OBSERVATION OF WATER QUALITY OF BALU RIVER

Submitted By

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DECLARATION

This is to certify that the following student worked on the project and thesis titled "Observation of water quality in Balu river" under my direct supervision in the laboratories of the department of Civil Engineering under the faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science. On September 2022, the work was presented.

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ABSTRACT

The Balu River is a notoriously contaminated location where unreliable chemical interactions between harmful compounds and water quality occur. As a result, ongoing monitoring of this area is essential for implementing the necessary environmental system of management. The study was carried out at the Balu River in Dhaka.area close to the Demra. Analysis of water quality plays a big role in environmental engineering. Aquatic life and the surrounding ecology are also impacted. It is occasionally necessary to take qualitative measurements in order to continuously assess the water quality coming from the various supply sources. Physical, chemical, or biological variables can affect the quality of water. Thermodynamic characteristics of water quality include turbidity and temperature.

This study was about to measuring water quality in Balu river. We were selected three different stations these are Meradia bazar, poschimgaon and Demra. We also selected eight water quality parameters to measuring water quality these are pH, DO, BOD, EC, COD, Turbidity, Temperature and Iron. We have collected water samples and tested in a lab.

This study shows the variation of water quality parameters at three different locations. These are- Meradia bazar, Poschimgaon and Demra. From the observed physicochemical parameters. The mean values of these parameters are, pH 6.77, DO 4.27 mg/l, BOD 9.3 mg/l, COD 40 mg/l, EC 197 µS/cm, Turbidity 72 NTU, Temperature 33 °C and Iron 1 mg/l. On the basis of this study, The acceptable ranges of all parameters for aquatic life- pH (6.5-6.8), DO 5 mg/l, BOD 6 mg/l, EC (200-1000) µS/cm, Turbidity 10 NTU, Temperature (26-32) °C and Iron 1 mg/l. The majority of the parameters are not within permissible range.

Keywords

Balu river, samples locations, water quality parameters and aquatic

CHAPTER 1
INTRODUCTION

1.1 General

Water is the most significant elements in nature. Animals and human beings can not able to suffer without having water. Water participates all of human activities such as transportation, industrial factories, agriculture and more. The main thing is, all life depend on water.

Dhaka is most densely population and polluted city in the world. It is bounded by few rivers such as Buriganga, Dhaleshwari, Shitalaksya, Turag, and Balu. Water pollution is huge trouble for Dhaka city. Water pollution can caused by organic and inorganic elements. Many rivers are polluted by industrial effluents, solid waste, agricultural waste, sewage disposal. water also gets polluted from heavy metals like iron, magnesium, nitrogen, copper, carbon, zinc, mercury etc.

The Balu River runs through the swaps of belai beel and joining the Shitalaksya River near demra. The Balu river importance for local drainage and access by small boats. Balu River is polluted area which is responsible for polluting Shitalaksya River day by day. There are lot of industrial and chemical factories at rupganj which is polluting Balu River. Its influence on human, plants, and agricultural activities.

1.2 Why this study

Water quality analysis is a significant part of environmental engineering. It's affect aquatic life and surrounding ecosystem as well. Qualitative measurements are needed from time to time to constantly analysis the quality of water from the different sources of supply. Water quality can be physical, chemical or biological factors. Physical properties of water quality include temperature and turbidity (M.N Mobin,2013). Chemical characteristics involve parameters such as pH, conductivity, dissolve oxygen etc. these parameters are relevant not only to surface water studies of the ocean, lakes, rivers, but to groundwater and industrial processes as well. Water quality analysis can help researchers to predict and learn from natural processes in environment and determine human impact on ecosystem. These measurement efforts of the water can also assist in restoration projects or ensure environmental standards are being met. We evaluated the parameters to discover aquatic properties of the Balu River.

1.3 Objective of this study

(I) To observe selected water quality parameters of study area.

(II) To observe the effect of water quality parameters on aquatic life.

1.4 Scope of the study

Balu river is most polluted River in Bangladesh. Specifically, industrial garbage from the Dhaka-Narayanganj-Demra Dam region pollutes the Balu River. Because of the pollution, the aquatic ecosystem of Balu River has been obstructed. The living organisms of the ecosystem are under a big ultimatum.

