OBSERVATION OF QUALITY AND QUANTITY OF AC WATER

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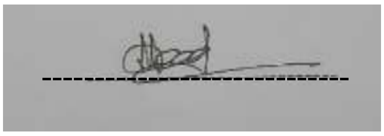

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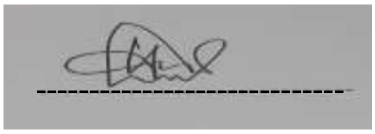

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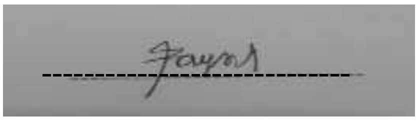

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Abstract

Today, a large portion of the world is experiencing water scarcity. The global demand for freshwater is increasing every day. The demand of fresh water is increasing day by day in big cities especially for Dhaka city where the groundwater table depletion rate is about 2 m to 3 m per year. As a result, other sources are being investigated in order to reduce demand. Water from air conditioners (AC) could be used. The water from air conditioner is usually wasted. The water from the air conditioner is good water and "clean," in general. We are first collecting water from air conditioning (morning, noon, night). Then we tested the water before and after boiling. On the acquired sample, various water quality parameter testing were performed. The average concentrations of before boil value pH 7.6, Iron 0, Conductivity 0,Turbidity 0.67, and DO 3.51, BOD 10, COD 36, and after boil value pH 7.73, Iron 0, Conductivity 0,Turbidity 0.80, and DO 2.66, BOD 8, COD 32, in condensate water from air conditioners were determined in this study. We compared the Air Conditioning water quality with WHO's drinking water standard. Since they don't include any salts or residual solids. We can get extremely cheap clean drinking water with the right filter equipment. The goal of this research is to learn more about how condensate water from air conditioning systems can be reused. A sample of AC water was taken and its volume was calculated over time. Then we get the test value of parameters pH is acceptable but BOD, COD, Iron, Conductivity, Turbidity, and DO are not in acceptable limit.

CHAPTER I

INTRODUCTION

1.1 General

The value of water to every human being and species on the planet is enormous. As the supply of clean water in the cosmos decreases, the desire for pure water rises. With this situation, the whole earth is covered in pure water. 98.5 percent salty water, 2.5 percent clean water, and 0.3 percent liquid water are accessible from the surface of the 2.59876 X 10^{11} cubic miles (bn.m.wikipedia.org). In this condition, we are growing more reliant on ground water, which is dwindling by the day. As a consequence, there is now a clean water shortage in our deserts and major towns. Then we shall confront a major water shortage in the future. As a consequence, we're taking different steps. The technology entails converting the water ejected by the air conditioner into drinkable water. In this project, we examine whether air conditioned water is a viable alternative to drinking water. Air conditioning is useful in both residential and business settings. Air conditioning is most usually employed to provide a more pleasant indoor atmosphere for people or animals, but it may also be used to cool/dehumidify rooms containing heat-producing electrical gear like computer servers, power amplifiers, and even to show and keep artwork. 71% of the Earth's surface is covered by water. 96.5 percent of the planet's crust water is found in the seas and oceans; 1.7 percent in groundwater; 1.7 percent in glaciers and the ice caps of Antarctica and Greenland; a minor fraction in other big water bodies; and 0.001 percent in the air as mist, clouds, and precipitation. Only 2.5% of this water is freshwater, with the remaining 98.8% being ice (except in clouds) and ground water Rivers, lakes, and the atmosphere contain less than 0.3 percent of all freshwater, while biological organisms and manufactured goods contain even less (0.003 percent).The earth's interior has a greater amount of water. Water on the planet's surface, such as in a river, lake, marsh, or ocean, is known as surface water. It is distinguished from groundwater and atmospheric water. Precipitation and groundwater recharge non-saline surface water. It is lost by evaporation, seepage into the earth where it becomes groundwater, usage by plants for transpiration, or discharged to the sea where it turns salty. In the air conditioner's evaporator coil, heated air is cooled. This generates condensation on the coil, much like on a cold glass of water on a hot day. The coil's moisture drops into a drain pan and out a white pvc condensate drain line. Through an expansion valve, the evaporator coil flashes heated liquid refrigerant into cold gas. The fan sweeps warm interior air over the evaporator coils, circulating cold gas through them. The refrigerant gas heats and cools the air. Evaporative cooling can obtain phase space densities that optical cooling can't (Ketterle et al., 1996). Free cooling employs pumps to circulate a coolant from a cold source, which functions as a heat sink for the energy extracted from the cooled area. Deep aquifers or subsurface rock masses with heat exchangers are common storage mediums. Some modest storage capacity systems are hybrids, utilizing free cooling early in the cooling season and a heat pump afterwards. The heat pump was introduced because the storage temperature rises during the cooling season, reducing its efficiency. Free cooling systems are occasionally paired with seasonal thermal energy storage (STES) so that winter cold may be utilized for summer air conditioning. Hybrid and free-cooling systems are mature (Snijders A, 2008). This research demonstrated that AC water (generic) can be made into drinking water. Those with restricted water supplies may use AC water. Strong survey done in order to discover this information. This study was also carried out in order to discover certain key water factors.

1.2 Scope of the study

From this Study we can get drinking water from Ac water in the coming days. Which will be very beneficial for desert countries. The success of this project is essential to prevent water scarcity in desert regions.

1.3 Objective of the research

The specific objective of this study are:

- To observe the water quality parameter of AC water.
- To determine the quantity of AC water.

