WATER QUALITY ASSESSMENT OF DRINKING WATER, COMMUNAL FAUCETS, AND TRADITIONAL WATER PUMP INSIDE A UNIVERSITY CAMPUS

ABSTRACT

Over the years, the water quality continues to deteriorate at an alarming rate, in fact, according to the World Health Organization (WHO) unsafe water are responsible for an estimated 485,000 deaths worldwide. Thus, this study aimed to determine the water quality of water sources in University of Eastern Philippines – Main Campus in terms of physical properties (pH, temperature, salinity, total dissolved solid), chemical properties (dissolved oxygen, total hardness, chloride, and potassium) and bacteriological (Escherichia coli) content and total coliform count. Samples were collected inside the campus: communal faucets, traditional water pumps, and water refilling stations. To determine its physical properties, a 900 multi-parameter was used and was performed in three trials from each samples. The six water samples have almost the same temperature and shows a salinity close to 0. There is also a presence of potassium, chlorine, total hardness, and dissolved oxygen. Furthermore, the TDS result, shows that the water samples are safe, reliable and suits the recommended standards of EPA. In addition, a bacteriological content was also performed using a 3M Petrifilm, observed for 24-48 hours and shows that the water samples have no presence of E. coli but has total coliform. Thus, the water sources do not meet the level and federal standards for consumption. A clean and accessible water quality is also a fundamental human right and an essential step towards an improving living standards.

Keywords: water refilling stations, communal faucets, traditional water pumps, *Escherichia coli*, total coliform

I. Introduction

Water is one of the most essential resources for life on earth, and its quality plays a crucial role in sustaining both humans and the environment (Dagalea *et al.,* 2022). However, over the years, the water quality continues to deteriorate at an alarming rate, posing a significant threat to the health and well-being of people and ecosystems. Several factors have contributed to this decline in water quality, including industrialization, agriculture, population growth, climate change, and natural disasters.

Safe drinking water is of critical importance for human health and well-being. It is essential for maintaining proper hydration, supporting various bodily functions, and preventing waterborne diseases. Access to clean and safe drinking water is a basic human right, and lack of access to safe drinking water is a significant public health concern worldwide. Unsafe drinking water can contain harmful contaminants such as bacteria, viruses, parasites, and chemicals that can cause various waterborne diseases such as cholera, typhoid, and diarrhea (Romah *et al.,* 2018). These diseases can lead to severe illness and even death, especially among vulnerable populations such as children, pregnant women, and those with weakened immune systems. In fact, according to the World Health Organization

UNDER PEER REVIEW

(WHO, 2021), unsafe water, poor sanitation, and inadequate hygiene are responsible for an estimated 485,000 deaths each worldwide. These deaths are mainly attributed to waterborne diseases which are often caused by the consumption of contaminated water or food. Additionally, it is estimated that 2.2 billion people around the world lack access to safe drinking water, and about 4.2 billion people do not have access to safely managed sanitation services. In Philippines alone, 31% of households still rely on unimproved water sources, such as unprotected wells or springs, which can be contaminated with bacteria and other harmful substances (WHO, 2021; CDC, 2023).

These figures highlight the importance of ensuring access to safe drinking water and sanitation to promote public health and reduce the global burden of waterborne diseases.

In addition to the health risks, unsafe drinking water can also have a significant economic impact. The costs associated with treating waterborne diseases, such as hospitalization, medication, and lost productivity, can be substantial and can put a strain on healthcare systems and the overall economy. Unsafe drinking water can have significant economic impacts on individuals, communities, and even the wider environment (Blokker *et al.,* 2016; Blokker *et al.,* 2013). One of the most significant impacts is the cost of treating water-related illnesses. Contaminated water can cause a range of illnesses, from acute gastrointestinal illnesses to chronic diseases like cancer, kidney failure, and neurological disorders (Chakraborty *et al.,* 2019). Treating these illnesses can be expensive and require long-term care, which can place a strain on healthcare systems and government budgets. For individuals, the cost of treatment can also lead to financial hardship, as they may have to pay for medical expenses out of pocket or forego other necessities to pay for healthcare.

