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Department of Education
Region III - Central Luzon
Schools Division OF CITY OF MEYCAUAYAN
MEYCAUAYAN NATIONAL HIGH SCHOOL
Camalig, City of Meycauayan, Bulacan

Evaluation of Water Quality and Filtration Methods for Household Use in the City of Meycauayan Bulacan for Everyday Water Usage

A Project Proposal presented to Meycauayan National High School-

SENIOR HIGH SCHOOL

Camalig, City of Meycauayan, Bulacan

In Partial Fulfilment of the Requirements for PRACTICAL RESEARCH 2

Applied Subject for Science, Technology, Engineering and Mathematics

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by

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Abstract

The study evaluates water quality and filtration methods for household use in Meycauayan, Bulacan, focusing on identifying contaminants and assessing traditional methods such as boiling and distillation. Given the area's industrial activities, which significantly contribute to water pollution (Diwa et al., 2021), the research aligns with several UN Sustainable Development Goals, including Goal 6 (Clean Water and Sanitation) and Goal 3 (Good Health and Well-being), by addressing water safety and reducing waterborne diseases. Using an experimental research design, researchers collected water samples from three different locations in Meycauayan to ensure diverse representation. These samples were analyzed for pH levels, potential microbials, and metal contaminants before and after applying the filtration methods. Descriptive and inferential statistics, including One-way ANOVA, were utilized to evaluate the effectiveness of boiling and distillation on improving water quality. The results indicated statistically significant improvements in water quality post-filtration, with distillation showing slightly better outcomes in reducing microbial contamination and improving water clarity. The ANOVA results revealed a significant difference in pH levels among the groups (F-statistic of 7.5281 and p-value of 0.02314), supporting the hypothesis that filtration methods significantly impact water quality. In conclusion, while both boiling and distillation effectively enhance water safety, distillation proves to be more reliable. The study suggests regular water quality testing and increased public awareness on effective filtration practices to ensure improved health outcomes for the community.

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INTRODUCTION

Rationale

Water quality is a critical concern globally, as it directly influences multiple aspects of life, including human health, ecosystem stability, and overall environmental sustainability (Dewangan et al., 2023). Clean and safe water is essential not only for drinking but also for agriculture, sanitation, industrial processes, and maintaining biodiversity in aquatic and terrestrial ecosystems. (United Nations, 2020). When water quality is compromised, it can lead to severe health risks such as waterborne diseases, including cholera, dysentery, and typhoid, which disproportionately affect vulnerable populations, especially in developing regions (World Health Organization: WHO, 2023). Beyond human health, poor water quality disrupts the delicate balance of ecosystems, leading to the decline of aquatic species, the degradation of natural habitats, and the loss of biodiversity (Edo et al., 2024). Contaminated water bodies can become unsuitable for supporting fish and other wildlife, threatening food chains and local economies that depend on fishing and tourism (Bashir et al., 2020).

Moreover, as stated by the study of Du Plessis (2022), the deterioration of water quality has a broader impact on environmental sustainability. Polluted water can damage soil quality, reduce agricultural productivity, and contribute to the spread of pollutants across larger ecosystems, including rivers, lakes, and oceans. In addition, industries that rely heavily on water resources, such as agriculture, energy production, and manufacturing, are also affected by poor water quality, leading to higher operational costs and decreased efficiency. Thus, maintaining high water quality is crucial for supporting the long-term health of both human populations and the planet's ecosystems (Hogue, 2021). Global efforts to monitor, manage, and improve water quality are essential for promoting sustainable development and ensuring that future generations have access to safe and reliable water resources.

This study also aligns closely with several United Nations Sustainable Development Goals (SDGs), particularly Goal 6: Clean Water and Sanitation, as well as Goals 3, 11, 12, and 15, which emphasize good health, sustainable communities, responsible consumption, and environmental conservation. Goal 6 highlights the need for accessible and safe water resources, and this study directly addresses water safety by assessing tap water quality and evaluating effective filtration methods, contributing to the reduction of contamination in household water. Goal 3, Good Health and Well-being, is supported by ensuring cleaner water for communities, which helps reduce waterborne diseases. Goal 11, Sustainable Cities and Communities, is advanced by improving local water quality, essential for urban resilience. The project also reinforces Goal 12, Responsible Consumption and Production, by optimizing traditional filtration techniques, promoting sustainable water use, and encouraging responsible resource management at the community level. Lastly, by protecting water resources from contamination, the study contributes to Goal 15, Life on Land, as clean water is vital for maintaining biodiversity and supporting local ecosystems