Chapter II

LITERATURE REVIEW

2.1 About Air Conditioner.

It is possible to describe an air conditioner as a system that regulates the humidity, ventilation, and temperature inside of a structure or vehicle, often in order to maintain a cool environment even when the outside temperature is high. The very first air-conditioning system went into service in the year 1902. Willis Haviland Carrier discovered a method to regulate the temperature and humidity in the printing factory. The dimensions of the printing paper continued to shift ever-so-slightly as a result of changes in temperature and humidity. These shifts were significant enough to produce a misalignment of the colored inks. The new air conditioning system maintained a consistent atmosphere, which made it feasible to print in four different colors for the first time. Industrial enterprises that rely on consistent weather conditions are fortunate to have access to air conditioning since it helps them save money. Cotton threads would break, cigarette machines would clog, film would accumulate dust, and chocolate would turn gray because of the wildly varying temperatures and humidity levels in the days before air conditioning. In addition to making manufacturing employees more comfortable, air that is cool and dry may also increase their productivity and decrease their likelihood of calling in sick. Willis Havilland Carrier was given his first invention in 1906 for an apparatus for treating air. This was the first of multiple patents that he would go on to get. Although Carrier is often referred to as the "father of air conditioning," the word "air conditioning" was originally coined by Stuart H. Cramer, who was a textile engineer. In a patent claim that Cramer submitted in 1906 for a device that conditioned yarn by adding water vapor to the air in textile mills, the word "air conditioning" was used by Cramer. The device was named after the phrase. Willis Havilland Carrier shared the fundamental logical psychometric equations that he had developed with the American Society of Mechanical Engineers in the year 1911. The method is still used as the foundation for all essential calculations in the heating, ventilation, and air conditioning sector even now. As a result of the newly acquired capacity to manage the temperature and humidity levels during and after manufacturing, several industries saw explosive growth. The invention of air conditioning led to substantial advances in the quality of a variety of items, including film, cigarettes, processed meats, medicine capsules, textiles, and others. Carrier engineering was founded by Willis along with six other engineers. The Corporation was established in 1915 with an initial capital of $35,000 (annual revenues in 1995 reached $5 billion). The business's primary focus was on developing more advanced methods of air conditioning. Up until 1921, refrigeration units relied on reciprocating compressors that were powered by pistons to circulate refrigerant (sometimes combustible and deadly ammonia) throughout the system. The centrifugal spinning blades of a water pump inspired Carrier to create a centrifugal compressor with a similar function. The end product was a chiller that was both more secure and more effective. In addition to that, it was the first system that could effectively cool and ventilate big rooms. In 1924 the beginning of cooling systems was designed more for the comfort of people than for the requirements of industry. The use of mechanical cooling enables architects to defy conventional urban design practices. They removed the window awnings since there was no need for shade, built additional offices because there was no need for windows, and constructed glass skyscrapers that were impervious to the outside world so long as the air conditioner maintained a comfortable temperature of 22 degrees Celsius within the building. Willis Havilland Carrier invented the first domestic "weather maker" in 1928, which was an air conditioner designed specifically for use inside private residences. In 1929, the refrigerator manufacturer Frigidaire introduced a new product called the "room cooler," which was a compact and pricey air conditioning unit that could be put in homes or smaller businesses. This eventually resulted in the development of new housing designs, the window box unit, and air conditioners for automobiles. However, widespread implementation of so-called "comfort cooling" did not occur until after the Great Depression and World War II had passed. After the war, there was a noticeable rebound in the growth of consumer sales. (Needham et al., 1991).

2.2 About natural air conditioning system

The use of air conditioning consumes a significant amount of energy, but a recently formed team of designers believes they have found a way to mitigate this issue by emulating the ingenuity of Mother Nature.

2.3 A brief history of the air conditioning system

The interiors of the first cars were not exactly famed for the level of comfort they provided. Because of the open design of these automobiles, the ride was exceedingly rough. This, in conjunction with the cars' tiny tires and sturdy structure, contributed to the exceptionally bumpy nature of the ride. During the winter months, passengers were required to wear thick clothing; however, during the summer months, the top speed of 15 miles per hour made it possible to easily cool down owing to the breeze. And when automotive makers started sealing the hoods, the situation grew a great deal more serious. The temperature inside had reached an unacceptable level, which indicated that immediate action was necessary. They drilled holes in the floor of the car so that the vents could be installed. On the other hand, as a consequence of this, a greater quantity of dirt and dust than fresh air was drawn into the car. Following that, there were even more brilliant recommendations. In the year 1884, William Whitely conducted experiments in which he placed ice cubes in a container that was fastened to the underside of horse carriages and then blew air into the carriage using a fan that was linked to the axle. The goal of these experiments was to determine whether or not it was possible to cool the interior of the carriage using this method. A bucket positioned in close proximity to a floor vent would serve the same purpose in a car. The installation of an evaporative cooling system was the next step that needed to be taken after that. A company by the name of Nash discovered the phenomena known as the "weather eye," which involves a drop in temperature and takes place when air passes over water. However, the first vehicle to really have a refrigeration system was the 1939 Packard, which was produced by the company. It was a large evaporator that was referred to as the "cooling coil," and it took up the all of the space that was designated for freight in the automobile. The switch for the blower was the only control that was built-in to the device. In point of fact, Packard used the tagline "Forget the heat this summer in the only air-conditioned car in the world" while advertising their vehicles. In the same year, 1941, Cadillac produced an additional 300 autos that were also fitted with air conditioning. Because none of these early air-conditioning systems included a compressor clutch, the pump was required to remain active while the vehicle's engine was in motion in order to maintain temperature control. This was a major drawback to the situation. To turn off the system, the car needed to be stopped, the driver needed to exit the vehicle, the hood needed to be opened, and the seat belt needed to be removed. Following the conclusion of World War II, Cadillac started selling an innovative new feature that was the controls for the air conditioning system that was installed in their automobiles. Because the controls were situated on the package shelf behind the driver's seat, the latter was required to go forward in order to deactivate the safety feature. However, this was a far more convenient alternative than opening the engine compartment. It is possible that the Harrison radiator division of General Motors was responsible for the development of the first unit that was both cost-effective and efficient and could be manufactured in big quantities. In 1954, it was an optional option on all Pontiacs equipped with V8 engines. It included an all-brazed condenser in addition to a reciprocating compressor with two cylinders. It also used a magnetic clutch, which meant that when it was not in use, no power was required to run the compressor. This resulted in an improvement in both the efficiency and effectiveness of the vehicle. However, for a considerable number of years, air conditioning remained a rather uncommon choice. It wasn't until the late 1970s and early 1980s that people started going crazy for air-conditioned automobiles. The systems were growing better, and people learned that they didn't actually have to suffer through the heat just because their air-conditioning equipment were not functioning properly. It is believed that more than 80 percent of the automobiles and light trucks that are now in use in the United States are equipped with air conditioning. These days, heating and cooling systems are more energy efficient than ever before. The vacuum and thermostatic mechanisms that were used in the past are less reliable than the modern automated temperature control systems that have replaced them. Computers also ensure that both the driver and passenger are comfortable by ensuring that the ideal temperature is maintained throughout the vehicle. The forecast for the development of air conditioning in automobiles is looking brighter and brighter. There have been recent developments in electrical and compressor technology. Chlorofluorocarbon emissions are a source of worry because of the harm they do to the ozone layer. This concern has led to developments that aim to minimize chlorofluorocarbon emissions. R-134A is a new kind of refrigerant that has replaced chlorine-based refrigerants in almost all modern automobiles. Businesses that specialize in auto repairs are also taking measures to cut down on the quantity of R-12 or chlorofluorocarbons that are released during the servicing process. (2000) according to Shane Smith.