The economic impact of unsafe drinking water is not limited to human health and productivity. Contaminated water can also have a significant impact on the environment. Industrial pollution and agricultural runoff can contaminate water sources, leading to reduced agricultural yields, contaminated soil, and impaired ecosystem services. This can affect not only the health and well-being of local communities but also their livelihoods, as many rely on natural resources for their income. This served as the springboard for the researcher in conducting the study.

UNDER PEER REVIEW

II. Methodology

Study Description

The water quality assessment was conducted at the Chemistry Laboratory in the College of Science, University of Eastern Philippines, University Town, Catarman Northern Samar. The water samples were collected in the designated areas of the University (Buildings/ Offices, Communal Faucets, Water Refilling Stations, and Traditional Water Pump).

Procedure

The following procedures conform to the AOAC International, US FDA Bacteriological Analytical Manual (BAM) standard procedure, and from the studies of Dagalea *et al.* (2022), Leano (2017), Getalado (2002), Lucban (2019), and Poblete (2012). After the collection, a test analysis was carried out, as under.

Determination of the Physical Properties of Water Samples

A multi-parameter meter was used to measure the water samples' pH, salinity, TDS and temperature.

pH and Temperature

To prepare the buffer solution, pH 7.00 buffer packet was opened. The powder was put into a 300 mL volumetric flask and poured a 250 mL distilled water. The solution was mixed thoroughly using a stirring rod until the reagent were completely dissolved.

In calibrating the 900 multi-parameter meter, "CAL key" was pressed until the meter shows "pH 7.00/CAL". The electrode was dipped into the prepared pH 7.00 buffer solution making sure that the tip of the electrode was completely plunged. Then, "ENTER" was pressed until the "Calibrated" indicator flashed on the screen. The display showed "END" when the measured value had stabilized. The meter automatically returned to its measurement mode. The pH measurement was pressed in the 900 multi-parameter meter. The pH electrode and temperature probe was rinsed thoroughly with distilled water. A 200 mL water sample was poured into a 350 mL beaker. The pH electrode and temperature probe was dipped into the water sample and the sensor was gently stirred, without touching the beaker. The measured value on the display was recorded after the reading has stabilized. The electrode was dipped into the distilled water then continued the procedure for the remaining two trials.

Salinity

The "MODE key" was pressed until the "SAL" (salinity) indicator was shown on the display. A 200 mL water sample was poured into a 350 mL beaker. The electrode was dipped into the water sample and the sensor was gently stirred, without touching the beaker. The measured value on the display was recorded after the reading has stabilized. The electrode was dipped into the distilled water then continued the procedure for the remaining two trials.

Total Dissolved Solid (TDS)

The "MODE key" was pressed until the "TDS" (Total Dissolved Solid) indicator was shown on the display. Poured a 200 mL water sample into a 350 mL beaker. Dipped the electrode into the water sample, the sensor was gently stirred without touching the beaker. The measured value on the display was recorded after the reading has stabilized. The electrode was dipped into the distilled water then continued the procedure for the remaining two trials.

UNDER PEER REVIEW

Determination of the Mineral Contents of Water Samples

A multi-parameter meter was used to measure the ion concentration: Potassium.

Potassium

The ion selective was rinsed thoroughly with a 300 mL distilled water. A 200 mL water sample was poured into a 350 mL beaker. Dipped the electrode into the water sample and the sensor was gently stirred without touching the beaker. The measured value on the display was recorded after the reading has stabilized. Dipped the electrode into the distilled water and repeated the procedure for the next two trials.

Chloride Ion (using Titration Method)

In a graduated cylinder, a 50 mL of water sample was measured. Transferred it to a 250 mL Erlenmeyer flask. Added five (5) drops of potassium chromate indicator into the water sample. Placed the burette on the retort stand, placed a funnel above and added in silver nitrate solution until zero point was reached. An Erlenmeyer flask with the water sample was placed in the retort stand, the loop was carefully loosed so that silver nitrate solution will come out from the burette in small drops until the sample turned its color to brick red (mud clay). The end point was recorded and calculated using the chlorine content formula. The procedure was done in three trials.