According to the study by Diwa et al. (2021), Meycauayan is well-known for its industrial activity, which includes sectors such as tanneries, jewelry production, and various manufacturing industries. While these industries are vital to the local economy, they also contribute significantly

to water pollution in the area. The industrial processes release a variety of harmful effluents, including heavy metals, toxic chemicals, and organic waste, into nearby rivers, streams, and groundwater sources. These pollutants can make their way into the local water supply, contaminating the water that residents rely on for everyday use, such as drinking, cooking, and bathing. This poses serious challenges for monitoring and maintaining water quality, especially since these pollutants can accumulate over time, making detection and regulation more difficult.

Furthermore, the presence of industrial effluents complicates the analysis of water quality, as the contaminants vary in type and concentration depending on the industrial output. For instance, tanneries are known to release chromium and other heavy metals, while jewelry production can introduce chemicals used in metal processing. This variety of pollutants makes it essential to conduct regular and thorough assessments of water quality to protect public health. Understanding the specific contaminants present in household water supplies is crucial for identifying potential health risks, such as exposure to carcinogenic substances or harmful pathogens that thrive in polluted water.

In addition to identifying health hazards, regular monitoring of water contaminants also plays a key role in establishing a baseline for regulatory compliance (Levin et al., 2023). Local governments and environmental agencies must set strict water quality standards to ensure that industries adhere to pollution limits and that the water provided to residents is safe for consumption. Effective water management strategies, such as improved filtration systems and stricter industrial regulations, are necessary to address the ongoing challenges posed by industrial pollution in Meycauayan, helping to safeguard the health and well-being of its residents.

Additionally, this study also focuses on evaluating filtration methods for everyday water usage. Given the industrial nature of Meycauayan, where tanneries, jewelry production, and other industries release pollutants into the local water sources, it is essential to assess the effectiveness of home water filtration systems. These systems need to be evaluated in terms of their capacity to eliminate specific contaminants (Kordbacheh & Heidari, 2023), such as heavy metals, chemicals, and harmful microorganisms, which are frequently present in the water supply. Evaluating these filtration techniques provides reliable solutions for households to maintain water quality in addition to guaranteeing the safety of water usage. This not only ensures the safety of drinking water but also reduces the risk of waterborne diseases and long-term exposure to toxins, which can have severe health implications for the community. The study intends to support improved health outcomes and water sustainability for the Meycauayan residents by determining the most appropriate filtration techniques.

Statement of the Research Problem

Household Water Services in the City of Meycauayan Province of Bulacan is a need to many people, but there are concerns about its quality and safety due to potential contaminants. This study aims to examine the water quality and identify any harmful substances, as well as to evaluate whether the current filtration processes are sufficient to ensure that the water is safe for consumption or if improvements are necessary.

Researchers specifically ought to answer these following questions:

1. What is the average pH, potential microbials, and levels of metal contaminants in household water in Meycauayan, Bulacan?
2. Are there statistically significant differences in water quality measurements (e.g., pH, potential microbials, metal contaminants) when using different traditional filtration methods?
3. Which filtration methods yield the most consistent and safe results in terms of pH, potential microbials, and contaminant levels, based on statistical analysis?

Hypotheses:

- **H_0:** There is no significant difference in the water quality of household water before and after applying filtration methods (boiling and distillation)
- **H_1:** There is a significant difference in the water quality of household water before and after applying filtration methods (boiling and distillation)

Significance of the Study

This study will identify potential contaminants that may be eliminated from the water through a variety of filtration methods that can be beneficial to the following:

Household owner/s - The results of this research can be used to inform the owner(s) of the household about the potential toxins in their water and how to filter them out.

Community - This study can provide information regarding various and enhanced filtering methods as well as the contaminants that a particular filtration method may remove that will be beneficial to the community.

Future Researcher/s - Future researchers can benefit from using this work as a foundation for their own research.