2.4 About Different shapes and sizes.

For various uses, an HVAC designer would propose several kinds of air conditioning systems. In this chapter, we'll go through the most prevalent ones.

The kind of air conditioner to employ is determined by a variety of parameters, including the size of the space to be cooled, the total heat produced inside the enclosed area, and so on. An HVAC designer will take into account all of the relevant factors before recommending the best system for your area. For single rooms, the "window air conditioner" is the most often used air conditioner. The compressor, condenser, expansion valve or coil, evaporator, and cooling coil are all included in a single box in this air conditioner. This device is installed in a slot cut into the room's wall or, more typically, a window sill.

Fig 2.1: Window type air conditioner

There are two pieces to a "split air conditioner": the outside unit and the interior unit. The compressor, condenser, and expansion valve are all housed in the outside unit, which is mounted outside the room. The evaporator, often known as a cooling coil, and the cooling fan make up the interior unit. There is no need to cut a hole in the room's wall for this device. Furthermore, modern split units are more aesthetically pleasing than window units and take up less room. One or two rooms may be cooled using a split air conditioner.

Fig 2.2: Split type air conditioner

If you wish to cool more than two rooms or a bigger area at your home or workplace, an HVAC designer would recommend a "packaged air conditioner" kind of air conditioner. The packaging unit may be arranged in two ways. The compressor, condenser (which may be air or water cooled), expansion valve, and evaporator are all located in a single box in the first place. The chilled air is blown by the large capacity blower and passes via the ducts installed throughout the rooms. The compressor and condenser are located in the same housing in the second configuration. The pressurized gas is routed via different units in various rooms, each of which has an expansion valve and a cooling coil.

Fig 2.3: Packaged type air conditioner

Cooling large structures such as homes, businesses, hotels, gyms, movie theaters, and industries is accomplished by the use of "central air conditioning." HVAC experts have discovered that installing separate units in each room would be too costly if the whole building is to be air-conditioned, hence this is the preferred alternative. A large compressor, capable of producing hundreds of tons of cooling, is the heart of a central air conditioning system. Central air conditioning systems are frequently the only way to cool large, open areas like malls, galleries, and museums. For more information on this topic, please visit the Haresh Khemani 2009 website.

Fig 2.4: Central type air conditioning plant

2.5 Gree Air conditioner

Gree Electric Appliances Inc., based in Zhuhai, Guangdong province, is a significant Chinese appliance manufacturer. It is the world's biggest maker of domestic air conditioners. There are two kinds of air conditioners available from the company: residential air conditioners and commercial air conditioners. Electric fans, water dispensers, heaters, rice cookers, air purifiers, water kettles, humidifiers, and induction cookers are among the goods produced by the firm. Gree is the brand name under which it sells its goods in China and overseas. Zhuhai Gree Daikin Device Co., Ltd. and Zhuhai Gree Daikin Precision Mold Co., Ltd. are two of the company's joint ventures with Daikin.

By merging "central air conditioning + hot sanitary water + floor heating" into one multi-VRF system, GREE has broken the conventional VRF system's barrier. System that gives five distinct alternatives to meet your needs and comfort level based on your preferences:

- Only the process of cooling
- The only thing that needs to be heated
- Only water heating is used.
- Heating and cooling of water
- Water and steam heating are included in this category.

Units for outdoor use have a power range of 10 kW to 28 kW and can operate in temperatures as low as -15 degrees Celsius and as high as 43 degrees Celsius. With an ECOP of up to 6.6, this system achieves a high degree of energy efficiency. Among the other key features:

DC Inverter technology is used to drive Twin Rotary and scroll compressors for greater energy efficiency. An eco-friendly refrigerant, R410A, is available. The whole system's cost efficiency is considerably enhanced by heat recovery technology. Indoor units come in a broad variety to meet the needs of every installation location. Making hot water for drinking, cooking, or both. GREE is the only company with a patent on this ground-breaking VRF system technology. Up to an EER of 4,6 while operating at a reduced load.