Total Hardness (using Titration Method)

In a graduated cylinder, a 50 mL of water sample was measured. Transferred it to a 250 mL Erlenmeyer flask. Added five (5) drops of Eriochrome Black Tea indicator into the water sample. Placed the burette on the retort stand, placed a funnel above and added in Ethylenediaminetetraacetic (EDTA) solution until zero point is reached. The Erlenmeyer flask with the water sample was placed in the retort stand, the loop was carefully loosed so that EDTA solution will come out from the burette in small drops until the sample turned its color to blue. The end point was recorded and calculated using the total hardness formula. The procedure was done in three trials.

Determination of *E. coli* Contents of Water Samples

A commercially available 3M Petrifilm plate (2010) for *E. coli*/coliform count, designated as 6404/6414, was employed in the study. Clean and sterilized bottles were used to collect water samples, ensuring careful labeling to represent the water source accurately and prevent contamination during collection. To maintain sample integrity, collected water samples were stored in a cooler (icebox) to prevent exposure to sunlight. Subsequently, the water samples were transported to the UEP-College of Science Chemistry Laboratory for E. coli determination using the 3M Petrifilm method.

Upon preparation, a leveled surface was chosen to place the 3M Petrifilm plate for E. coli/coliform count. The top film was peeled back to begin inoculating the samples. One milliliter of inoculum was aseptically dispensed onto the 3M Petrifilm E. coli count plates using a new sterile pipette. A spreader was then used to evenly distribute the inoculum over the circular area. Incubation was carried out according

UNDER PEER REVIEW

to the AOAC Official Method 991.14, maintaining the samples at 35±1ºC for 24±2 hours to promote microbial growth.

During colony counting, an improvised colony counter (utilizing a lampshade and magnifying lens) was employed to enlarge the colonies for clear visibility. Colonies were counted following a method resembling the pattern used for counting red and white blood cells, with an estimation made if the plate contained more than 150 colonies. This estimation involved counting the number of colonies in one or more representative squares using the bacterial colony counter, then multiplying the average count per square by 20 to determine the estimated count per plate.

III. Results

Table 1 shows the physical properties of different water samples collected from six (6) water sources located inside the University of Eastern Philippines – Main Campus.

The pH of water refilling station no. 1 is 6.53 which indicates that it follows the standard level of Philippine National Standards for Drinking Water (PNSDW) of 6.5 to 8.5 pH. However, water refilling station no. 2 has 6.22 pH which indicate that it does not reach the standard level of PNSDW. Low pH in drinking water implies that it is acidic and the lower the pH, the more it will further increase heavy metal toxicity and will cause pitting of pipes and fixtures or a metallic taste. This may also an implication that metals are being dissolved. The communal faucet no. 1 has a pH of 7.62, communal faucet no. 2 has 7.56 pH, traditional water pump no. 1 has 7.49 pH and traditional water pump has 7.35 pH. This conforms that only 5 out of 6 water samples follows the pH standard for human consumption from 6.5 to 8.5 of Philippine National Standard (PNS). The pH stands for “power of hydrogen”, the numerical value of pH is the molar of concentration of hydrogen ions (H+). The pH of water is an important quantity whether for drinking water or for normal human consumption. If there is change in pH of water (too acidic or too alkaline), it can be implied that it only reflects the conditions of water such as the presence of nutrients, chemical conditions and its behavior, and the microbial activity. It can damage and corrode water pipes and even home appliances, as well as it is unhealthful to drink. Humans have higher tolerance in pH, however, it still can affect the human body. If pH is higher, the more basic it is, the more it causes damage to the skin,minimal gastrointestinal irritation and other organ linings. A considered neutral pH is 7. The normal and acceptable pH of water usually varies between 6.5 and 8.5 on the pH scale.