Pesticides, sewage, snails, fertilizers, and household garbage are the main sources of pollution (Dara S, Chand S, A text book of environmental chemistry and pollution control.). The majority of Bangladesh releases effluents into rivers without any sort of treatment. Currently, 1176 industrial facilities in Bangladesh release 0.4 million cubic meters of untreated trash into rivers each day (JICA Master Plan for Greater Dhaka Protection Project). Nearly 300 domestic and industrial wastewater outfalls are located along the Balu River, however only nine of them are major (Rahman MK. 2001).

The principal point source of pollution to the Balu is Norai Khal and Tongi Khal. Balu River carries wastewater from a number of wastewater Khals, such as Raja Bazar Khal, Kanthal Bagan Khal, Paribagh Khal, Begunbari Khal, Mohakhali Khal, Gulshan Khal, Rampura Khal, Gojarai Khal, Manda Khal, Norai Khal, These Khals transport waste water from the northern flood plan to the city's central area. Waste water from these Khals and rising pollutants are carried by the Balu River.

1.5 Limitation of the research

(I) Only three sampling stations were selected.

(II) Samples were collected during wet season.

(III) Should have included few more parameters like Magnesium, Cooper, Zinc etc.

1.6 Organization of the thesis

Chapter 1: Contains general information, objective of the thesis, scope and limitations of the study and gives an idea about the whole study.

Chapter 2: Contains a brief and selective review on relevant literature, details of Balu river, water quality parameters and aquatic life.

Chapter 3: It's research methodology. It includes our research work.

Chapter 4: Contains the result and discussion found from the analysis, result variation for different models are discussed.

Chapter 5: Contains conclusion and recommendation on the basis of result.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews literature on the following topics: Balu river location, details of water quality parameters, aquatic organisms.

2.1 Balu River

The Shitalakshya river has a tributary called the Balu river. In order to store surface water, Beel Belai's wetlands, located at (23.96485°N and 90.51988°E) are one sort of submerged land. It has a small connection to the Shitalakshya river through the Suti river at Kapasia and a link to the Turag river through the Tongi Khal river in Kaliganj Upazila, Gazipur. The principal water sources for the Balu river are Tongi Khal and Norai Khal. During the flood season, the Balu river channels floodwater through the Shitalakshya and the Turag. At Demra in Dhaka, the Balu and Shitalakshya rivers converge.

2.2 Short history of Balu River and significance

The river Balu runs mainly through the extensive swamps of Belai Beel and the east of Dhaka, joining Shitalakhya river near Demra ghat in the downstream. It has a narrow connection with Shitalakhya through Suti River and also by the way of Tongi canal with Turag river that passes through northwest of Dhaka. It carries floodwater from Shitalakhya and Turag during flood season. Balu River (with inputs from the Norai Khal) contributes to carry a large quantity of sewage in upstream of the Saidabad intake. Sewage and industrial effluent from many locations significantly load in the river water which have different chemicals and toxic metals and contaminate Balu river water. The river Balu is increasingly being polluted with the city's many of industrial units and sewerage lines dumping huge volumes of toxic wastes into it day and night.

Stench from the polluted waters of Balu River affects local people as the sewage of the capital is dumped into the river. According to World Bank report, over the last 10 years major industrialization in the Dhaka watershed has been observed, especially in dyeing, washing, and textiles sectors.

Balu river is one of the important water resources to supply drinking water for Dhaka metropolitan area (DMA), which is an 11th largest city in the world (Mokaddes MAA, Nahar BS, Baten MA, 2013). The important sources of pollutants are fertilizers, pesticides, sewage, slugs, and domestic wastes (Dara S, Chand S. 2006). Most industries in this area discharge untreated effluents directly into the Tongi khal, which reaches Balu river at the end. Almost all the non-monsoon flow of Balu river originates from Tongi khal (Kamal MM, Hansen A, Badruzzaman ABM, 1999).

Figure 2.1: Balu river.

