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Hypo Attachment as a Tool for Manual Water Pump Filtration

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DEDICATION

This study is devoted to the supportive parents who helped the researchers in any given task. With their legal, supernatural, passionate, inspiring, and motivational aid, our research was made more fruitful.

Despite the many difficulties posed by the pandemic, committed students make an effort to learn and educate themselves using solely the resources available online. Our researchers make an effort to inspire themselves to carry out this investigation under everyone's direction.

We are grateful to the instructors who face difficulties while guiding every child to continue going forward in learning while being in pandemic times, as they were the driving factor behind the researchers' determination in concluding and establishing the research.

We also dedicate this study to our beloved Barangay Dapitan where they let us conduct our research to aim for a better review in our study and also for allowing us to use their manual hand water pump.

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ABSTRACT

Hypo Attachment as a Tool for Manual Water Pump Filtration

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This study aims to analyze and evaluate Hypo Attachment as a tool for manual water pump filtration especially during disasters, like typhoon where clean water is abundantly missing. Furthermore, This study determines to analyze and evaluate its effectiveness on balancing the pH scale, And lowering its TDS PPM and Salinity level. The researchers choose barangay Dapitan as the place where they would conduct their research as it is abundant in manual water pumps that are unused .After choosing the place where the testing I conducted, The researchers liquidate the the expenses on the production of the Hypo Attachment, and for the water tester. The test is carried out promptly after the creation the hypo attachment. This study applied the experimental method of research design where the researcher finds factual information that supports our study and to find an experimental way to use the Hypo Attachment as tool for manual water pump filtration. The finding shows that the Hypo Attachment is effective in balancing and keeping the pH level neutral, although it also showcase that it didn't have any effect on with high TDS PPM levels but show no disturbance on low Salt levels.

Keywords: Hypo Attachment, Manual Water Pump, pH Scale, TDS PPM, Salinity level, barangay Dapitan

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Chapter I

THE PROBLEM AND ITS SCOPE

Rationale

Water in the Philippines is becoming very abundant as time progresses. Many clean sources have been discovered and many cheap alternatives that had a lot of downsides have now been abandoned in time, especially the manual water pump. This type of mechanism breaks down easily and is susceptible to rusting, which causes iron poisoning (Wikiwater, E36). While also being a breeding place for microbacterial growth, according to Kay C. Potargo and Carin M. Magtibay (2022). Although this type of mechanism is abandoned due to its flaws, it's still the second best in terms of emergencies, and this study aims to make it more usable, especially during emergencies.

Typhoon Odette has led people to use Manual Pump Water despite its disadvantages and the possibility of getting sick due to harmful mycobacterial. A study conducted by Toure, A. and Wendia, D. Appl Water Sci 10, found out that many harmful microbes are living inside manual water pumps. This type of microbe is what people in the Philippines are forced to use during an emergency as many people are only relying on filtered water. This has led to an increasing number of Typhoid cases where they got from using Manual Pump Water ("Typhoon Odette Linked to Barili Typhoid Cases"), so people would do their best to secure clean water despite its scarcity. This is evident, as according to Munez, Ligaya of HEA Manager, many people were waiting hours in line for clean water but to no avail. This has led some people to pay more just to skip the line. Witnessing how people go to great lengths in order to get healthy water.

An article published by Science Direct, Water Filtration (2016) showed that multiple materials are capable of water filtration. This could be nonwoven, ionized resin, nanofibers, membranes, graphene and many others that can be used for water filtration. The benefits of water

filtration are published by Watercare UK showcase that filtering one's own water is cost effective, environmentally beneficial, and water feels clean and refreshing. These benefits can be considered quality of life improvement towards dirty water, furthermore filtration can be done cost effectively and can be maintained quite easily.

Research on water purification proved to be useful on purification of fluorine on cleaning water (et al., 2015). This is done through commercial brand water purifiers and has been proven effective. But this could be done using traditional media filters where sand and glass is most common. (Lugo-Arias et al., 2020, pp. Volume6, Issue1) studied low cost filters and found out that they have reduced the total metal and bacteria to 98% and 77% percent of it respectively. This showcase that filtration are capable of producing clean water for the usage of everyday but the study also showed that this is not safe for consumption as its not putting chemicals to filtered out the hard materials

Cost-effectiveness is an important consideration for any project or initiative, particularly in areas where resources may be limited. By designing this hypo attachment for manual water pumps that is affordable and cost-effective, we can ensure that it will be accessible to as many people as possible in Barangay Dapitan.

Ease of use is another crucial factor to consider, especially in emergency situations where time may be of the essence. A hypo attachment that is simple to install and operate will be more effective in ensuring that residents have access to clean running water when they need it most.

Theoretical Background

This study aims at the significant theories and concept of water filtration. The following theories will be beneficial in achieving the purpose of this study namely “Water Microbiology. Bacterial Pathogens and Water”, Water Purification: A Brief Review On Evaluating The Impact of Water Used In Purification, Solid-liquid separations in Suspension Atomization Theory.

Water Purification Theory

A Brief Review On Evaluating the Impact of Water Used in Purification, this theory aims at the water quality measurement, observation, and analysis. These are essential for stimulating and predicting the distribution, danger, and quantity of various biological and chemical contaminants found in water resources. Filtration effectiveness can be checked by evaluating the flow rate, loss coefficient growth, and outflow quality features on a regular basis. Flow rates differ depending on the type of filter, the filtration media, the facility, and the quality of the purified water. Filtration is a fundamental procedure in water purification. For these reasons, experts have been attempting to improve the efficiency of the existing filtration procedures.

Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal of this process is to produce water fit for a specific purpose. Most water is disinfected for human consumption (drinking water) but water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacological, chemical and industrial applications. In general, the methods used include physical processes such as filtration, sedimentation, and distillation, biological processes such as slow sand filters or biologically

active carbon, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light.

The purification process of water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi; and a range of dissolved and particulate material derived from the surfaces that water may have made contact with after falling as rain. The standards for drinking water quality are typically set by governments or by international standards. These standards will typically set minimum and maximum concentrations of contaminants for the use that is to be made of the water.

Visual inspection is incapable of determining whether water satisfies their standards for quality. All potential pollutants that can be harmful to aquatic life from an unknown source cannot be treated with easy steps like boiling or the use of a domestic activated carbon filter. Even natural spring water, which was regarded as entirely safe in the 19th century, must today be tested in order to determine whether any treatment, if any, is necessary. Even if they are costly, chemical and microbiological analysis is the only way to get the data needed to choose the best procedure.

In addition to evaluating the impact of water used in purification, it is also important to consider the environmental impact of the purification process itself. The use of chemicals and energy in the purification process can have a negative impact on the environment, and it is important to explore alternative technologies and methods that can reduce this impact. For example, the use of renewable energy sources and natural filtration methods can help to reduce the carbon footprint of the purification process, while also improving the quality of the water produced.