The salinity of all six (6) water samples is close to zero, which indicates that there were no salt components detected during the samples. A multi-parameter was used to determine the salinity. According to the Philippine National Standard (PNS), the results of all six (6) water samples are acceptable. Salinity is the dissolved salt content of water. It helps the nerve and the muscle to function well, and is very important in regulating the fluids in the human body. In addition, salt content also helps in controlling the blood pressure and volume. If there is change in salinity, it can be implied that high level of salts may affect the taste of water, it can also reduce the suitability of water supply because salts can corrode metals and exacerbate heavy metal contamination.

UNDER PEER REVIEW

The temperature of the two refilling stations is 28.9ºC, conforms with the standard range for drinking water established by Philippine National Standards for Drinking Water (PNSDW). The two communal faucets and two traditional water pumps have the same temperature of 28.8ºC. All six (6) water sources are within the range of 25-32ºC. Amultiparameter was used to determine temperature. Temperature in water is a physical property expressing how hot or coldness it is. It is an important factor in water quality assessment since temperature can influence other parameters and can also affect the physical and chemical properties of water. When the temperature increases, it can be implied that the solubility of oxygen will decrease. It also implies that temperature may vary from time to time depending on its surrounding.

The Total Dissolved Solid (TDS) were also detected from all six (6) water samples, with the highest to least value: communal faucet no. 1 with 211ppm, communal faucet no. 2 with 196 ppm, traditional water pump no. 2 with 160 ppm, traditional water pump no. 1 with 117 ppm, water refilling station no. 1 with 13.82 ppm and water refilling station no. 2 with 6.94 ppm. Only the water refilling station no. 2 follows the established level of Philippine National Standard (PNS) for ensuring the water quality. The remaining five water samples had exceeded the amount needed for TDS levels for human consumption. The Total Dissolved Solid (TDS) was determined using a 900 multi-parameter. Total Dissolved Solid (TDS) helps to identify if the water is fit and safe for human consumption, and also an indicator if it is highly contaminated. Usually, the measurement used for measuring is parts per million (ppm) or mg/L. It can be implied that a change or increased level of TDS is still safe to use and does not affect health, however will affect the taste of the food. The recommended amount of TDS for human consumption is 10 ppm, higher to this level is unsafe and a filter system might possibly not be able to filter TDS.

Table 1. Summary result of the physical properties from the water sources

Sampling Site	Parameters			
	pH	**Salinity**	**Temperature**	**TDS**
Water Refilling Station No. 1	6.53	0.02 psu	28.9 ºC	13.82 ppm
Water Refilling Station No. 2	6.22	0.02 psu	28.9 ºC	6.94 ppm
Communal Faucet No. 1	7.62	0.20 psu	28.9 ºC	211 ppm
Communal Faucet No. 2	7.56	0.22 psu	28.8 ºC	196 ppm
Traditional Water Pump No. 1	7.49	0.08 psu	28.8 ºC	117 ppm
Traditional Water Pump No. 2	7.35	0.09 psu	28.8 ºC	160 ppm

**All results are average of the three trials conducted*

Table 2 shows the chemical properties of all six (6) water samples from (6) water sources from refilling stations, communal faucets, and traditional water pumps located inside the University of Eastern Philippines – Main Campus, Catarman, Northern Samar.

The presence of Chloride Ion in all water sources was detected with the highest to least: communal faucet no. 1 with 9 mL, traditional water pump no. 2 with 5 mL, communal faucet no. 2 and traditional water pump no. 1 with the same value

UNDER PEER REVIEW

of 3 mL, water refilling station no. 1 with 2 mL, and water refilling station no. 2 with 1 mL. The chloride ion was determined using titration method, all water samples turned its color into brick red (mud clay) indicating that there is presence of chloride ion. Chloride Ion is a common natural element in water, it can either be a component of sodium chloride or can be a combination of potassium and calcium. It is an important electrolyte and responsible in maintaining acidic and basic balance, it also helps the transmission of nerve impulses and the regulation of fluid in cells. If the Chloride Ion level increases, the change can be implied that it will affect or cause a potential corrosion in water and it might affect the water systems and the quality of drinking water. According to the Philippine National Standard, water supply must maintain the chlorine between 0.3 mg/L to 1.5 mg/L or $1.5x10^{-6}$ mL.