Scope and Delimitations

This study focuses on analyzing the water quality and contaminants from Household water services in the City of Meycauayan Province of Bulacan specifically to determine the water's safety for everyday use. The water samples will be collected and tested within a specific timeframe, and seasonal variations in water quality will not be considered. The research will also include both chemical and biological analyses to assess various parameters crucial to water quality. These parameters include the pH level, the presence of microorganisms, and the presence of heavy metals. Additionally, the study will evaluate traditional filtration methods to determine what effective filtration methods can be used to filter out the contaminants.

The study is limited to the water samples obtained from the Household Water in the City of Meycauayan Province of Bulacan. The research will not extend to other water sources. The evaluation of filtration methods will be limited to traditional filtration methods, such as Boiling

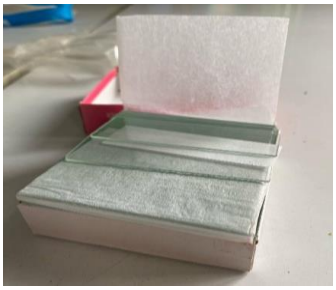
and Distillation. Experimental techniques will be part of this study. Moreover, the effectiveness of filtration methods will be evaluated based on standard laboratory conditions. The assessment of microorganisms will be limited to those that are commonly found in Household's water and recognized as potential health hazards. The study will not cover the long-term health effects of consuming water with specific contaminants, focusing instead on the immediate safety and quality of the water. Additionally, the research will not investigate the effects of potential water treatment chemicals on the water's final quality.

METHODOLOGY

The researchers collected three different samples: sample 1 is collected from Matthews Street, 3d, while sample 2 is collected from Datig Street, Camalig, and sample 3 is collected from Meycauayan National High School. Afterwards, the obtained water samples go under the microscope to observe the microorganisms and potential metal contaminants in the water. The collected water samples were observed with two different revolving nose pieces, which are S100/1.25 oil and 160/0.17.

The three water samples were divided into 250 ml each, and after the distillation for 5-10 minutes, the remaining 250 ml were boiled for 5 minutes. Afterwards, the distilled and boiled water were collected and cooled down to room temperature. Furthermore, the 2 treatments of each water sample were examined under a microscope with different kinds of revolving nose pieces, which were 10/0.25, 160/0.17, and S40/0.65, to see whether or not the contaminants in water before and after the filtration had changed significantly.

Materials:



MICROSCOPE SLIDE

MICROSCOPE

WATER SAMPLE 1 AND 2

BOWL AND CASSEROLE

ICE AND COVER OF CASSEROLE

GLASS BOTTLES

BOROSILICATE GLASS PIPETTE

PH TESTER

METHODS

The researchers collected three different samples: sample 1 is collected from Matthews Street, 3d, while sample 2 is collected from Datig Street, Camalig, and sample 3 is collected from Meycauayan National High School.

Figure 1. *Collection of Water Samples*

The three water samples were divided into 250 ml each, and after the distillation for 10 minutes, the remaining 250 ml were boiled for 5 minutes. Furthermore, the distilled and boiled water were collected and cooled down to room temperature.

Figure 2. *Boiling and Distillation of Water Samples*

The obtained water samples and the 2 treatments of each water sample were examined under a microscope with different kinds of revolving nose pieces which were S100/1.25 oil, 160/0.17, 10/0.25, and S40/0.65 to observe the microorganisms and potential metal contaminants in the water and to see whether or not the contaminants in water before and after the filtration had changed significantly.

All the samples were collected and prepared for the Ph testing after examining the different treatments of water samples under the microscope and gathering all the information needed for analyzing data.

Figure 4. *ph Testing*

Research Design

This study utilizes an experimental research design to analyze water quality and assess the effectiveness of traditional filtration methods in household water services in the City of Meycauayan, Province of Bulacan. Water samples will be collected from three households across the city to ensure diverse representation. These samples will undergo initial testing to determine pH levels, potential microbials, and the presence of metal contaminants. The filtration methods to be tested includes boiling and distillation, as they are commonly used in households. After applying these filtration techniques, the water will be analyzed again to assess changes in its quality.

The study will compare the pre- and post-filtration water quality to established safe water standards, using descriptive and inferential statistics (One-way ANOVA and Tukey's HSD) to evaluate the effectiveness of each method. The filtration efficiency will be measured based on reductions in pH imbalances, microbial presence, and me tal contamination.