An ECOP of up to 6,6 when heat recovery is used results in an extremely high overall energy efficiency ratio. Electricity may be converted to 2,8 kW of cooling power and 3,8 kW of hot water heating power from a single kW of power. It is equal to (Q2+Q3) divided by 1 = 6,6

Fig 2.5: Gree GMV5 Air Conditioner

2.6 Indicators of water quality

It is critical to consider the physiochemical and biological quality of raw water when determining the level of pollution and when selecting which source would provide the best treatment solution (WHO, 1984)

2.6.1 Temperature

Definition: temperature is the degree of warmth or chilliness that exists inside the body of a living creature, whether that organism is found in water or on land (Lucinda et.al, 1999). Because fish are cold-blooded animals, the temperature of their bodies fluctuates in response to their surroundings, which in turn has an influence on their metabolism and physiology, which in turn affects their productivity. The pace of biochemical activity that is carried out by the microbiota, the rate at which plants respire, and the rise in oxygen demand are all increased when the temperature is raised. In addition to this, it caused the solubility of oxygen to decrease, and it also caused a rise in the quantity of ammonia in the water. On the other hand, when there is prolonged ice cover, dangerously high concentrations of gases such as hydrogen sulfide, carbon dioxide, and methane may accumulate, which can have an adverse impact on human health**.**

2.6.2 pH

On a scale of 0 to 14, the pH of water indicates how acidic or alkaline it is. With a pH of 7, pure water is neutral. The pH scale is used to determine the acidity or basicity of a solution (alkalinity). The scale is logarithmic since it is based on pH values, therefore a change of one pH unit equates to a ten-fold change in H++start superscript, plus, end superscript ion concentration. The pH scale is often said to run from 0 to 14, and most solutions lie within this range, while a pH below 0 or beyond 14 is conceivable. Anything with a pH below 7.0 is acidic, whereas anything with a pH over 7.0 is alkaline, or basic. Drinking water, on the other hand, should have a pH range of 6.5 to 8.5. In a study of drinking water from various sources, Darko-Manteyet discovered a pH range of 6.1 to 7.2. Because aqueous chemical equilibrium typically involves hydrogen ions H+, pH is connected to practically every other water quality measure in a variety of ways (WHO, 1984). The discharge of acidic water into these sources by agricultural and home activities is attributed to the low pH of the water sample. Because of lime stone weathering in catchments and under groundwater beds, Ca + HCO3" dominates 98 percent of the global ground water (Meybeck, 1997). Despite the fact that pH has no direct influence on human health, all biological reactions are sensitive to changes in pH. The pH value of 7.0 is regarded the optimum and perfect for most reactions and human beings.

2.6.3 Dissolved oxygen (DO)

Oxygen concentration is a much more relevant biological indicator of water quality than fecal coliforms. Oxygen dissolved in water is vital for the life of all aquatic species. Moreover, oxygen influences a multitude of water indicators, including biochemical as well as aesthetic ones like as odor, clarity, and flavor. Therefore, oxygen may be the most well-established indicator of water quality. A certain amount of dissolved oxygen is required for water quality. Oxygen is essential to all forms of life. The process of natural stream filtration need proper oxygen levels in order to sustain aerobic life. When the concentration of dissolved oxygen in water falls below 5.0 mg/L, aquatic life is placed under stress. The less attention there is, the higher the tension. A few hours of oxygen levels below 1-2 mg/L may result in a significant fish death. The total concentration of dissolved gases in water should not exceed 110 percent. Aquatic life may be harmed by concentrations exceeding this threshold.

2.6.4 Turbidity

It's obvious that water quality must be maintained in order for it to be visually acceptable. To put it another way, turbidity is the quality of a sample that inhibits light from being transmitted in a straight path. When it comes to drinking water, the more turbid it is, the greater the chance that someone may become sick. The findings of A.G. Mann et al., 2007 Light penetration and productivity, recreational values, and habitat quality are negatively impacted by high quantities of particulate matter, which causes lakes to fill up quicker. Fish and other aquatic species may be harmed by increased sedimentation and siltation that occurs in streams. Other contaminants, such as metals and microorganisms, may attach themselves to particles. The presence of turbidity in a body of water might serve as a warning sign of contamination. Toxic levels of turbidity (cloudiness) in drinking water are not only unappetizing but also potentially harmful. Food and shelter for infections may be found in the turbidity of the water. Waterborne illness outbreaks may occur if turbidity is not eliminated from the distribution system, resulting in major occurrences of gastroenteritis in the United States and across the globe. Many studies have shown a close correlation between turbidity reduction and the elimination of protozoa from the water. By decreasing their exposure to disinfectants, turbidity particles offer "a shelter" for microorganisms. Particulate particles have been linked to the survival of microbes. There is a good chance that typical water treatment technologies can efficiently eliminate turbidity.

2.6.5 Total Iron

When iron is present in water sources, it might be a problem. Iron is one of the planet's most abundant resources, making up at least 5% of the Earth's crust. Rainwater dissolves iron in the soil and geological formations underneath it, allowing it to flow into aquifers that provide groundwater for wells and other sources. In spite of the fact that iron is present in drinking water, concentrations of more than 10 mg/L or 10 ppm are very rare. In contrast, as little as 0.3 mg/l may cause water to acquire a reddish brown tint.

Ferrous and ferric iron are the two most common types of iron found in water. Because the iron is totally dissolved, the water is pure and colorless. The water becomes hazy and a reddish brown material forms when exposed to air in the pressure tank or the environment. This sediment contains oxidized iron, or ferric iron, which can't dissolve in water.