Theoretical Framework

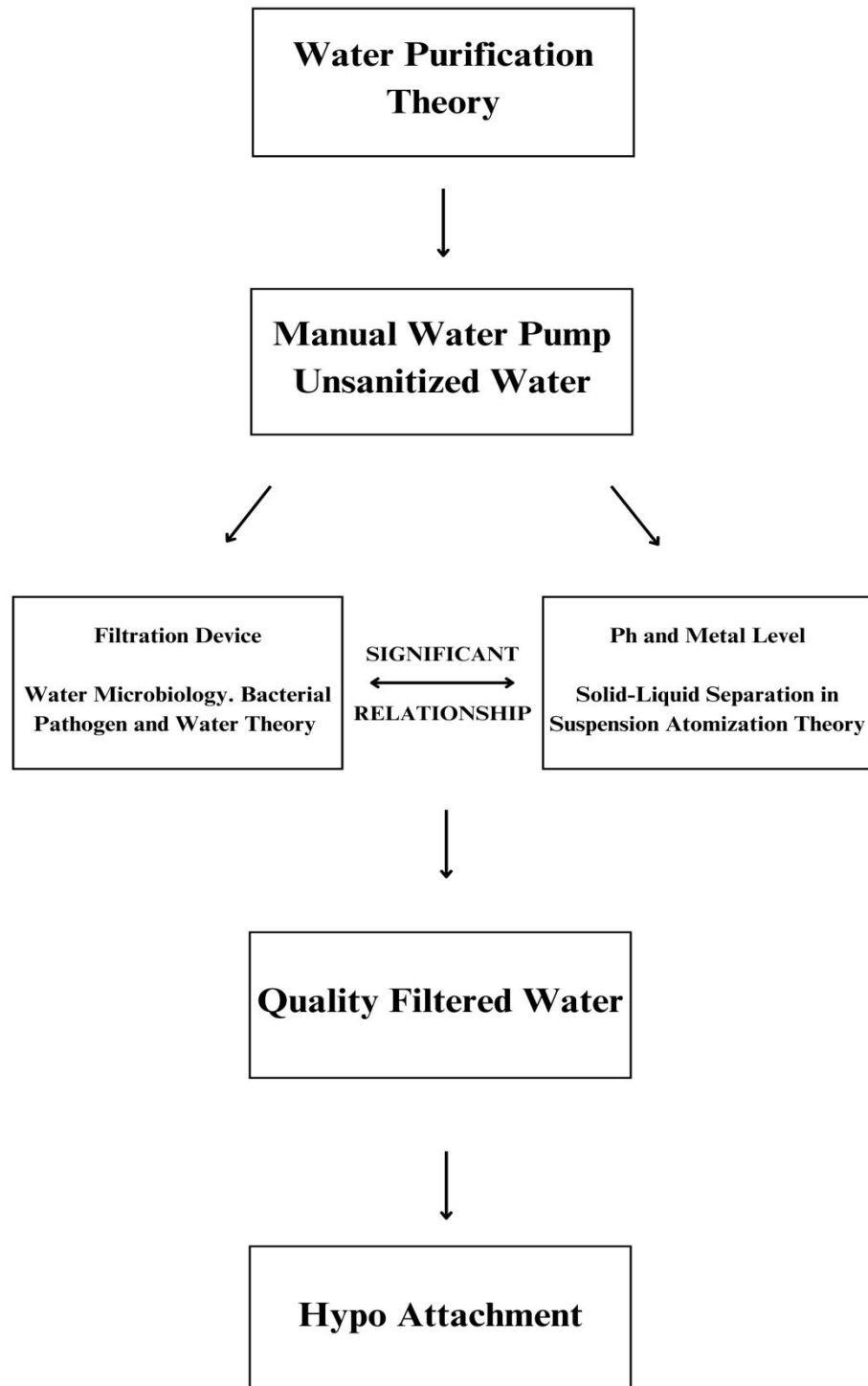


Figure 1. *A Schematic Presentation of the Theoretical Background of the Study*

Water Microbiology. Bacterial Pathogens and Water Theory

The overall characterization of the most significant bacterial diseases transmitted via water—cholera, typhoid fever, and bacillary dysentery—is introduced with emphasis on the biology and ecology of the causal agents, as well as the attributes and life periods of the diseases in the environment. The principle of fecal indicator bacteria supports microbiological water analysis. This principal bacteria is mainly found in human and animal feces, as well as their activity in their carriers and in the environment.

Fecal indicator bacteria are the basic foundation for microbiological water analysis. The most significant fecal indicator bacteria are described and discussed, along with the major bacteria found in both human and animal feces (with an emphasis on how they interact with their hosts and the environment) (focusing on the advantages and limitations of their use as markers). Also briefly mentioned are essential contributors of bacterial fecal contamination of environmental waterways. Which fecal contamination indicators should be utilized in the existing water supply microbiological analysis is covered in the last topic. It was determined that providing everyone with access to safe drinking water is one of the century's greatest problems and that drinking water should always be subject to microbiological control standard basic (testing for a preliminary screening for emergency fecal pollution outbreaks).

Besides fecal indicator bacteria, there are other methods and technologies available to improve water quality and prevent waterborne diseases. These include disinfection methods, filtration, sedimentation, and genetic sequencing. By combining different approaches, we can ensure the provision of safe and clean drinking water to communities worldwide. furthermore, advances in genetic sequencing have allowed for the identification of specific pathogens and the

monitoring of microbial communities in water sources. This technology can help in early detection and prevention of waterborne disease outbreaks, as well as the development of targeted treatment strategies.

Solid-liquid Separations in Suspension Atomization Theory

Determine the fragmentation process during suspension atomization. In terms of solid particulate matter, two distinct regimes of suspension atomization have already been discovered. It demonstrates that absolute solid-liquid separation in the suspension spray is possible. Filtration is an excellent separation process for separating mixtures containing an insoluble material and a liquid. Solid-liquid separator is a significant device for the purification step of manure and wastewater mixtures, removing solids from sludge and making both liquid and solid components more amenable for future biological treatment.

Suspension droplets are atomized droplets formed from suspensions of relatively small solid particles (containing liquid and solid particles). In this instance, a correlation between the drop size distribution in a twin-fluid nozzle's spray and the flow rate has been established. When the suspended solid particle size exceeds a threshold value, solid particles and liquid will become increasingly more separated, according to droplet size measurements in the suspension spray with various solid particle sizes. A bimodal size distribution in the suspension spray serves as an indicator of this effect. The pure liquid drops are demonstrably smaller than the separated solid particles, demonstrating that complete solid-liquid separation in the suspension spray is possible.