Population and Sample (Subjects/Materials)

The population for this study consists of household water services in the City of Meycauayan, Province of Bulacan. The sample will be drawn from tap water in various households across the city, ensuring that different locations within Meycauayan are represented.

Specifically, three water samples of 250 mL each will be collected from households in Meycauayan. These samples will be tested to measure pH levels, potential microbials, and metal contamination. The samples will then undergo filtration through traditional methods, such as boiling and distillation, to assess the filtration efficiency in removing contaminants.

Data Collection (or Experimentation)

The researcher will begin by collecting three water samples from different locations. After collecting the samples, an initial analysis will be conducted to assess the pH levels, potential microbials, and metal contamination in each sample. Following this, the researcher will apply traditional filtration methods, including boiling and distillation, to determine which method is most effective at removing contaminants. After testing, the researcher will compare water quality before and after filtration to assess the filtration efficiency and compliance with safe water standards. Once filtration testing is complete, the researcher will evaluate the effectiveness of these methods and explore potential improvements to achieve more significant reductions in contaminants, ensuring the water meets safety standards.

Data Analysis

The researchers will use experimental research and data collection methodologies, specifically sampling methods. The researchers will begin by collecting tap water sample from different location in the Meycauayan district. Each sample will have a volume of 500 mL of water needed for the experimentation and observation. The collection of samples will be conducted within a single day to ensure that the water conditions are consistent. Once collected, the samples will be taken in the laboratory of MNHS for the analysis. During the initial analysis, the water quality parameters will be used to assess the pH level, potential microbials, and metal contamination in each sample. The researcher will also applying traditional filtration methods, including boiling and distillation. Each method to all samples will be applied to determine which method is the most effective at removing contaminants After the filtration, we will compare the water quality to determine the filtration efficiency and assess compliance with safe water standards. After the experimentation, the researcher will assess the efficacy of the experimentation methods and explore potential enhancements to significantly reduce contaminants, to ensure the water safety standards.

Ethical Considerations

This study will adhere to certain ethical principles, including maintaining the household owner's confidentiality and the identity of their water source; providing factual, evidence-based information and statistics; using laboratory equipment appropriately; taking precautions against potential harm; and adhering to a set procedure. These ethical guidelines shall be strictly adhered to in order to avoid falsification of data or information, to prevent damage, and to secure the contributors privacy.

Results

Data Summary				
Groups	N	Mean	Std. Dev.	Std. Error
Group 1	3	4.27	1.7016	0.9824
Group 2	3	7.06	0.4331	0.2501
Group 3	3	7.1367	0.3265	0.1885

ANOVA Summary					
Source	Degrees of Freedom DF	Sum of Squares SS	Mean Square MS	F-Stat	P-Value
Between Groups	2	16.008	8.004	7.5281	0.0231
Within Groups	6	6.3792	1.0632		
Total:	8	22.3872			

Figure 5. *ANOVA test results*

The ANOVA analysis compares the effects of different water filtration methods on water pH levels. Group 1 represents unfiltered water, Group 2 represents water filtered by distillation, and Group 3 represents water filtered by boiling. Each group's input data reflects pH levels measured in three samples. The results show a statistically significant difference in pH levels between the groups, with an F-statistic of 7.5281 and a p-value of 0.02314 ($p < 0.05$). This indicates that at least one filtration method significantly alters the pH level compared to the others. Group 1 (unfiltered water) has the lowest mean pH level (4.27), while Group 3 (boiling) has a slightly higher mean pH (7.1367) than Group 2 (distillation), which has a mean pH of 7.06. This suggests that filtration methods improve the water quality, with boiling showing a marginally higher effect.

Test I.

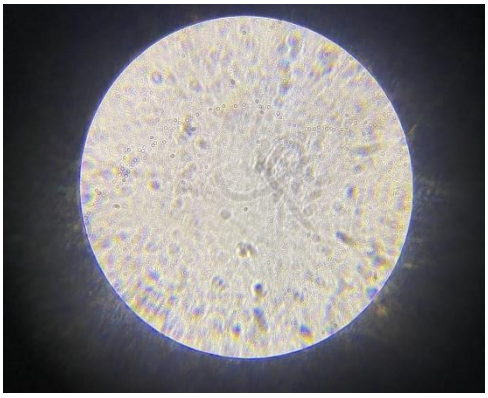


Figure 6. *Test 1 unfiltered water*

The image shows a control group water sample that did not undergo any treatment, providing a baseline for comparison with the treated samples. The sample displays a high density of small particles or bubbles, which are more concentrated than in the treated samples, suggesting the presence of typical impurities found in untreated water. The clarity is noticeably lower, with particles scattered throughout, indicating the absence of any purification process to remove these impurities. This control sample serves as a reference point, highlighting the improvements in clarity and reduction in particles observed in the treated samples.