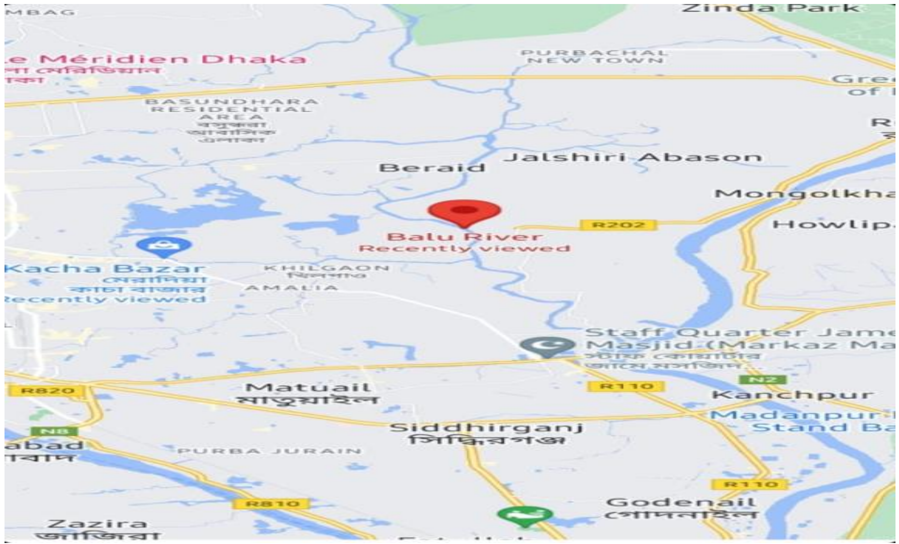


Figure 2.2: Location map of Balu river.

2.3 Water quality parameter

Water quality parameters include chemical, physical, and biological properties can be tested or monitored based on the desired water parameters of concern. Parameters that are frequently sampled or monitored for water quality include temperature, dissolved oxygen, pH, ORP, and turbidity. However, water monitoring may also include measuring total algae, (ammonia, nitrate, chloride, mercury, Mn, phosphate) or laboratory parameters such as BOD, COD, DO etc.

2.3.1 pH Of Water

pH is one of the more important parameters of water quality. pH is determined by the logarithm of the hydrogen n concentration. It is a number that represents the sample's level of acidic and basic solution. Water that is acidic includes more hydrogen ions than water that is basic, and water that is basic contains more hydroxyl ions. pH scales from 0 to 14, with 7 representing neutrality. Acidic solutions have a pH under 7, while base solutions have a pH over 7. Pure water has no odor. Rainfall has a pH of 5.6, which is somewhat acidic. A pH scale change of 1 unit corresponds to a 10-fold change in pH. This is written mathematically as pH — log [H +]. The level of high and low pH in water affects how much is used. Water with a higher pH has a harsh flavor and uses less chlorine to sterilize it. The amount of oxygen in water is the cause of the pH's rise. The pH scale is crucial because high pH levels can harm aquatic plants and animals.

The concentration of hydrogen ions has a big impact on a reservoir's productivity. pH levels between 6.4 to 8.3 are typically favorable for fish growth (Robert et al., 1940). The pH range for aquatic life protection is 6.0 to 8.5. (ISI, 1974). According to (Hepher and Pruginin, 1981), a value between 6.5 and 9.0 is ideal for fish culture. Due to waste deposits, the pH in fish cage culture may decrease (Beveridge, 1984; Pitta et al., 1999 and Demir et al., 2001). In the summer, a higher pH value (7.8 to 8.8) was noted in the Halali reservoir (Jiwyam and Chareontesprasit, 2001).

There are some effects of pH on aquatic life which are-

I. Nearly every aquatic organism has evolved to survive in water with a certain pH level. pH changes may cause them.

II. Low pH levels, which suggest an acidic environment, can harm hatchling fish eggs.

III A pH level at either extreme is lethal. Fish and other aquatic life in water can die at pH levels lower than 4 or higher than 10.