2.6.6 BOD

BOD is a measure of the amount of oxygen required to remove waste organic matter from water in the process of decomposition by aerobic bacteria. The BOD is an important parameter for assessing water quality. It deals with the amount of oxygen consumption (mg O_2 L^{-1}) by aerobic biological organisms to oxidize organic compounds. Sewage with high BOD can cause a decrease in oxygen of receiving waters, which in turn can cause the death of some organism. (https://www.sciencedirect.com/science/article/pii/B9780124095472115197)

2.6.7 COD

COD is a measure of the oxygen equivalent of the organic matter in a water sample that is susceptible to oxidation by a strong chemical oxidant. COD is widely used as a measure of the susceptibility to oxidation of the organic and inorganic materials present in water bodies and in the municipal and industrial wastes(https://www.sciencedirect.com/topics/earth-and-planetary-sciences/chemical-oxygen-demand) COD is a measure of the oxygen equivalent of the organic matter in a water sample that is susceptible to oxidation by a strong chemical oxidant. COD is widely used as a measure of the susceptibility to oxidation of the organic and inorganic materials present in water bodies and in the municipal and industrial wastes. The COD test of natural water yields the total quantity of oxygen that is required for oxidation of a waste to carbon dioxide and water (McCutcheon et al. 1993). In a BOD test, only biologically reactive carbon is oxidized while in a COD test, all organic matter is converted to carbon dioxide. The test for COD does not identify the oxidisable material or differentiate between the organic material and inorganic material present. Similarly, it does not indicate the total organic carbon present. Consequently, the COD values are higher compared to BOD. Nevertheless, COD is a useful variable that can be rapidly measured; the COD test can be performed in 3 hours against 5 days required for a BOD_5 test. The COD concentrations observed in surface water resources typically range from 20 mg/L or less in unpolluted waters to greater than 200 mg/L in waters receiving effluents. Industrial wastewaters may have COD ranging from 100 mg/L to 60,000 mg/L (Chapman 1992) (S.K. Jain, V.P. Singh, in Developments in Water Science, 2003).

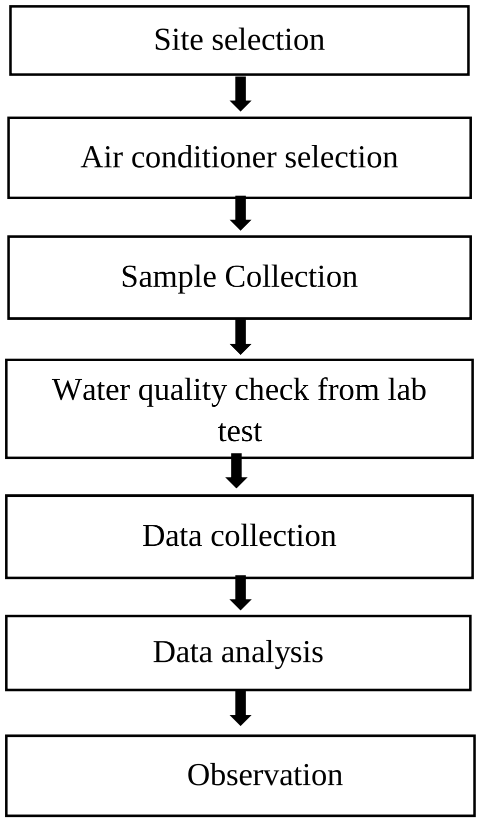
CHAPTER III

METHODOLOGY

The systematic and theoretical evaluation of research techniques is called "methodology." Theoretical investigation of a field's general concepts and practices. It includes theoretical frameworks, phases, and quantitative or qualitative research methodologies. A set of underlying concepts or guidelines from which strategies or procedures may be created to analyze or solve specific circumstances.

3.1 Methodological flowchart

A methodology is not a technique since it does not address issues. It offers the theoretical basis for deciding whether a method, set of processes, or "best practices" can be applied to this instance. Methodology flowchart:



3.2 Site Selection

One of the most common and important ways to collect data and information about an issue under the research investing is to choose the area. This research investing is based on a critical analysis and evaluation of Gree AC Daffodil International University’s mosque and accounts section at Ashulia.

3.3 Sample collection

Samples of water were taken at the height of the summer (7 October – 15 October 2021). For this project, we took water samples from every AC unit of mosque and accounts section. Daffodil International University's department of civil engineering conducted the testing.

Fig 3.1: Sample collection

3.4 Data Collection Methods

This study effort is centered on the critical assessment and analysis of the quality of 1 Ton and 2 Ton AC. The study gathered data to investigate and critically analyze and assess the water quality check and cost benefit of AC water. This research relied on a lab test from DIU (Daffodil International University) and Department of public health engineering central lab to conduct a water quality check and to determine the average amount of water used in a given area.

3.5 Analyses of samples

In this project from selected area we tested total 7 parameter among pH, Iron, Conductivity, Turbidity, and Do tasted in Daffodil International University's civil lab and other parameter BOD and COD from DPHE, Mohakhali, Dhaka. When we get various data from lab then we done this project work and analysis:

Serial Number	Parameter	International Standard Model	Model what we used
01	pH	PCE-PHD 1-ICA	HANNA, H198107,ROMANIA.
02	Conductivity	PCE-PHD 1-ICA	HANNA, H198302P, ROMANIA
03	Turbidity	WZS-175	R.046665 , TAIWAN
04	Dissolve Oxygen (DO)	DO-p 10	S. 036136, TAIWAN
05	Iron	HANNA, IRON Test Kit HI – 3834, ROMANIA	HANNA, IRON Test Kit HI – 3834, ROMANIA
06	BOD		5 days incubations
07	COD		CRM

Table 3.1: Instruments and methods for analyzing various parameters.