Figure 7. *Test 1 distilled water*

The microscopic image of the distilled water sample of treatment number 1 shows numerous small, circular structures that could be either microbubbles formed during the distillation process or very fine particulate impurities. The absence of larger particles suggests that the distillation effectively removed most impurities, leaving behind a fairly clean sample. The uniform distribution of these small particles or bubbles indicates that the water is largely purified, although minor microscopic content remains.

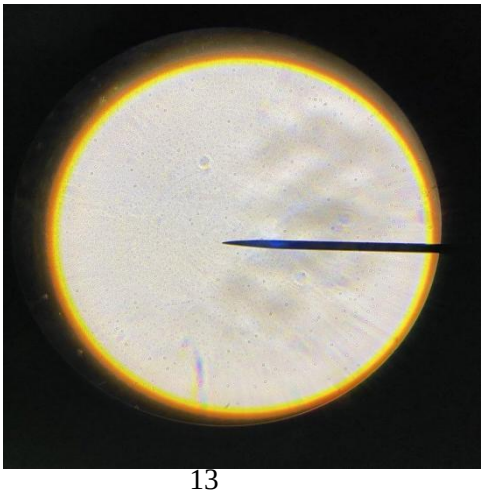


Figure 8. *Test 1 boiled water*

The image shows a water sample after undergoes a boiling method. Compared to the previous sample, the clarity appears improved, with fewer small particles visible. The boiling process may have effectively removed some additional impurities that remained after Treatment 1, distillation.

Test II.

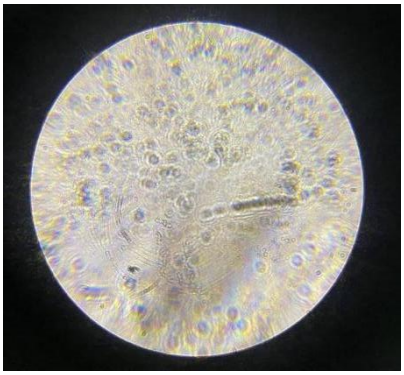


Figure 9. *Test 2 unfiltered water*

The images taken under the microscope demonstrate the potential large number of different microorganisms present. It also demonstrates the presence of long and big particles as well as their increased compactness. The microorganisms are more noticeable in the treatment 2 non-distilled sample than in the treatment 2 distilled sample. This shows a high level of contaminants in untreated water, emphasizing the need for purification methods such as boiling and distillation. The distribution of microorganisms and particles appears inconsistent, with some areas showing denser concentrations than others.

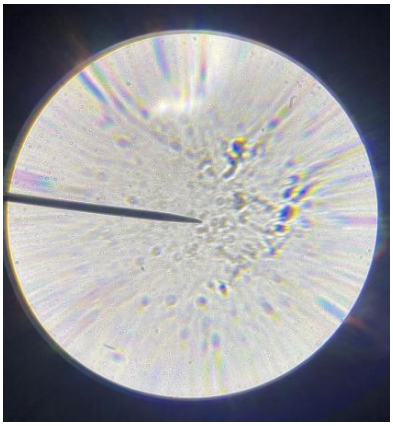


Figure 10. *Test 2 distilled water*

In comparison to the distilled sample from treatment 1, the microscopic image of the distilled water from treatment 2 shows both large and some longer particles, indicating that the distillation process did not entirely eradicate the microorganisms in the water. Nevertheless, when comparing the microscopic picture of the treatment 2 distillation sample to the treatment 2 sample prior to distillation, it is clear that the potential microbials in the water had decreased. Additionally, compared to the picture of the treatment 2 sample without distillation, the presence of the tiny particles or bubbles is more visible, indicating that the water has been partially cleansed.