Dissolved oxygen (DO) were also present in all water sources. The highest value of Dissolved Oxygen (DO) is the traditional water pump no. 1 and water refilling station no. 1 with the lowest value of 4.09. The Dissolved Oxygen (DO) was determined using a 900 multi-parameter. Dissolved Oxygen (DO) is the amount of oxygen present in water, a necessary for a good quality. The high level of Dissolved Oxygen in water sources can be good as it makes the water taste better. It can be implied that a change in DO will affect and cause corrosion in water systems.

A minimal amount of Potassium was also observed using of 900 multi-parameter meters. The amount of Potassium from water samples ranges from 0.13 to 0.37 ppm. Potassium is an important element in human body, but is very rare to be found in water. The standard level of potassium intake is 3,000 mg daily. The increased intake of potassium may have side effects such as nausea, chest pain, vomiting, and heart palpitations. This implies, that all water sources must have a regular monitoring with their water systems.

Total Hardness was also detected using of titration method, with the highest value of 520 ppm from traditional water pump no. 2 and water refilling station no. 2 with 220 ppm. All six water samples turned into bluish color which indicates that there is presence of total hardness. According to the Philippine National Standard, the permissible limit for total hardness is 300 mg/L or 300 ppm. Thus, it means, both the water refilling stations no. 1 and 2 follows the range of values established by Philippine National Standard. The remaining four water sources exceeded the needed level for safe human consumption. Total Hardness is the sum concentration of calcium and magnesium. Hard water is beneficial and can actually provide a slight benefit in dietary, however, the change of total hardness as it increases its level, it can be implied that it will affect human resulting into bowel problem, can cause chemical buildup in pipes, faucets and appliances.

UNDER PEER REVIEW

Table 2. Summary result of the chemical properties from the water sources

Sampling Site	Parameters			
	Chloride Ion	Dissolved Oxygen	Potassium	Total Hardness
Water Refilling Station No. 1	2 mL	4.09 mg/L	0.37 ppm	300 ppm
Water Refilling Station No. 2	1 mL	4.59 mg/L	0.27 ppm	220 ppm

Communal Faucet No. 1	9 mL	4.22 mg/L	0.14 ppm	460 ppm
Communal Faucet No. 2	3 mL	4.55 mg/L	0.14 ppm	380 ppm
Traditional Water Pump No. 1	3 mL	6.21 mg/L	0.13 ppm	480 ppm
Traditional Water Pump No. 2	5 mL	5.62 mg/L	0.17 ppm	520 ppm

**All results are average of the three trials conducted*

Table 3 shows the bacteriological content in terms of Escherichia coli (E. coli) and total coliform count of water samples from six (6) water sources located inside the premises of University of Eastern Philippines – Main Campus.

All water samples from six water sources have no presence of *Escherichia coli* (E. coli) however, a total coliform was observed. Traditional Water Pump no. 1 has the highest total coliform of 84 counts, communal faucet no. 1 with 67 counts, traditional water pump no. 2 with 53 counts, communal faucet no. 2 with 36 counts, water refilling station no. 2 with 7 counts and water refilling station no. 1 with 5 counts. 3M Petrifilm was used to determine the presence of E. coli and was incubated for 24 to 48 hours – undisturbed. Most *E. coli* produce beta-glucuronidase which produces precipitate associated with the colony indicated by the blue to red-blue colonies. E. coli produces gas, as indicated by colonies, associated with entrapped gas. Blue colonies without gas are not counted as E. coli. Other coliform colonies are red and closely associated with entrapped gas. The total coliform count consists of both red and blue colonies associated with gas. The colonies that appeared on the foam barrier are not counted because they are removed from the selective influence of the medium. Coliform count plates with colonies that are too numerous to count (TNTC) have one or more of the following characteristics: many small colonies, many gas bubbles and a deepening of the gel color from red to purple-blue. When high numbers of non-coliform organisms such as Pseudomonas are present on 3M Petrifilm, the gel may turn into yellow. In counting the E. coli and total coliform, a 3M Petrifilm Plate Reader can be used or other illuminated magnifier or by getting the average number of colonies in one square and multiply to 20 to obtain the total count per plate.