3.6 Lab Test procedure

Fig 3.2: Pictures of lab test

3.6.1 Determination of pH

Apparatus:

1) pH meter

2) Beaker

3) Timer

4) Distill water

5) Tissue

Procedure: Step-by-step instructions are provided to walk you through the procedure. They are as follows:

1. Making Reagents
2. Checking the Instrument for Accuracy
3. Sample Testing

Steps:

1. Use standard pH solutions to calibrate the pH meter. For a given pH range of interest, the calibration technique would be different.
2. Make sure the water sample is clean and dry before placing it in a 100 mL beaker, then insert the teflon coated stirring bar and stir well.
3. After placing the electrode in the water sample, check the pH meter to see what the reading is. Wait for a steady reading before proceeding.
4. Wipe a soft tissue over the electrode after it has been cleaned with deionized water.

3.6.2 Determination of conductivity

Apparatus:

1) Conductivity Meter
2) Standard flask
3) Measuring jar
4) Beaker 250 mL
5) Funnel
6) Tissue Paper

Procedure:

Turn on the electronic balance, keep the weighing pan in place, and zero the reading.

1. Measure and transfer 50 mL of distilled water to the beaker.
2. Weigh the potassium chloride at 0.7456 grams.
3. Mix the 0.7456g of potassium chloride with the distilled water in the beaker using the glass rod until it dissolves completely.
4. Pour the contents into a standard flask with a capacity of 100 mL.
5. Raise the volume to 100 mL by adding distilled water and thoroughly shaking the contents. The conductivity meter is calibrated using this solution.

An summary of the conductivity meter is as follows:

The conductivity of a solution is measured using an electrical conductivity meter.

3.6.3 Determination of Turbidity

Apparatus:

1) Turbidity Meter
2) Beaker
3) Soft tissue
4) Digital timer

Procedure:

1. In order to conduct the test on the provided water sample, the reagents need to be prepared first. The turbidity meter must then go through the process of being calibrated.
2. Pour sample water into the sample cells until the horizontal mark is reached, then carefully wipe the sample with a soft tissue before placing it in the turbidity meter. The light shield should be placed on top of the sample cell.
3. Examine the reading that is shown on the turbidity meter. Hold off until you have a reading that is consistent.

3.6.4 Determination of DO

Apparatus:

1. DO meter,
2. Standard flask,
3. Measuring jar,
4. Beaker 250 mL,
5 Funnel,
6. Tissue Paper

Procedure:

1. To begin, we started by calibrating the DO meter.
2. Next, we adjusted the value for open air such that it would equal 20.9
3. Following that, we prepared the sample and transferred it to a beaker with a capacity of 250 ml.
4. Place the probe of the meter into the water, and then wait ten minutes.

5. The value is considered satisfactory if it has not changed at all after ten minutes have passed. In addition, if the value is unstable, you will be required to wait ten minutes between each value adjustment.

6. Once you have determined the proper value, you need to make a note of it in your notebook.

3.6.5 Determination of Iron

Apparatus:

1. HANNA, IRON Test Kit HI – 3834, ROMANIA
2. Measuring cylinder
3. Dropper
4. Tissue
5. Timer

Procedure:

1. To begin, we will use the reagent from the iron test kit.
2. Next, fill roughly 10 milliliters of a beaker with the solution that came with the iron kit.
3. Maintain it on air for about four minutes.
4. After that, transfer some of this solution into the indicator container.
5. Finally, wait for four minutes and observe the water's hue before proceeding.

3.6.6 Biochemical Oxygen Demand

Apparatus:

1) BOD bottle
2) Beaker (250 ml)
3) Measuring cylinder
4) Dropper
5) Stirrer

Procedure: Fill two BOD bottles with sample (or diluted sample); the bottles should be completely filled. Determine initial DO (DO) in one bottle immediately after filling with sample (or diluted sample). Keep the other bottle in dark at 20°C and after particular days (usually 5-days) determine DO (DOf) in the sample (or diluted sample). Dissolved oxygen (DO) is determined according to the following procedure:

1. Add 1 mL of manganous sulfate solution to the BOD bottle by means of pipette, dipping in end of the pipette just below the surface of the water.
2. Add 1 mL of alkaline potassium iodide solution to the BOD bottle in a similar manner.
3. Insert the stopper and mix by inverting the bottle several times.
4. Allow the "precipitates" to settle halfway and mix again.
5. Again allow the "precipitates" to settle halfway.
6. Add 1 mL of concentrated sulfuric acid. Immediately insert the stopper and mix as before.
7. Allow the solution to stand at least 5 minutes.
8. Withdraw 100 mL of solution into an Erlenmeyer flask and immediately add 0.025N sodium thiosulfate drop by drop from a burette until the yellow color almost disappears.
9. Add about 1 mL of starch solution and continue the addition of the thiosulfate solution until the blue color just disappears. Record the ml. of thiosulfate solution used (disregard any return of the blue color).

3.6.7 Chemical Oxygen Demand

Apparatus:

1. Beaker (250 mL)
2. Dropper
3. Stirrer

Procedure:

1. Pipette 100 mL of the sample into a 250 mL Erlenmeyer flask.
2. Add 10 mL of diluted sulfuric acid and 10 mL of standard KMn04 solution.
3. Heat the flask in a boiling water bath for exactly 30 minutes, keeping the water in the bath above the level of the solution in the flask. The heating enhances the rate of oxidation reaction in the flask.

4. If the solution becomes faintly colored, it means that most of the potassium permanganate has been utilized in the oxidation of organic matter. In such a case, repeat the above using a smaller sample diluted to 100 mL with distilled water.

5. After 30 minutes in the water bath, add 10 mL of standard ammonium oxalate [(NH4)2C204] solution into the flask. This 10 mL ammonium oxalate, which is a reducing agent, is just equivalent to the 10 mL potassium permanganate (oxidizing agent) added earlier. The excess of reducing agent [(NH4)2C204] now remaining in the flask is just equivalent to the amount of the oxidizing agent (KMn04) used in the oxidation of organic matter.