Statement of the Problem

This study is to conduct a comprehensive analysis and evaluation of the effectiveness of hypo attachment as a mean of improving water quality through manual water pump filtration. This aims to provide a thorough understanding of the potential benefit and limitations of using hypo attachment in manual water pump systems for water filtration purposes.

Specifically, this sought to answer the following questions:

1. What degree of filtration does the manual wastewater pump's hypo-attachment provide?
2. What role does the hypo attachment provide in alleviating the lack of clean running water?
3. How effective is the hypo attachment on filtering after the experiment?
 - 3.1. pH Level;
 - 3.2. Metal Levels;
4. Based on the finding, what recommendation can be implemented

Statement of Proposition and Hypothesis

Proposition:

The hypothesis being tested in this study is that hypo attachment can balance pH levels and lower metal debris in water through manual water pump filtration

Null Hypothesis:

Ho1.

There are no significant evidence that Hypo Attachment can filter manual waste water.

Ho2.

There are no significant evidence that Hypo Attachment can alleviate the lack of clean running water.

Ho3.

There are no significant evidence that Hypo Attachment can balance the Ph level and Metals in the water.

Ho4.

There are no significant evidence that Hypo Attachment can be implemented in the public

Scope and Limitations

The Hypo attachment filtering device is most typically used to strain out larger pollutants from water. A manual water pump contains components that are toxic to obtain in the human body if no adequate filtration method is employed. This research is being carried out in Barangay Dapitan, Cordova, Cebu. There are an estimated 20 manual water pumps in Dapitan. The researcher concentrates on four public manual water pumps that are accessible to residents.

The manual water pump filtration is built for unwanted impurities, quality, to result better quality of water and testing pathogen, Bacteria is excluded in the attachment during filtering. It remains to be seen whether this experimental configuration can be utilized as an option for water shortages.

This study was conducted during the first semester of S.Y. 2022–2023. The goal of this experiment is to evaluate its effectiveness. It is necessary to determine whether this manual hand filtering method is successful and whether it can be utilized for an emergency purpose. One of the processes to verify and prove the effectiveness is pH scale water testing, Total Dissolve Solids particles per meter, and salinity levels.

The researcher excluded testing Pathogen, bacteria, durability, percentage of particles of certain size, photometric test, colorimetric comparison test. This type of filtration needs to be happen at the source of extraction while the hypo attachment only filtered the delivered water of the water pump.

Significance of the study

This study was conducted with a goal, purpose, and information that will help the residents of Barangay Dapitan with water filtration. Hence, they have a lot of access to hand water pumps, which can be used in emergencies and this would help them survive during unforeseen circumstances. This study would benefit the following:

Researchers. This will be a tool that will guide them to ensure their product's effectiveness. Thus, to have stronger information that could help them conduct a wiser and better outcome.

Residence of Barangay Dapitan. The residents of Barangay Dapitan would highly gain a lot of benefits from this study, especially during uncertain circumstances, if you look into the situation of typhoon Odette. They have easy access to any hand water pumps.

Barangay Officials. The officials of the barangay would gain a lot of information on where and what to improve in their community, as well as the pros and cons. Wherein, it could help them develop more facilities that could help them during unexpected circumstances and are easily accessible to the residents.

Future Researchers. Future researchers can benefit from this study. They can gain a lot of pieces of information that could guide them to have a strong foundation for their future research project.

Respondents

The study involved the residents of Purok 3 in Barangay Dapitan, who served as respondents. There were approximately 20 manual water pumps in the area, but the research focused on four public pumps that were easily accessible.

Definition of Terms

To further more understand the content of this study, here are some keywords to help you out: Attachment. This is an additional component or extension that is or can be attached to a hand water pump in order to perform filtration.

Manual Water Pump. This term refers to water-lifting devices that can be manually operated to extract water from surface water sources, groundwater sources, or to pump water into distribution systems.

Salinity. This term refers to the salt content of water or soil. It is typically measured in parts per thousand (ppt) or percentage (%).

TDS PPM. This is a TDS (Total Dissolved Solids) is a measure of the weight of all inorganic and organic substances present in water, expressed in parts per million (ppm)

Filtration. This term is an alternative tool used in manual water pump to remove impurities and suspended particles from a fluid, such as water, by passing it through a porous material.

pH level. This term is a tool to measure the acidity or alkalinity of a the water. The pH scale ranges from 0 to 14, with a value of 7 being neutral, values below 7 indicating acidity, and values above 7 indicating alkalinity..

Usable. This determines how conveniently the filtration will be utilized.

Waste Water. This term refers to water that has come from manual water pump and is still untested

Hypo Attachment. This term refers to a capstone product where it can effectively filter manual water pump.

Chapter II

REVIEW OF RELATED LITERATURE AND RELATED STUDIES

This chapter presents the related literature and studies, foreign and local which researchers have thoroughly searched and considered as relevant to the present study.

Related Literature

A water treatment system refers to any system or process that is used to filter particles and pollutants from water (Mifflin, 2020). It depends on their materials to filter certain particles present in the water. Each material blocks or absorbs particles depending on its physical or chemical property. Most of the water filters today do not filter metal ions that may be present in the water. The main focus of this research is to make a household physical water treatment system that will filter turbidity, acidity or basicity, oil and grease, metal ions, and foul odor. The choice of the right materials is important for the water treatment system to filter effectively.

First of all, water treatment systems work in two ways - physical filtration and chemical filtration. Physical filtration uses gauze-like membrane-like sand or gravel to remove larger particles. Chemical filtration uses active materials that remove impurities chemically as they pass through (Woodford, 2020). The most common materials used in physical filtration systems are activated carbon, gravel, and sand (Cuffari, 2019).

Activated carbon's molecular structure enables it to attract other molecules. It has a large surface area and intermolecular forces attract pollutants into the millions of pores and pockets on the surface (Carbon Block Technology, 2018). It can remove organic compounds that affect the taste, odor, and color of the water, and reduce chlorine, pesticides, and other compounds.

PH scale is an important quantity that reflects the chemical conditions of a solution. The PH can control the availability of nutrients, biological functions, microbial activity, and the behavior of chemicals. Because of this, monitor or control the pH of the water. Whether treating drinking water or waste water, PH is important. The PH of drinking water should be between 6.5 and 8.5. Low-PH drinking water can degrade pipes, causing toxic metals such as copper and lead to leach into the water supply. Water with a PH that is too high has an unpleasant taste, and the effectiveness of disinfectants such as chlorine is decreased (Siwek, 2020).