2.3.2 Dissolved Oxygen (DO)

Dissolved oxygen is an important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. A reservoir's year-round DO content of 5 mg/l is beneficial for fish culture (Tarzwall, 1957; Banerjee, 1967). The levels of pollution in water bodies are indicated by the DO readings (Amankwa ah et al., 2014). It is crucial for the creation and maintenance of life. Additionally, it is essential for the breakdown and degradation of organic substances. Due to water mixing caused by strong wind activity and mixing of monsoon rainfall, higher ranges of dissolved oxygen were documented during the rainy season. The importance of DO as a measure of water quality, particularly the level of eutrophication, has been noted. Temperature, dissolved salts, wind speed, pollution load, photosynthetic activity, and respiration rate all have a major impact on DO content in water (Tamot et al., 2008). The fundamental reason for the reduced DO at some aquaculture locations is that microbes consume DO during the degradation of organic waste (Yee et al., 2012). Never did oxygen levels drop below 4.0 mg/l, which is thought to be the crucial amount for raising tropical fish (Mallasen et al., 2012). The formation of ammonia and other pollutants as well as issues with DO depletion at night can be brought on by rapid plankton development. According to (Nsonga, 2014), warm water fish prefer a DO level of 6.5 mg/l or more than 5 mg/l. According to reports, the fish in cages' breathing causes the water around them to become oxygen-depleted (Cornel and Whoriskey, 1993). Fish farming experts Swingle (1969), Neill and Bryan (1991), and Daniel et al. (2005) all agreed that DO values below 3.5 mg/l are not acceptable. Boyd (1998) came to the conclusion that the ideal range for dissolved oxygen concentration in water is 5 to 15 mg/l. In the summer, when wind is weak and oxygen levels are low, cage culture activities have been reported to self-pollute in Lake Taal, Philippines, killing fish (Yambot, 2000). (Rani et al., 2004) showed decreased dissolved oxygen values throughout the summer because of a greater rate of organic matter breakdown and a constrained water flow in a low holding environment due to high temperature. According to (Karnatak and Kumar, 2014), cage culture frequently experiences localized water quality issues, particularly those related to low dissolved oxygen. Other organisms in the lake, pond, or stream may not be affected by low dissolved oxygen inside cages.

2.3.3 Biochemical Oxygen Demand (BOD)

BOD measures how much oxygen is used up by bacteria and other microorganisms during the aerobic breakdown of organic material. The biological oxygen demand is a crucial factor in determining the level of pollution in a body of water. BOD itself is not a pollutant and does not directly hurt anything, but it may inadvertently harm things by lowering DO concentrations that are harmful to fish life and other useful applications. BOD stands for the portion of dissolved organic matter that is broken down and readily absorbed by bacteria. BOD is a quantitative indicator of the existence of biodegradable organic matter, which removes DO from water. Higher BOD values result in an unpleasant odor and an unhealthy environment. Due to favorable environmental factors for microbial activities at a higher temperature, BOD values are higher (Tamot et al., 2008). Higher values of BOD can be directly correlated with pollution status and have an inverse relationship with DO concentration because BOD is directly linked to the breakdown of dead organic matter present in the lake. In Bhopal's Hathaikheda reservoir, BOD readings ranged from 0.0 to 4.0 mg/l (Namdev et al., 2011). According to (Tamot et al. 2008), the BOD level in Halali Reservoir ranged from 3.2 to 6.8 mg/l. High oxygen demand was caused by high BOD values, which were typically found near the bottom of the cage aquaculture site where nutrients and organic matter from the fish, excess feed, and waste accumulated. During the dry season, when the water temperature rises, the rate of decomposition also increases (Yee et al., 2012).

2.3.4 Chemical Oxygen Demand (COD)

A measurement of the quality of water and wastewater is the chemical oxygen demand (COD). The COD test is frequently used to evaluate the effectiveness of water treatment plants. Chemical oxygen demand, which is typically combined with biological oxygen demand, is a measure of the amount of organics in water (BOD). The COD is a measurement of the amount of organic matter in a sample that can be oxidized by a potent chemical oxidant (APHA, 1995). The COD is frequently used to assess how susceptible organic and inorganic elements are to oxidation in water bodies, sewage effluents, and industrial plant effluents (Chapman, 1996). As a result, the COD is a valid metric for determining the degree of water pollution. As organic and inorganic matter concentrations rise, water's COD rises as well (Boyd, 1981). (Garg and co. 2010).

2.3.5 Iron

The most prevalent element or metal in the crust of the Earth is iron (chemical symbol Fe), which is also a necessity for life. Aquatic species, however, might suffer negative impacts from elevated levels in the water, whether from anthropogenic activity or naturally occurring substances. Negative effects include physical harm to the gills and oxidative damage to other organs. Despite the widespread and potentially dangerous impacts of high iron, the USA has a national water quality guideline that states that it should be less than 1.0 mg per liter.

Iron does not kill aquatic species at normal levels, but at greater concentrations, when it does not dissolve in water, fish and other animals cannot metabolize all the iron they consume from the environment or their diet. Animals that have too much iron in their internal organs may eventually die. Higher iron content in fish and aquatic plants is harmful to the people and animals who consume them.