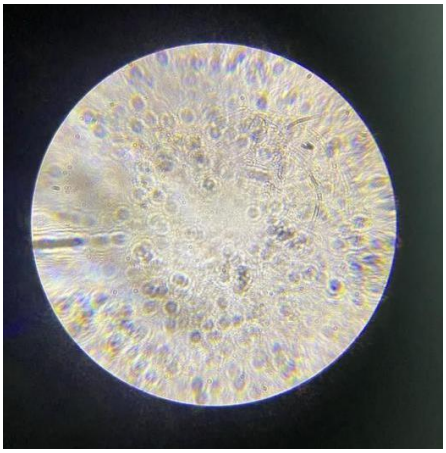


Figure 11. *Test 2 boiled water*

This microscope image shows tap water after boiling. It can be observed that there is little change compared to the before boiling state, with many small, round structures that could be microbubbles formed during the boiling process. The absence of larger particles after boiling indicates that some impurities have been removed, but it is not as effective as distillation. This suggests that boiling is not sufficient to fully purify the sample. The nearly uniform distribution of small structures shows that the remaining impurities are evenly spread throughout the sample.

Test III.

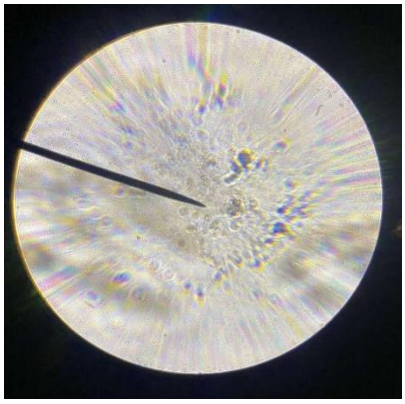


Figure 12. *Test 3 unfiltered water*

In this image, the water sample that has not yet undergone distillation or boiling. The sample shows a high concentration of particles or bubbles scattered throughout, which likely indicates the presence of various impurities commonly found in untreated water. The central region appears especially dense with these particles, creating a less clear appearance compared to treated samples.

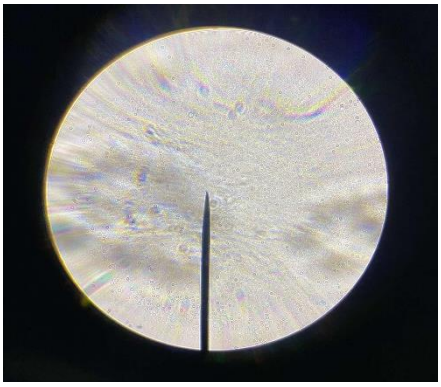


Figure 13. *Test 3 distilled water*

The water sample after it has undergone distillation. Compared to the untreated control sample, there is a noticeable reduction in the density of particles or bubbles, indicating that the distillation process has effectively removed a portion of the impurities. The sample appears clearer, with fewer visible particles scattered throughout, which suggests improved purity.

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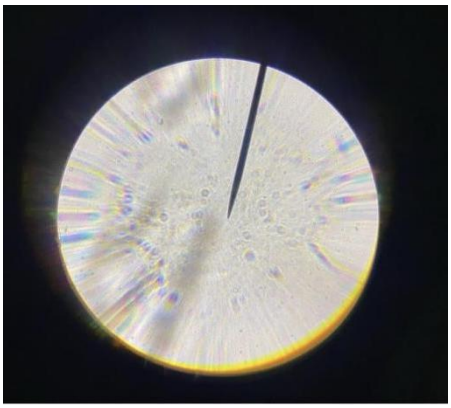

Figure 14. *Test 3 boiled water*

The water sample after undergoing boiling treatment. Compared to the untreated control and the distilled sample, there is a noticeable reduction in visible particles, but it may not be as clear as the distilled sample. Boiling has effectively decreased some impurities, although smaller particles or bubbles may still remain.

Discussion

The study investigates household water quality in Meycauayan, Bulacan by measuring average pH levels, potential microbials, and metal contaminant levels, as well as comparing the effects of different traditional filtration methods (boiling and distillation) on these parameters. The ANOVA results potentially indicate a statistically significant improvement in water pH after filtration, with an F-statistic of 7.5281 and a p-value of 0.02314, confirming that at least one method, which is boiling, significantly impacts water quality. Microscopic images potentially illustrate that distillation is more effective than boiling at reducing visible particles and microbial contaminants, though neither method completely purifies the water. Additionally, tests potentially indicate that none of the samples, whether filtered or unfiltered, contain detectable levels of metal contaminants. Thus, distillation potentially appears to provide slightly more consistent improvements in clarity and contaminant reduction, aligning with the hypothesis that filtration methods positively impact water quality.