Ensuring a safe water supply for communities across the United States is a growing challenge due to aging infrastructure, impaired source water, strained community finances, etc. In 2019, about 6% of public water utilities in the U.S. had a health-based violation. Due to the high risk of exposure to various contaminants in drinking water, point-of-use (POU) drinking water treatment is rapidly growing in popularity in the U.S. and beyond. POU treatment technologies include various combinations of string-wound sediment filters, activated carbon, modified carbon, ion exchange and redox media filters, reverse osmosis membranes, and ultraviolet lamps, depending on the contaminants of concern. While the technologies are well-proven, highly commoditized, and cost-effective, most systems offer little in the way of real-time performance monitoring or interactive technology like other smart home appliances (e.g., thermostats, smoke detectors, doorbells, etc.). Herein, we review water quality regulations and violations in the U.S. as well as state-of-the-art POU technologies and systems with an emphasis on their effectiveness at removing the contaminants most frequently reported in notices of violations. We conclude by briefly reviewing emerging smart water technologies and the need for advances in these state-of-the-art technologies. The smartness of commercially available POU water filters is critiqued, and a definition of a smart water filter is proposed.

In drinking water treatment, filtration plays an important role in the multi-barrier approach employed for the removal of pathogens. The presence of suspended solids and other particulate matter in water increases the resistance of most microbes to disinfection. Therefore, high performance in the removal of particles achieved by granular filtration can increase the disinfection efficiency. Although sand is one of the major filter media, alternative media have been developed and used in recent years. In this review, the performance of alternative media is compared with traditional sand/anthracite for drinking water treatment. Advantages in the use of alternative media, especially glass media, have been found, including high filtration performance in removing residual particles and turbidity, minor modification requirements to the existing filtration configuration and slow head loss development. However, before the employment of them in industry, additional tests are recommended. In particular, full scale tests with variations in the operating conditions and analyses of pathogen removal should be performed. Moreover, this paper reviews the filtration processes and operating configurations which provide overall references to those who are studying and working in the field of water technology and treatment. In this paper, legislations/standards of safe drinking water are summarized as they are the driving force of developing new treatment technologies; mathematical modules for predicting the media filtration performance are briefed. Finally, future work on the application of alternative filter media is recommended. (Cescon 2020).

The existing water filtration device has features that can be developed to be more useful and functional during emergency situations. The project's development has been aided by the following provisions. In PEC, NEC, NEMA, and the Philippine National Standard for Safe Drinking Water, standards are provided for the construction of the project. These standards protect both the prototype and the user. These also served as guides for the maintenance of every

component. This also shows its effectiveness and reliability based on the results of the discharging test, water quality test, and water production test. The materials and components used are cost-effective and efficient. The time for charging the battery using the solar panel is from 9:00 am onwards, while the hand crank generator is too slow because the generated current is small. The water filtration device is very efficient regarding the operating hours and water production. The machine may have a great effect on society and the economy in generation of clean, available water at a lower cost.

Related Studies

A. Foreign Studies

In the study of Amadou Toure and Duan Wenbiao, (2020) entitled **“Physicochemical and microorganism analysis of some hand pump water in Pelengana, Segou, Mali ”**, this study aimed to experiment with the effectiveness of microfiltration using hand pump water. In the majority of Mali's rural communities, groundwater obtained via hand pumps might serve as the primary source of drinkable water. In fact, it was discovered that this source was the most secure for supplying water needs in rural, isolated parts of low-income nations like Mali. However, once foreign contaminants are allowed to come into contact with the water table, the quality of the groundwater changes. In the rural commune of Pelengana, Mali, the physical, chemical, and microbiological characteristics of the hand pump water were assessed. Utilizing accepted analytical techniques, the following characteristics were examined: physical (temperature, pH, and turbidity), chemical (nitrate, and phosphate), and microbiological (both fecal and total coliform bacteria).

Additionally, the API 20E test was utilized to identify the isolates. The results have been compared to values from the WHO drinking water recommendations or other sources. While microbiological concentrations during the rainy season were over the WHO permissible limits, all physicochemical parameters in hand pump water samples were within the limit indicated by the WHO guideline (or other) values except for turbidity and nitrate. Because hand pump fluids include organisms including *Escherichia coli*, *Salmonella*, and *Klebsiella*, it is likely unsafe to drink the water directly from these sources without first treating it.

In the study of Aamer Ali, (2018) entitled **“Evaluation of integrated microfiltration and membrane distillation/crystallization processes for produced water treatment”**, this study aimed Proper management and treatment of produced water has emerged as a major challenge for the oil and gas industry. Increasingly stringent environmental regulations and economic constraints are compelling the use of more advanced treatment methods. Membrane operations are gaining significant interest for this application due to their broad range of separation capabilities, high efficiency, and low operational cost. Commercially less-adopted membrane operations, such as membrane distillation (MD) and membrane crystallization (MCr), are gaining significant interest for produced water treatment due to their almost concentration-independent performance and lower fouling potential. The current study analyzes the performance of an integrated microfiltration (MF) and direct contact membrane distillation (DCMD)/membrane crystallization (MCr) system for freshwater and mineral recovery from produced water. Based on the experimental data, thermodynamic, energetic, and quantitative analyses have been performed. The performance of the integrated processes has been compared with that of the conventional multi-stage flash (MSF) in terms of process intensification metrics.

In the study of Kathleen Ward Brown, (2017) entitled "**Potential effectiveness of point-of-use filtration to address risks to drinking water in the United States**", Numerous contemporary incidents demonstrate that conventional control strategies for municipal tap water have limited ability to mitigate exposures to chemicals whose sources are within distribution systems, such as lead, and chemicals that are not removed by standard treatment technologies, such as perfluorooctanoic acid (PFOA)/perfluorooctanesulfonic acid (PFOS). In these situations, point-of-use (POU) controls may be effective in mitigating exposures and managing health risks of chemicals in drinking water, but their potential utility has not been extensively examined. As an initial effort to fill this information gap, we conducted a critical review and analysis of the existing literature and data on the effectiveness of POU drinking water treatment technologies for reducing chemical contaminants commonly found in tap water in the United States. We found that many types of water treatment devices available to consumers in the United States have undergone laboratory testing and often certification for removal of chemical contaminants in tap water, but in most cases their efficacy in actual use has yet to be well characterized. In addition, the few studies of POU devices while “in use” focus on traditional contaminants regulated under the Safe Drinking Water Act, but do not generally consider nontraditional contaminants of concern, such as certain novel human carcinogens, industrial chemicals, pesticides, pharmaceuticals, personal care products, and flame retardants. Nevertheless, the limited information available at present suggests that POU devices can be highly effective when used prophylactically and when deployed in response to contamination incidents. Based on these findings, we identify future areas of research for assessing the ability of POU filters to reduce health-related chemical contaminants distributed through public water systems and private wells.