2.3.6 Turbidity

In May 2015, the turbidity of water samples from the Balu River ranged from 0.85 to 43.54 NTU and from 12.78 to 20.4 NTU during the monsoon (June 2015). While the drinking water regulation for turbidity is 10 NTU, the highest measurement of turbidity in the Balu River was discovered to be 43.54 NTU. The presence of fine suspended stuff in the water, such as clay, silt, colloidal particles, plankton, and other minute organisms, is what causes turbidity. In addition to shielding bacteria from chlorine treatment, high turbidity may also do so. On the other hand, reduced turbidity does not guarantee that water is pathogen-free (Boyd DR. 2006) A high level of turbidity poses an indirect threat to public health rather than a direct one. A health danger associated with consuming excessively turbid waters, such as Balu river water, is the possibility of gastrointestinal (GI) disorders and outbreaks (Hasan MK, Happy MA, Nesha MK, et al.2014). Infections of the stomach and intestines are referred to as gastrointestinal (Boyd CE, 1998).

2.3.7 Temperature

Temperature is a critical water quality and environmental parameter. due to the fact that it controls the diversity of aquatic life, the water's maximum dissolved oxygen content, and the speed of chemical and biological reactions. Aquatic species are impacted by temperature in many different ways. The majority of aquatic species have bodies that are constantly changing in temperature and are identical to the water they are in. The majority of aquatic species are acclimated to a restricted range of temperatures, and they perish when that range is exceeded or diminished. Their metabolism, reproduction, and emergence are all impacted by temperature. The rate of photosynthesis of aquatic plants, the foundation of the aquatic food web, is similarly influenced by temperature. The toxicity of pollutants can increase with temperature. As the water warms, dissolved oxygen concentrations decrease. Fahrenheit or Celsius degrees are used to measure temperature (Centigrade).

All aquatic life is controlled by water temperature. Temperature has an impact on every biological and chemical process in an aquaculture operation. It is among the most significant outside influences that affect fish productivity. Fish growth is slowed down at temperatures above or below their optimum, and fatalities can happen in very hot or very cold temperatures (Joseph et al., 1993). (Boyd,1982) said that warm water fish culture is good for water temperatures between 26.06 and 31.97°C. According to research, the best temperature range for tropical fish culture is between 25 and 32 °C (Bolorunduro and Abdullah, 1996). According to (Siti-zahrah et al. 2004, 2008), tilapia cage cultures in Malaysia's Tasik Kenyir reservoir experience a high death rate when the water temperature rises above 30°C. Thailand's tilapia cage culture had an average temperature of 21.38 ºC, according to Mondal et al. (2010). In a tilapia cage cultivation system, (Zanatta et al. 2010) measured an average temperature of 23.58 ºC in the Jurumirim reservoir, Brazil. Due to the low water level, high air temperature, and clean environment, most water bodies have high water temperatures (Thirupathaiah et al., 2012). (Jiwyam,2012) found that tilapia cage culture in Thailand had an average water temperature of 26.81 °C. According to (Nyanti et al. 2012), in cage culture of the Batang Ai Hydroelectric dam reservoir, Sarawak, Malaysia, the temperature drops as depth rises.

2.3.8 Electric Conductivity (EC)

Water's ability to transmit an electric current is known as its electrical conductivity, or EC. It evaluates a solution's capacity to transport an electrical current. Ions carry the electrical current, and as ion concentration rises, so does conductivity. The dissolution of salts and other compounds in water can produce positively and negatively charged ions. These free ions in the water transmit electricity, hence the water electrical conductivity relies on the concentration of ions. The EC of water is calculated using salinity and total dissolved solids (TDS), which aids in determining the purity of the water. The conductivity decreases with increasing water purity. To use a practical illustration, saltwater is a much more effective electrical conductor than pure water, which is virtually an insulator. Sodium, calcium, potassium, and magnesium are the four main positively charged ions that have an impact on the conductivity of water (M. A. 2012). Chloride, sulfate, carbonate, and bicarbonate are the four most common negatively charged ions. Although they only contribute a small amount to conductivity, nitrates and phosphates are crucial for life. Rain, geology, and evaporation are the three main natural influences on EC in water.

