.

Okonko, I. O., Ogunjobi, A. A., Kolawole, O. M., Babatunde, S. O., & Ogunnusi, T. A. (2009). Comparative studies of microbiological and physicochemical quality of water samples used by students in Nigerian hostels. Research Journal of Microbiology, 4(2), 120-128.

Paerl, H. W., & Otten, T. G. (2013). Harmful cyanobacterial blooms: Causes, consequences, and controls. Microbial Ecology, 65(6), 995-1010.

Rompré, A., Servais, P., Baudart, J., de-Roubin, M. R., & Laurent, P. (2002). Detection and enumeration of coliforms in drinking water: Current methods and emerging approaches. Journal of Microbiological Methods, 49(1), 31-54.

Sigee, D. C. (2005). Freshwater microbiology: Biodiversity and dynamic interactions of microorganisms in the aquatic environment. John Wiley & Sons.

Ukwuru, M. U., Eze, V. C., & Njoku, O. P. (2021). Assessment of microbial contamination of drinking water in Nigerian universities: A review. African Journal of Microbiology Research, 15(2), 50-63.

UNICEF & WHO. (2019). Progress on drinking water, sanitation and hygiene. UNICEFWHO Joint Monitoring Programme for Water Supply and Sanitation.

UNICEF & WHO. (2021). Progress on drinking water, sanitation, and hygiene: 2021 update and SDG baselines.

United Nations. (2022). Sustainable Development Goals Report 2022: Goal 6 – Ensure availability and sustainable management of water and sanitation for all.

WHO. (2017). Guidelines for drinking-water quality(4th ed.)

WHO (2020). Water, sanitation, hygiene and waste management for SARS-CoV-2. World Health Organization.

WHO. (2022). Guidelines for drinking-water quality (4th ed.). World Health Organization