B. Local Studies

In the study of Jocelyn, (2016) entitled “**Cheap way to filter water for the poor**”, this study aimed to access safe drinking water. The Department of Science and Technology (DOST) recently developed a pitcher equipped with a water filter made from soil, pebbles, sand, and cotton that can make deep wells and tap water clean and safe to drink. Hopefully, with this technology that is very cheap and reusable, we will help more Filipinos get access to clean and potable water, "said Carlos Primo David, executive director of the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD). If households with poor water sources were equipped with this filtering device, the country's accessibility rate to potable water would rise from 82.9 percent in 2007 to 86.6 percent this year, according to DOST. It is also cost-effective and sustainable since hypo attachment is an abundant resource in many parts of the country, such as Ilocos Sur, Isabela, Aurora, Tarlac, Camarines Sur, Sorsogon, Aklan, Leyte, and South Cotabato provinces, and Cagayan de Oro City. The filter can purify tap water and that from deep wells and hand water pumps.

In the study of Ferrer, (2019) entitled “**An Investigatory Study of Water Filtration**”, a water filtration project is a process that can remove unwanted substances in water using materials such as pebbles, sand, and charcoal and turn it into water that can be used for everyday habits and can eventually be drunk. Charcoal is activated to remove chlorine. Pebbles are used to trap and strain particles in the water. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt. This study utilized a quantitative analysis method of research. It also utilized a questionnaire to test the level of acceptability of the water filtration process in terms of color, suspended particles, and usefulness, and was assessed by five science experts and five science

teachers of Bestlink College of the Philippines. To determine the level of acceptability of the water filtration process, the researchers used a t-test to test the significant differences between the assessments of the Science Experts and Science Teachers at the level of significance of $= 0.01$ and the degree of freedom of 8. The level of acceptability of the water filtration process in terms of color, suspended particles, and usefulness is moderately acceptable as assessed by the science experts and science teachers. There is no significant difference between the assessment of the science experts and science teachers on the level of acceptability of the water filtration process in terms of color, suspended particles, and usefulness.

In the study of Cristina Tuser (2021), entitled “**The Effectiveness of Water Filtration in Barangay Paa**”, Water purification takes place on small and large scales, and water filtering can provide clean and potable water for industrial applications in addition to individual households. The Philippines is one country with many communities in need of clean water. According to UNICEF, the number of Filipinos without access to safe drinking water is approximately 17 million. iv Over 15% of the rural communities in the Philippines do not have access to potable water due to limited income. (S. Gallardo 2010) Filtration is the process of removing undesirable chemicals, biological contaminants, and suspended solids from contaminated water so as to produce safe and clean drinking water. Filtration methods include reverse osmosis filtration, slow sand filtration, activated carbon filtration, ceramic filtration, membrane filtration, cloth filtration, rapid sand filtration, and household sand filtration. Boiling and cloth filtration of water are often recommended by health workers to communities where pipeborne water does not exist. In most of the hinterlands of Ghana, there are wells, dams, lakes, However, many of these water sources are not safe for consumption due to contamination from human activities such as mining, agriculture, and improper waste disposal.

Chapter III

Research Methodology

This chapter discusses the methodology and procedures in conducting the study. It includes the processes particularly the design, environment, respondents and instruments, methods of obtaining data and the analysis of the data that is used to answer the problems of the study.

Design

This research was designed with experimental research. This aims to comprehensively analyze and evaluate our hypo-attachment toward the filtration of manual water pump water. It will give a set of data on which part of the attachment can be improved and how effectively it can filter. The result will be demonstrated by a graph bar and how effectively clean it is in comparison to unfiltered water. It also employs the help of a quantitative set of data in regards to helping the viewers understand the flow of the given experiments.

Environment

The research is being carried out at the Brgy. Dapitan, Cordova, Cebu. There are an estimated 20 manual water pumps in Dapitan. The researcher concentrates on four public manual water pumps that are accessible to residents. To evaluate the water quality, it is necessary to determine whether this manual hand filtering method is successful and whether it can be utilized for an emergency purpose.