6. The quantity of ammonium oxalate remaining in the flask is now determined by titration with standard potassium permanganate. Titrate the content of the flask while hot with standard potassium permanganate to the first pink coloration. Record the mL of potassium permanganate used.

CHAPTER IV

RESULT AND DISCUSSION

4.1 Introduction

The amount of water in AC as well as its quality are the foci of the investigation that this research will undertake. The water that was collected from the Gree air conditioners (1 ton and 2 ton) at DIU (Daffodil International University), which is located in Dhaka. All of the samples were gathered in the time span beginning in October -2021 and ending in October -2021. In the course of our research, we collected a total of 30 water samples from a chosen location, covering an area of 1824 square feet. In addition, the purpose of this research is to broaden people's access to a new kind of water system that is not already used in everyday life. The samples were taken in the morning, throughout the day, and in the evening.

Table 4.1: Time of Sample collection

Sample	**Day time**
1	9.00AM-10.00AM
2	11:00AM-12:00PM
3	2:00PM-3:00PM

Here is the time of collected water sample that is morning noon and evening time.

4.2 Hear the temperature and quantity of AC water given bellow:

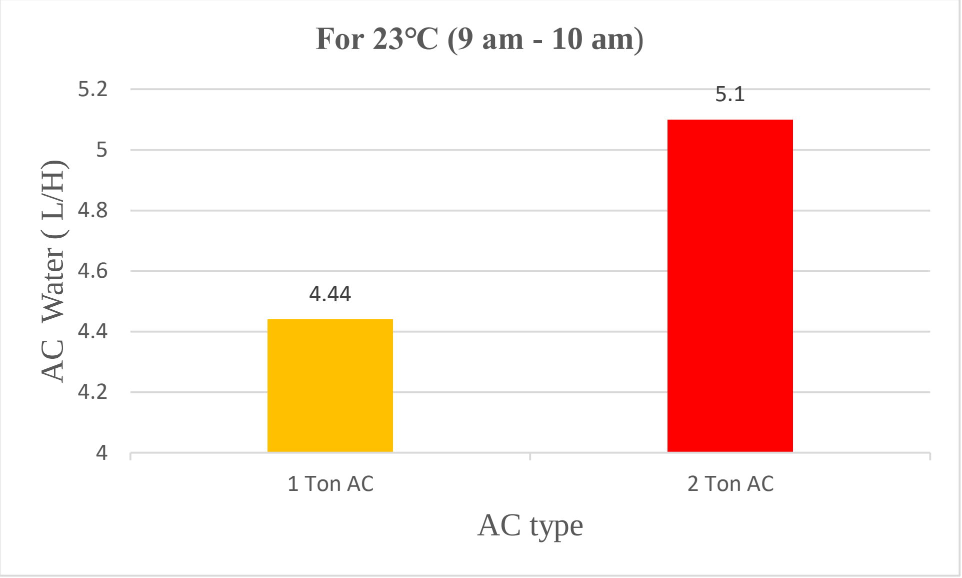


Fig 4.1: Quantity of AC water at 23℃ AC Temperature

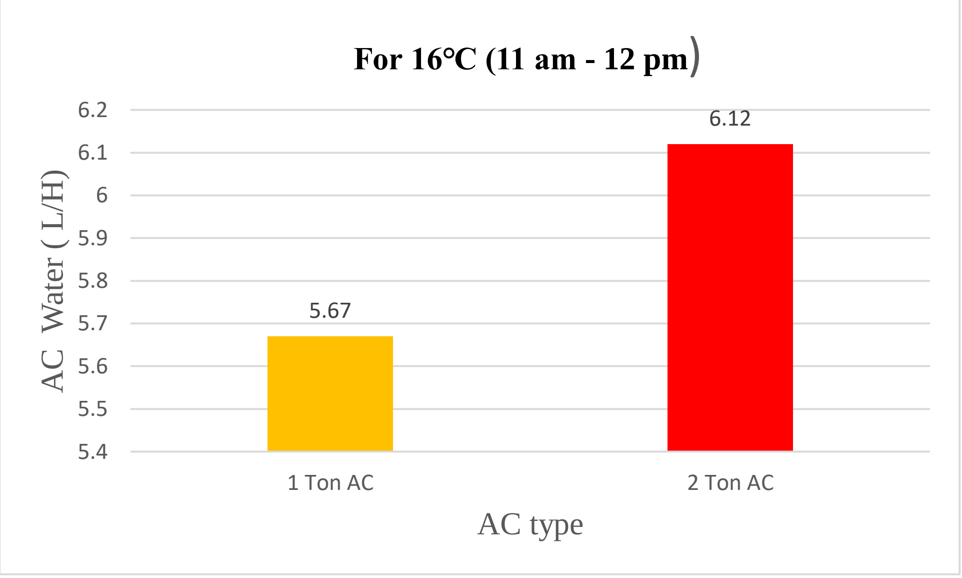


Fig 4.2: Quantity of AC water at 16℃ AC Temperature

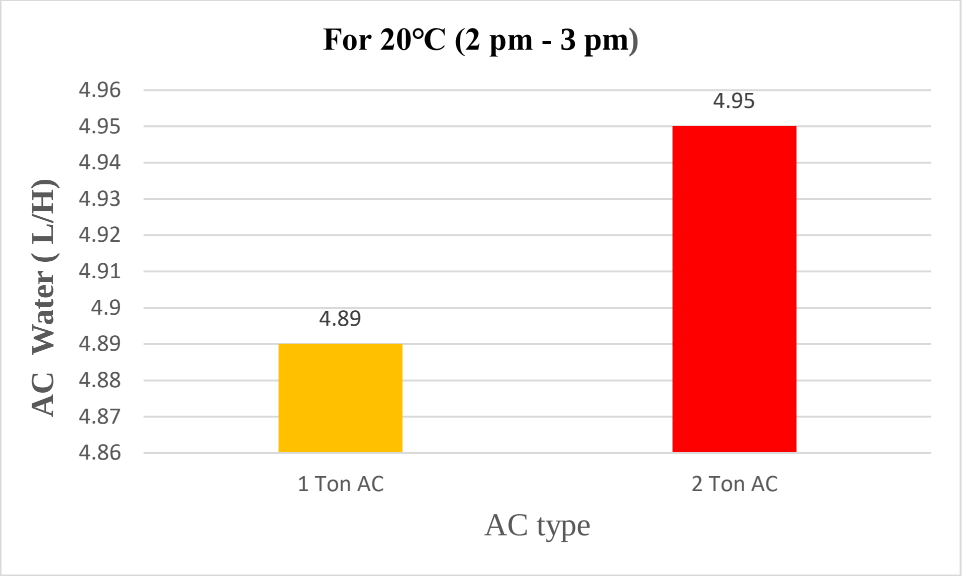


Fig 4.3: Quantity of AC water at 20℃ AC Temperature

4.3 Result of Lab Tests

Table 4.2: Lab Test result

Parameters	**Normal water before boiling**			**Water before Boil (Mean value)**	**After Boil Water**			**After Boil (mean Value)**	**Unites**
Test	**Morning**	**Noon**	**Afternoon**		**Morning**	**Noon**	**After noon**		
pH	7.8	7.6	7.4	7.6	7.8	8.0	7.4	7.73	------
Iron	0	0	0	0	0	0	0	0	mg/l
Conductivity	0	0	0	0	0	0	0	0	NTU
Turbidity	0.30	0.16	1.55	0.67	0.36	0.76	1.29	0.80	mg/l
DO	3.6	3.6	3.33	3.51	2.7	3.0	2.3	2.66	mg/l
BOD	10	9.5	10.5	10	7.5	8	8.5	8	mg/l
COD	36	37.5	34.5	36	33	31	32	32	mg/l

4.4: Tested Value comparison with WHO & Bangladesh Standard

Table 4.3: Tested Value comparison with WHO & Bangladesh Standard

Parameters	Water before Boil (Mean value)	After Boil (mean Value)	Standard value (WHO-)	Bangladesh standards
pH	7.6	7.73	6.5-8.5	6.5–8.5
Iron	0	0	0.3 mg/l	0.3-1.0
Conductivity	0	0		
Turbidity	0.67	0.80	1-5 NTU	10 NTU
DO	3.51	2.66	6.5-8 mg/l	6 mg/l
BOD	10	8	Less than 5.0 mg/l	0.2 mg/l
COD	36	32		4.0 mg/l

4.5 Discharge of Water

We can calculate water discharge in a day. AC temperature was 23 degree in morning 16 degree in noon and 20 degree in night. That was 1 ton air conditioner. Another 2 ton AC produce 22 degree in morning 17 degree in noon and 20 degree in night.

Table 4.4: Discharge of water 1 Ton AC

Ac	AC Temperature	Time	L/H
1 Ton	23℃	9 am – 10 am	4.44