Conclusion

The study concludes that household water in Meycauayan, Bulacan, has an average pH of 4.27 when unfiltered, which is slightly acidic and below the neutral pH ideal for safe drinking water. Following filtration through boiling and distillation, the pH levels increase to approximately neutral, with mean values of 7.1367 for boiling and 7.06 for distillation, indicating improved water quality. Microscopic analysis potentially shows that both filtration methods reduce potential microbials and visible impurities, although distillation achieves slightly clearer results. Notably, all water samples, filtered and unfiltered, potentially lack detectable levels of metal contaminants.

The ANOVA test results demonstrate statistically significant differences in pH levels among the groups ($p = 0.02314$), supporting the alternative hypothesis (H_1) that filtration methods significantly affect water quality compared to untreated water. However, both boiling and distillation potentially yield comparable pH improvements, with only minor differences between the two methods.

Overall, distillation potentially appears to provide the most consistent and effective results for improving water clarity and reducing microbial contamination. Boiling also potentially enhances water quality but is slightly less effective than distillation. This study suggests that while traditional filtration methods like boiling and distillation significantly improve water safety, distillation may be more reliable in achieving the highest water quality in terms of pH and microbial reduction.

Recommendations

1. **Use Distillation and Modern Filtration Techniques:** Encourage households to use distillation or modern filtration systems like reverse osmosis and UV purification for better contaminant removal and water safety.

2. **Implement Regular Water Quality Testing:** Local authorities should provide regular testing for pH, potential microbials, and metal contaminants to ensure household water remains safe.

3. **Increase Awareness on Filtration Practices:** Educate the public on the importance of modern filtration methods and proper maintenance to improve water quality and safety.

References

Belo, L. P., Orbecido, A. H., Beltran, A. B., Vallar, E. A., Galvez, M. C. D., Eusebio, R. C. P., Ledesma, N. A., & Deocaris, C. C. (n.d.). *Water quality assessment of Meycauayan River, Bulacan, Philippines (Research Note)*. University Knowledge Digital Repository. https://www.ukdr.uplb.edu.ph/journal-articles/4192/

Bashir, I., Lone, F. A., Bhat, R. A., Mir, S. A., Dar, Z. A., & Dar, S. A. (2020). Concerns and threats of contamination on aquatic ecosystems. In Springer eBooks (pp. 1–26). https://doi.org/10.1007/978-3-030-35691-0_1

Dewangan, S. K., Toppo, D. N., & Kujur, A. (2023). Investigating the impact of pH levels on water quality: an Experimental approach. *International Journal for Research in Applied Science and Engineering Technology*, *11*(9), 756–759. https://doi.org/10.22214/ijraset.2023.55733

Diwa, R., Deocaris, C., Orbecido, A., Beltran, A., Vallar, E., Galvez, M. C., & Belo, L. (2021). Meycauayan, an Industrial City in Bulacan, Philippines: Heavy Metal Pollution in Soil and Surface Sediments and Their Relationship to Environmental Indicators. *ResearchGate*. https://doi.org/10.20944/preprints202106.0439.v1

Du Plessis, A. (2022). Persistent degradation: Global water quality challenges and required actions. One Earth, 5(2), 129–131. https://doi.org/10.1016/j.oneear.2022.01.005

Edo, G. I., Itoje-Akpokiniovo, L. O., Obasohan, P., Ikpekoro, V. O., Samuel, P. O., Jikah, A. N., Nosu, L. C., Ekokotu, H. A., Ugbune, U., Oghroro, E. E. A., Emakpor, O. L., Ainyanbhor, I. E., Mohammed, W. A., Akpoghelie, P. O., Owheruo, J. O., & Agbo, J. J. (2024). Impact of environmental pollution from human activities on water, air quality and climate change. *Deleted Journal*. https://doi.org/10.1016/j.ecofro.2024.02.014