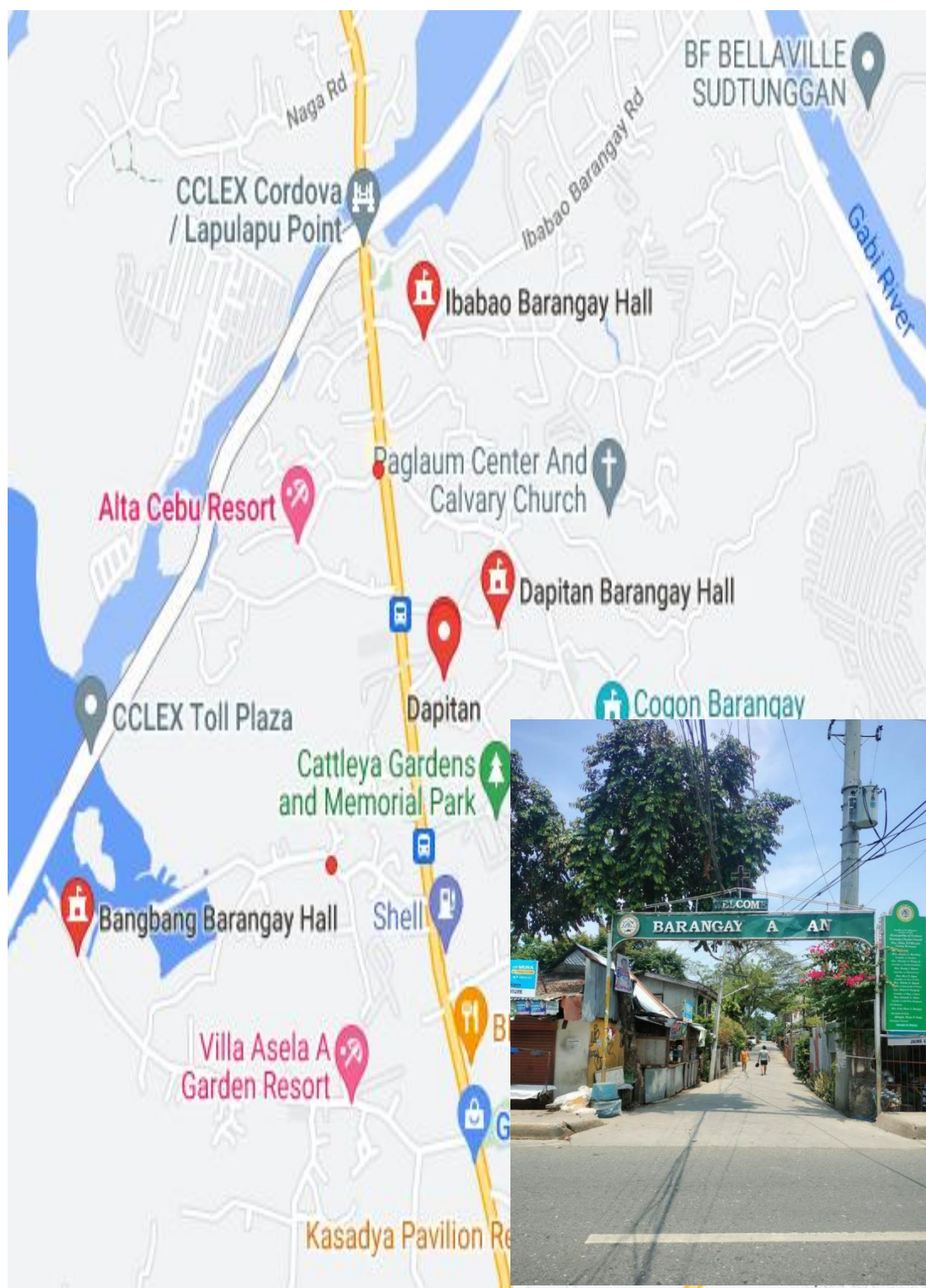


Figure 2. *Locale of the Study*

Instrument

In this research study, two research instruments were used to collect data on water quality. The first instrument is a 14 in 1 Strip test, providing a general overview of the difference between unfiltered and filtered water. The second instrument is a Multifunctional tester, providing specific and accurate measurements of the factors being studied. To ensure fairness, both instruments were tested on all 4 manual water pumps with varying degrees of quality. Overall, these instruments provide a comprehensive understanding of water quality and allow for informed decisions about water treatment and management.

Procedure of Data Gathering

In this research study, the effectiveness of the hypo attachment in the filtration of manual water pumps was measured using research tools. To conduct the testing, a letter was sent to individual houses asking for permission to conduct the water filtration experiment. Once approval was obtained, the researchers went to the designated testing houses with the manual water pumps.

To collect data on water quality, the researchers used two tools. The 14 in 1 Strip test was used initially to provide a general understanding and showcase the immediate differences in water quality. Afterward, the Multifunctional tester was used to collect specific data.

Treatment of Data

Significant data were collected and accumulated to analyze. Appropriate statistical tool were employed to quantify or qualify the data collected and interpret to serve as an answer to the problem set on this study.

Chapter IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter gives the summary of findings, conclusion and recommendations drawn from the data through the research instrument and statistical analysis. Furthermore, an instructional material is hereby suggested for the enhancement regarding this study.

Hypo Attachment PH Level in Comparison to Naked Water Pump

This table shows the comparison between Hypo Attachment and Naked Water Pump on their testing. This test was conducted three times to ensure stability. Every pump has its own highness and lowness although the majority of them are within the same category.

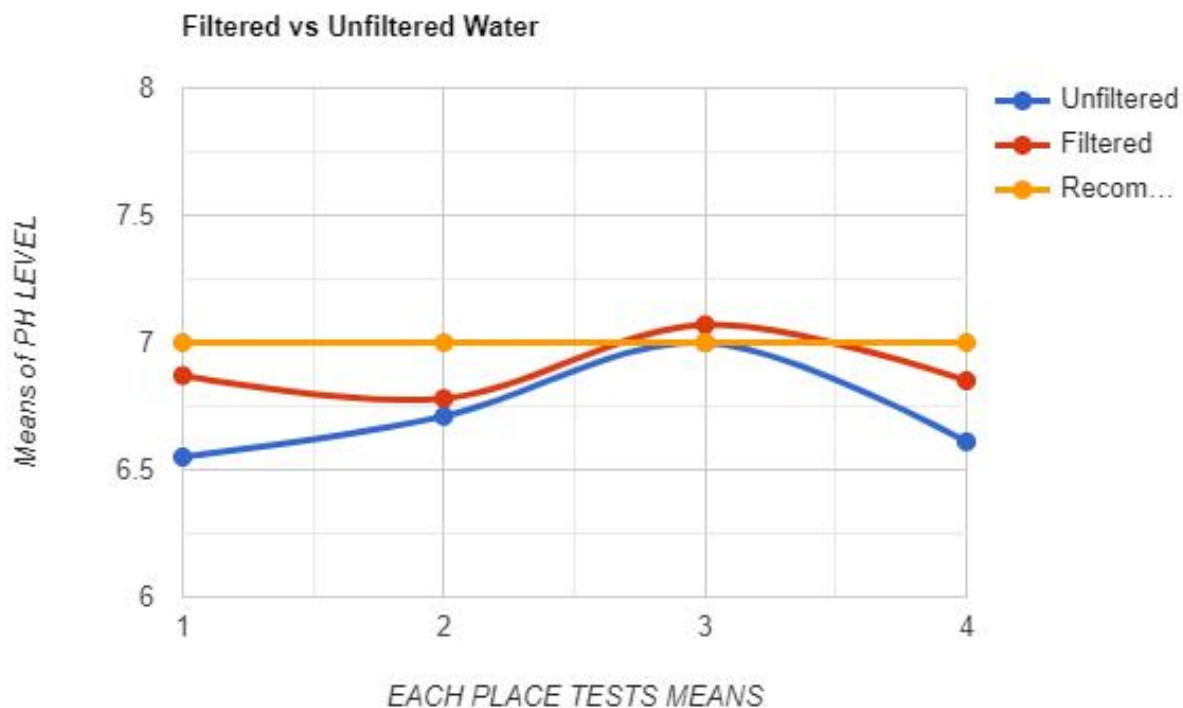
Table 1

pH Scale Comparison

Manual Water Pump	1st	2nd	3rd	4th	Observation
Unfiltered Test 1	6.64 pH	6.72 pH	6.98 pH	6.61 pH	Different Water Pumps have varying pH level
Unfiltered Test 2	6.74 pH	6.70 pH	7.10 pH	6.61 pH	
Unfiltered Test 3	6.28 pH	6.70 pH	6.93 pH	6.63 pH	
Mean	6.55	6.71	7.00	6.61	
Filtered Test Test 1	6.83 pH	6.74 pH	7.02 pH	6.84 pH	Filtration seems to keep the water pH level to 7.0
Filtered Test Test 2	6.88 pH	6.82 pH	7.06 pH	6.85 pH	
Filtered Test Test 3	6.92 pH	6.77 pH	7.13 pH	6.88 pH	
Mean	6.87	6.78	7.07	6.85	
Improvement	+0.32	+0.7	-0.7	+0.24	

Legend: pH Scale: 1 - 6 Acidic. 7 Balance. 8 - 10 Alkaline. The closer to 7 the better

Table 2

pH Scale Graph Comparison

This table show the analysis of the data, as it showcase that the hypo attachment is effective in balancing the pH level of the water and ensuring that it is appropriate for consumption. The table demonstrates that the hypo attachment is able to increase the pH level of the water to a level that is considered proper and appropriate for consumption.