	16℃	11 am – 12 pm	5.67
	20℃	2 pm – 3 pm	4.89

Table 4.5: Discharge of water 2 Ton AC

Ac	AC Temperature	Time	L/H
2 Ton	23℃	9 am – 10 am	5.1
	16℃	11 am – 12 pm	6.12
	20℃	2 pm – 3 pm	4.95

4.6 Discussion

This instance we evaluated factors like as pH, Iron, Conductivity, Turbidity, and DO and we test this From Daffodil International University Civil Lab. In this project, we want to investigate whether or not it is possible to get pure drinking water from ac water. However, as we are unable to get a flawless outcome, we have determined that this AC water is not suitable for use as drinking water. Pure water has a pH value that ranges from 6.5 to 8.5 on average. The results of our tests came back with readings of 7.6 and 7.73. On the other hand, the turbidity value should have been more than 10, but the results that we obtained were 0.6 and 0.80, which are not acceptable in this context. The value of conductivity ought to have been more than 300, however the result of my tests came back as 0. Furthermore, doing so is not acceptable. It was expected that the value of DO would be less than 7, but we got it to be 3.51 and 2.6 instead, therefore this figure is ok. And the value of Iron should have been between 0.3 and 1.0, but instead we received a value of 0, which is unacceptable. The range should have been 0.3 to 1.0. The water has been put through both normal and boiling tests, and the results of both show that it does not meet the standards for suitable drinking water. Our study focuses on producing clean and safe drinking water from air conditioners; nevertheless, there are certain minerals that must be present.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The production of hygienic and risk-free drinking water using air conditioners is the primary focus of our project; nevertheless, the water must also include a number of certain minerals. The following are some of the findings and conclusions that may be drawn from this study:

- Among all the parameters used in this project only the value of pH is satisfactory. The values of the remaining 6 parameters (BOD, COD, Iron, Conductivity, Turbidity, and DO) are not satisfactory.
- 1 ton AC yielded 4.44 L/H, 5.67 L/H, 4.89 L/H water yield respectively at 23° 16° 20 ° C and 2 ton AC yielded 5.1 L/H, 6.12 L/H, 4.95 L/H water is released.

5.2 Recommendations

The access analysis that may take place in the various types of AC is the primary part of this project. The following items, however, are the most significant discoveries made. This topic has to be investigated more in future research. The following is a summary of the most important suggestions for the continuation of the current work in the future.

- Better results can be expected by working with more parameters and doing more AC research in different seasons
- In order to transform this AC water into drinkable water, can be add necessary minerals in the water.

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