Kordbacheh, F., & Heidari, G. (2023). Water pollutants and approaches for their removal. mch.du.ac.ir. https://doi.org/10.22128/mch.2023.684.1039

Levin, R., Villanueva, C. M., Beene, D., Cradock, A. L., Donat-Vargas, C., Lewis, J., Martinez-Morata, I., Minovi, D., Nigra, A. E., Olson, E. D., Schaider, L. A., Ward, M. H., & Deziel, N. C. (2023). US drinking water quality: exposure risk profiles for seven legacy and emerging contaminants. *Journal of Exposure Science & Environmental Epidemiology*. https://doi.org/10.1038/s41370-023-00597-z

Shayo, G. M., Elimbinzi, E., Shao, G. N., & Fabian, C. (2023). Severity of waterborne diseases in developing countries and the effectiveness of ceramic filters for improving water quality. *Bulletin of the National Research Centre/Bulletin of the National Research Center*, *47*(1). https://doi.org/10.1186/s42269-023-01088-9

THE 17 GOALS | Sustainable Development. (n.d.). https://sdgs.un.org/goals

United Nations: UN. (2020). Clean water and sanitation: why it matters. *UN Board.* https://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/6_Why-It-Matters-2020.pdf

World Health Organization: WHO. (2023, September 13). Drinking-water. https://www.who.int/news-room/fact-sheets/detail/drinking-water

Appendix A.

Image 1.1 *PH testing of Sample 1*

Image 1.2 *PH testing of Sample 2*

Image 1.3 *PH testing of Sample 3*

Image 2 *PH testing of Distilled Sample 1*

Image 2.2 *PH testing of Distilled* ***Sample 2***

Image 2.3 *PH testing of Distilled Sample 3*

Image 3 *PH testing of Boiled Sample 1*

Image 3.2 *PH testing of Boiled Sample 2*

Image 3.3 *PH testing of Boiled Sample 3*

Image 4 *Boiling of Water*

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Image 5 *Distillation of Water*

Image 6 *Microscope Testing*

Appendix B.

MEYCAUAYAN NATIONAL HIGH SCHOOL

El Camino Road Sto Niño Village CAMALIG, Meycauayan, Philippines

CURRICULUM VITAE

PERSONAL DATA:

Name: Sabbriah M. Navarro
Age: 18
Birthday: September 26, 2006
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EDUCATIONAL BACKGROUND

SECONDARY:

Senior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2023-2024

Junior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2019-2023

PRIMARY:

Camalig Elementary School
Camalig, City of Meycauayan Bulacan
S.Y 2011-2018

CURRICULUM VITAE

PERSONAL DATA:

Name: Glive Richard DT Lubina
Age: 17
Birthday: March 22, 2007
Address: Blk 804, Lot, 32 Singapore street Phase 7, Loma De Gato Heritage Homes Marilao Bulacan.
Contact number: 0999 505 9481
Email: glivelubina@gmail.com

EDUCATIONAL BACKGROUND

SECONDARY:

Senior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2023-2024

Junior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2019-2023

PRIMARY:

Perez Elementary School,
City of Meycauayan Bulacan
S.Y. 2013 - 2019

CURRICULUM VITAE

PERSONAL DATA:

Name: Alliana Sophia E. Poja
Age: 17
Birthday: August 07, 2007
Address: #390 Cadena de Amor Street, Perez, Meycauayan City, Bulacan.
Contact number: 09614792469
Email: phiapoja@gmail.com

EDUCATIONAL BACKGROUND

SECONDARY:

Senior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2023-2024

Junior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2019-2023

PRIMARY:

Perez Elementary School
City of Meycauayan Bulacan
S.Y 2011-2018

CURRICULUM VITAE

PERSONAL DATA:

Name: John Jhared M. Miravalles
Age: 17
Birthday: May 23, 2007
Address: 41 Evangelista Compound,
Bagbaguin, Meycauayan City, Bulacan
Contact Number: 09924041952
Email: jharedmiravalles09@gmail.com

EDUCATIONAL BACKGROUND

SECONDARY:

Senior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2023-2024

Junior High School:
Meycauayan National Highschool
El Camino Road Sto Niño Village Camalig, Meycauayan, Bulacan
S.Y 2019-2023

PRIMARY:

Bahay Pare Elementary School
City of Meycauayan Bulacan
S.Y 2011-2018