It is worth noting that when the pH level of the water is already within an adequate range, the hypo attachment only increases the pH level by a small amount. This is demonstrated in the second and third manual water pumps, where the pH level is already in balance, and the hypo attachment only increases the pH level by a small amount.

Table 3

TDS PPM Comparison

Manual Water Pump	1st	2nd	3rd	4th	Observation
Unfiltered Test 1	464 PPM	425 PPM	258 PPM	643 PPM	Different Water Pumps have different TDS PPM
Unfiltered Test 2	465 PPM	423 PPM	256 PPM	645 PPM	
Unfiltered Test 3	468 PPM	423 PPM	257 PPM	645 PPM	
Mean	465.6	423.6	257	644.3	
Filtered Test Test 1	469 PPM	428 PPM	275 PPM	659 PPM	Filtration didn't have any tangible effect on TDS PPM
Filtered Test Test 2	459 PPM	426 PPM	262 PPM	658 PPM	
Filtered Test Test 3	465 PPM	428 PPM	264 PPM	657 PPM	
Mean	464.3	427.3	267	658	
Interpretation	≈	≈	≈	≈	

Legend: 100 - Very good, 200 - very good still, 300 - good 400 medium, 500+ concerning, 1000 danger level

This table shows analysis of the data, as it showcase that there was an attempt to balance the pH scale by introducing a hypo attachment. However, this intervention has resulted in an increase in the total dissolved solid parts per million (TDS PPM) level, which is a cause for concern. The reference values for TDS PPM indicate that a healthy level is around 100, while a level of 500 is considered poor but still drinkable.

Although the increase shown in the data may not be statistically significant due to the high initial ppm value, it is still important to consider the potential health implications of an elevated TDS PPM level. Therefore, it is crucial to investigate the underlying cause of the increase and implement appropriate corrective measures.

Table 4

Salt Level Comparison

Manual Water Pump	1st	2nd	3rd	4ft	Observation
Unfiltered Test 1	0.04%	0.04%	0.02%	0.06%	Different Water Pumps have different salt levels
Unfiltered Test 2	0.04%	0.04%	0.02%	0.06%	
Unfiltered Test 3	0.04%	0.04%	0.02%	0.06%	
Mean	0.04	0.04	0.02	0.06	
Filtered Test 1	0.04%	0.04%	0.02%	0.06%	Filtration didn't have any effect on the salt level
Filtered Test 2	0.04%	0.04%	0.02%	0.06%	
Filtered Test 3	0.04%	0.04%	0.02%	0.06%	
Mean	0.04	0.04	0.02	0.06	
Interpretation	≈	≈	≈	≈	

Legend: below 1.0 is low, 3,5 is normal and above that is high

This table shows salinity levels of the water samples were assessed based on the data provided in the table. The measured salinity levels for the unfiltered water samples were 0.4, 0.04, 0.02, and 0.06, while the filtered water samples had corresponding salinity levels of 0.4, 0.04, 0.02, and 0.06 as well. The data indicates that there were no significant differences in the salinity levels between the unfiltered and filtered water samples, as the values were identical for both groups. This suggests that the filtration process did not have an impact on the salinity levels of the water samples.

Chapter V

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

This chapter gives the summary of findings, conclusion and recommendations drawn from the data through the research instrument and statistical analysis. Furthermore, an instructional material is hereby suggested for the enhancement regarding this study.

Summary of Findings

The study conducted on the Hypo Attachment as a Tool for Manual Water Pump Filtration has shown that it is an overall improvement compared to raw manual water pump water. The results demonstrate the effectiveness of the hypo attachment in improving the quality of the water.

The study found that the hypo attachment is effective in balancing the pH level of the water, with a notable increase observed in acidic water. This suggests that adjusting the frequency of adjustment can lead to optimal results. Additionally, while the TDS PPM level did increase due to the hypo attachment, the increase was not significant, as the baseline TDS PPM level was already high. The salinity level remained unchanged, which is a benefit as the baseline is already low.

Moreover, the study found that the hypo attachment was effective in balancing the metal levels in the water, resulting in improved water quality compared to unfiltered water. The study demonstrates that the hypo attachment is a viable solution for manual water pump filtration, providing safe and clean drinking water.

Conclusion

In summary, the study on the Hypo Attachment as a Tool for Manual Water Pump Filtration demonstrates the potential of the hypo attachment in improving water quality. The results of the study indicate that the hypo attachment is effective in balancing the pH level of the water, balancing harmful metals, doesn't impure the positive baseline and improving overall water quality.

The study's findings provide important insights into the effectiveness of the hypo attachment as a tool for communities with limited access to clean water sources. While further research may be necessary to fully understand the long-term effects of using the hypo attachment on water quality and health, the results of the study are promising and highlight the importance of exploring innovative solutions to improve access to clean water.

Recommendation

Out from the results obtained from the study and the conclusion made, the following are recommendations and/or suggestions can be applied:

1. Using the Hypo Attachment in situations of crisis where there is a severe dearth of clean, flowing water.
2. A widespread installation in the barangay to make it simpler to reach the barangay in times of emergency.
3. Increasing the lifespan and endurance of the hypo attachment.
4. This product has to be upgraded to become a filtration gadget that is even better.
5. Increasing the hypo attachment's ability to reduce salinity and TDS ppm levels.

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APPENDICES

APPENDIX A

Transmittal Letter

Group 3

Cordova Catholic Cooperative School

Cordova, Cebu City

November 25, 2022

Residents of Purok Three

Purok Three in Barangay Dapitan


Cordova, City of Cebu


Dear Residents of Purok Three,

For our research, we would like to request permission to conduct an experiment. For our attachment, we would like to use your manual water pump. Only the effectiveness of our hypo-attachment in filtering will be confirmed by this experiment. Your manual water pump will solely be used by us to carry out our experiment; we won't be changing any of its mechanical components.