The presence of *Escherichia coli* (E. coli) and other fecal coliform bacteria in water only indicates that the water may be contaminated by human or animal wastes. A zero count of total coliform in every 100 mL of drinking water is considered safe. An E. coli can survive between 4 to 12 weeks depending on its surrounding. Using or drinking water with E. coli can cause diarrhea, cramps, and nausea. Most E. coli strains do not harm, although some can cause serious and severe diseases. Total coliform bacteria are not harmful, however, some can make human sick. A person that is exposed to these bacteria in their drinking water may have upset stomach, fever, or diarrhea. Children and elders are more at risk from these bacteria. Total coliform also indicates that its presence may be an indication of the sanitary condition of the water supplies. To ensure safety, boil the water before drinking and properly sanitize your things.

Table 3. Summary result of the bacteriological content (*E. coli* and TC) from the water sources

Sampling Site	**Parameters**

UNDER PEER REVIEW

	E. coli	Total Coliform
Water Refilling Station No. 1	0	5
Water Refilling Station No. 2	0	7
Communal Faucet No. 1	0	67
Communal Faucet No. 2	0	36
Traditional Water Pump No. 1	0	84
Traditional Water Pump No. 2	0	53

**All results are average of the three trials conducted*

Table 4 shows the comparison data of qualities of different water sources in University of Eastern Philippines – Main Campus, Catarman, Northern Samar.

Table 4. Comparison of quality between the water samples collected

Parameter	Sampling Sites						PNSDW
Physical	WFS 1	WFS 2	CF 1	CF 2	TWP 1	TWP 2	
pH	6.53	5.98	7.62	7.56	7.49	7.35	6.5-8.5
Salinity (psu)	0.02	0.02	0.20	0.22	0.08	0.09	0.6 psu
Temperature (ºC)	28.9	28.9	28.9	28.8	28.8	28.8	25-32 ºC
TDS (ppm)	13.8	6.94	211	117	118	160	10 ppm
Chemical							
Chloride Ion (mL)	2	1	9	3	3	5	$1.5x10^{-6}$ mL
DO (mg/L)	4.09	4.59	4.22	4.55	6.21	5.61	6.5-8 mg/L
Potassium (ppm)	0.37	0.27	0.14	0.14	0.13	0.17	3,000 ppm
Total Hardness (ppm)	360	280	520	440	540	600	300 ppm
Bacteriological							
E. coli	0	0	0	0	0	0	0 per 100 mL of water
Total Coliform	5	7	67	36	84	53	0 per 100 mL of water
Interpretation	Not allowable for drinking	Not allowable for drinking	Unsafe for human use	Unsafe for human use	Unsafe for human use	Unsafe for human use	

UNDER PEER REVIEW

Water Treatment Practices and Technologies at Refiling station

The primary procedure in a water refilling station is determined by the quality of the raw water. The standard sequence involves multiple stages of filtration, softening, and disinfection. To provide an overview of the water purification process, let's outline the steps as described by Magtibay (2004) and cited by Dagalea *et al.* (2022): (1) implementation of a multi-media sediment filter, (2) ion-exchange process, (3) utilization of an activated carbon filter, (4) passage through a reverse osmosis membrane, (5) passage through a post-carbon filter, (6) exposure to an ultraviolet lamp, and (7) treatment with an ozone generator. These filtration stages ensure the elimination of harmful bacteria and the removal of sediments throughout the entire process.