Sincerely yours,


ABARQUEZ CATHREL MAE


BAGTIAO KENT RG


BARAQUIL, MA.KRISTINA

Be
BERING, MICHELLE RUFIA
Chavez
CHAVEZ, ARCEL
Conahay
CONAHAY, SHANIA SHANE
Dico
DICO, SASKIA
Galan
GALAN, MARGARET MARY
Manayon
MANAYON, REAL
Mirafuentes
MIRAFUENTES, JUSTINE

Noted by:

Jay Pe Terson Indoc
Research Adviser

Approved by:

Rodser S. Baguio
Rodser S. Baguio
Roland B. Fogoy
Roland B. Fogoy
Julita E. Baguio
Julita E. Baguio
Carmenita M. Manayon
Carmenita M. Manayon

Appendix B

Documentation





Curriculum Vitae



Arcgel Bataluna Chavez is a 12th-year senior high school student at Cordova Catholic Cooperative School who is taking up the STEM (Science Technology Engineering Mathematics) strand. He is 17 years old and currently resides in Tug-as Gun-ob Lapu-Lapu City. His parents are Rubi Catalona Chavez and John Salvador Chavez. He has one sibling, namely Mary Bataluna Chavez. He completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. He likes Playing Role Games, Reading Fantasy Literature, and Weeb Culture in general. His Outlook in life is “Life is what you made it out to be and you’re truly the one who’s in control”



Mikylla Rufa Bacus Bering is a 12th-year senior high school student at Cordova Catholic Cooperative School taking up the STEM (Science Technology Engineering Mathematics) strand. She is 17 years old and currently resides in Purok Mangga, Brygy. Gun-ob Lapu-Lapu City. Her parents are Buenafe Bacus and Michael Ymbong Bering. She has two siblings, namely, Minnie Antonette Bacus Bering and Mike William Bacus Bering. She completed her Junior High School in the Babag National High School year 2019-2020. She enjoys watching Disney-style animated films. She occasionally enjoys reading comic books, but mostly enjoys listening to music of many different genres. Lauren Aquilina's song "King" is one of her favorites. She believes in Roy T. Bennet's quote, "Believe in your infinite potential. Your only limitations are those you set upon yourself."



Saskia Cabije Dico is a 12th-year senior high school student at Cordova Catholic Cooperative School who is taking up the STEM (Science Technology Engineering Mathematics) strand. She is 18 years old and currently resides in Purok Sacred Heart Buagsong Cordova, Cebu. Her parents are Gemma Maghanoy Dico and Oliver Manayon Dico. She has one sibling, namely, Janrey Dico. She completed her Junior High School in Cordova Catholic Cooperative School year 2019-2020. She is one of the members of KKDAT-Buagsong (Kabataan Kontra Droga at Terrorismo) with the position of Auditor. She likes to watch movies, especially basketball and K-drama movies. She believed that "God has a purpose for your pain, a reason for your struggle, and a reward for your faithfulness. Trust him and don't give up"



Ma. Kristina Casul Baraquil is a 12th-year senior high school student at Cordova Catholic Cooperative School taking up the STEM (Science Technology Engineering Mathematics) strand. She is 17 years old and currently resides in Purok Rambo Babag 2, Lapu-Lapu City. Her parents are Viola Ajat Baraquil and Floriedo Tiempo Baraquil. She has two siblings, namely, Irish Casul Baraquil and Bryan Casul Baraquil. She completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. She is one of the members of Colo Youth Chapel and Babag Youth Cluster, with the position of treasurer. She likes to watch movies, especially Ghibli and anime movies. She also likes to paint, read books, draw manga, and listen to music, especially Taylor Swift. As Taylor Swift once said "Life isn't about surviving the storm, it's about learning to dance in the rain".



Shania Shane Sagarino Conahap is a 12th-year senior high school student at Cordova Catholic Cooperative School taking up the STEM (Science Technology Engineering Mathematics) strand. She is 18 years old and currently resides in Purok, Lower Highway, Pilipog, Cordova, Cebu. Her parents are Merlinda Sagarino Conahap and Danilo Pontillo Conahap. She has two siblings, namely Jessa Mae Sagarino and Edrian Sagarino Conahap. She completed his Junior High School in Babag National High School year 2019-2020. She likes to draw and experience a lot of things. She doesn't want something to come her way and continues doing something she loves. Her motto in life is "Everything happens for a reason" because she believes that whatever we do or whatever we want, if it's not for us then something out there is patiently waiting for you to be there.



Kent Aulestia Baguio is a 12th-year senior high school student at Cordova Catholic Cooperative School taking up the STEM (Science Technology Engineering Mathematics) strand. He is 18 years old and currently resides in Dapitan, Cordova, Cebu. His parents are Gina Aulestia Baguio and Rodser Sumagang Baguio. He completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. He likes learning new hobbies, Playing Competitive Games, Reading manga, and Playing Sports. He believed that “Mistakes don't define failure; they offer opportunities for improvement. Appreciate imperfections to develop your own perspective of perfection”.



Real Mahilum Manayon is a 12th-year senior high school student of Cordova Catholic Cooperative School who is taking up the STEM (Science Technology Engineering Mathematics) strand. He is 18 years old and currently resides in Purok 3, Dapitan Cordova, Cebu. His parents are Carmelita Mahilum Manayon and Ritchel Bentulan Manayon. He has two siblings, namely, Rica Mahilum Manayon and Ritche Mahilum Manayon. He completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. He likes to play basketball and watch anime movies. He believes that “sometimes you win, sometimes you learn”.



Cathrel Mae Nunez Abarquez is a 12th-year senior high school student at Cordova Catholic Cooperative School taking up the STEM (Science Technology Engineering Mathematics) strand. She is 18 years old and currently resides in Babag 2, Lapu-Lapu City. Her parents are Grel Go Abarquez and Cathleen Nunez Abarquez. She completed her Junior High School in Cordova Catholic Cooperative School year 2019-2020. A student leader in her school and a member of BKD (Barkada Kontra Droga) with the position of treasurer of the Municipality of Cordova. She also likes to paint, sketch, read books and listen to music. Aside from listening to music, painting is also her other way of relieving her stress. Thus, it helps her calm herself and have peace.



Margaret Mary Polancos Galan is a 12th-year senior high school student of Cordova Catholic Cooperative School who is taking up the STEM (Science Technology Engineering Mathematics) strand. She is 18 years old and currently resides in Villa Del Rio Mactan Babag 2 Lapu-Lapu City. Her parents are Arlin Polancos Galan. She completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. She loves to play basketball and watch documentary movies. She believes that “Life is short so cherish every moment in life.”



Justine Mirafuentes is a 12th-year senior high school student of Cordova Catholic Cooperative School who is taking up the STEM (Science Technology Engineering Mathematics) strand. He is 18 years old and currently resides in Cogon Cordova Cebu. His parents are Analee Toring Mirafuentes and Ronald Ando Mirafuentes. He completed his Junior High School in Cordova Catholic Cooperative School year 2019-2020. He likes making arts and crafts. He also enjoys being physically active and spends a lot of time playing sports and team games. He believes that "Vision without action is just a dream. Because nothing will change if you do nothing. So be critical in life and be real".