IV. Conclusion

The assessment of water quality is crucial for ensuring the safety and suitability of water for human consumption and various purposes. The comprehensive analysis conducted on water samples collected from different sources within the University of Eastern Philippines – Main Campus provides valuable insights into the physical, chemical, and bacteriological properties of the water.

Examining the physical properties, it's evident that while some parameters such as pH and temperature fall within acceptable ranges according to Philippine National Standards for Drinking Water (PNSDW), others like Total Dissolved Solids (TDS) exceed recommended levels in several samples. The pH values of most samples are within the acceptable range, except for water refilling station no. 2, which falls slightly below the standard, potentially indicating acidic conditions. However, communal faucets and traditional water pumps exhibit pH levels within the acceptable range, demonstrating a variation in water quality among different sources. Salinity levels across all samples are minimal, indicating the absence of significant salt components.

Furthermore, the chemical analysis reveals variations in chloride ion concentration, dissolved oxygen levels, potassium content, and total hardness among different water sources. While some parameters comply with standards, others exceed permissible limits, indicating potential concerns regarding water quality. Elevated levels of chloride ions and total hardness suggest the presence of impurities that could impact taste and potentially lead to corrosion in water systems.

Bacteriological assessment highlights the absence of *Escherichia coli* (*E. coli*) in all samples, signifying a lack of contamination by fecal matter. However, the presence of total coliform bacteria in some samples, particularly in traditional water pumps, raises concerns regarding sanitary conditions and the potential risk of waterborne illnesses.

Comparative analysis further emphasizes discrepancies in water quality among different sources, with some falling below acceptable standards outlined by PNSDW. Water refilling stations, communal faucets, and traditional water pumps exhibit varying levels of compliance with regulatory standards, indicating the need for improved monitoring and treatment measures to ensure consistent water quality across all sources.

The findings underscore the importance of regular monitoring and adherence to stringent water treatment protocols to safeguard public health and prevent potential health risks associated with poor water quality. Implementing

UNDER PEER REVIEW

effective treatment practices and technologies, as outlined in water refilling station procedures, is essential for ensuring the delivery of safe and potable water to consumers. Additionally, community awareness and education initiatives regarding water quality and safety can empower individuals to make informed choices and take necessary precautions to protect their health and well-being.

V. Recommendations

Based on the comprehensive analysis conducted on the water samples collected from various sources within the University of Eastern Philippines – Main Campus, the following recommendations are proposed to address identified issues and ensure the provision of safe and high-quality water:

1. **Enhanced Monitoring and Testing.** Implement regular monitoring and testing programs to assess water quality parameters, including physical, chemical, and bacteriological properties. Continuous monitoring will help identify any deviations from regulatory standards and prompt corrective actions to maintain water quality.

2. **Improved Water Treatment Practices**. Strengthen water treatment practices and technologies, particularly in water refilling stations and traditional water pumps, to ensure the effective removal of impurities and contaminants. This may involve upgrading filtration systems, enhancing disinfection processes, and implementing additional treatment steps to achieve optimal water quality.

3. **Public Awareness and Education.** Launch public awareness campaigns and educational initiatives to inform the community about the importance of water quality and safety. Provide guidance on proper water storage, handling, and consumption practices to minimize health risks associated with contaminated water.

4. **Infrastructure Upgrades.** Consider infrastructure upgrades and investments in water distribution systems to prevent contamination and ensure the delivery of clean and potable water to consumers. Upgrading aging infrastructure, repairing leaks, and implementing cross-connection control measures can help mitigate potential sources of contamination.

5. **Collaboration with Regulatory Agencies**. Foster collaboration with regulatory agencies and local authorities to establish and enforce stringent water quality standards. Work closely with relevant stakeholders to develop and implement policies, regulations, and guidelines aimed at safeguarding public health and promoting water quality compliance.

6. **Community Engagement and Participation.** Encourage community engagement and participation in water quality monitoring and management efforts. Foster partnerships with local community groups, academic institutions, and civic organizations to mobilize resources and expertise in addressing water quality challenges collaboratively.

UNDER PEER REVIEW

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UNDER PEER REVIEW