2.4 Water quality effect on fish culture

One of the most crucial prerequisites for aquatic life, including fish culture, is good water quality. For aquaculture production systems, it is essential. When we talk about good water quality, we don't only mean what we think the fish want. This shows that we need to comprehend the needs of the fish being raised in terms of water quality. Fish are entirely reliant on the water in which they reside for all of their needs. There are several fish species and distinct characteristics of water quality. Measurements of the pH and dissolved oxygen in water. For their development or survival, factors including biological oxygen requirements, salinity, hardness, and others are crucial. Each species has its own optimal range that falls within the limitations of water quality's tolerance level. the ideal temperature range where a species thrives. Therefore, maintaining adequate water quality within the ideal range for the fish being raised is crucial for the fish. Fish with low growth, various illness symptoms, or parasite infestations will live outside of these ranges. In dire circumstances, fish mortality is possible. According to climatic and seasonal variations, the river's water is always changing. Controlling the composition to produce the ideal conditions for fish is the goal of effective management. It's important to comprehend water quality characteristics in order to preserve fish growth and a suitable output rate.

CHAPTER 3

METHODOLOGY

This chapter describes the previous research works and objectives stated in chapter I, discusses the methodology is used in the study, the staged by which the methodology is implemented and the test procedure is detailed in section.

3.1 Methodology

The stages by which the methodology is implemented is shown as a flow chart (Figure 3.1) and then the details of the methodology is discussed.

3.2 Flow Chart

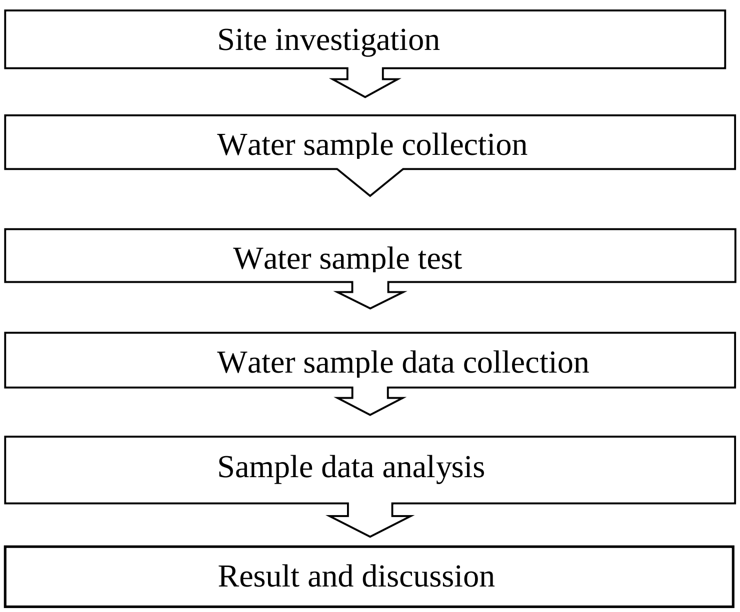


Figure 3.1: Flow chart of working process.

3.2.1 Site Investigation There are many Khals and industrial area around Balu river. We selected three station point in Balu river. These are Meradia bazar, Poschimgaon and Demra (Which is near by Shitalaksya river).

Location 1: Meradia Bazar.

Location 2: Poschimgaon.

Location 3: Demra.

Figure 3.2: Three sampling stations at Balu river.

3.2.2 Water Sample Collection

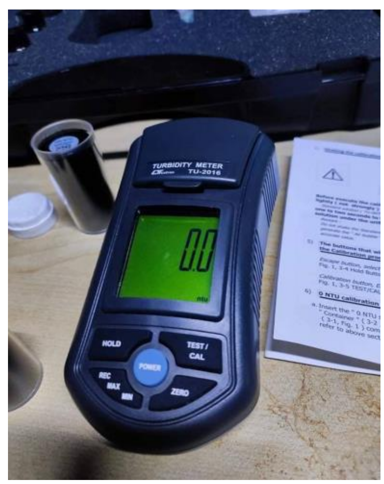
The water samples are collected from three different station point which are Meradia bazar, Poschimgaon and Demra. From each location, 1000 ml of water samples were collected by plastic bottles. The water samples were collected between 8 to 9:30 am from station point. Before sampling the bottles were cleaned and washed with detergent solution and rinsed again to avoid contamination. The sampling bottles needed to protected so it was placed to a safe place. The bottles were screwed carefully and marked with the location name and more information for sample collection, location etc. were recorded in a note book.

3.2.3 Water Sample Test

This study conducted through some experimental method. pH, DO, EC, BOD, COD, Iron, Turbidity, Temperature were measured. pH, EC, Temperature, Iron and Turbidity were tested in DIU civil engineering lab. BOD, COD, and DO were tested in DPHE lab.

EC and pH meter

DO meter



Turbidity meter

Figure 3.3: Water quality equipment for measuring water quality parameter.

3.2.3.1 pH

The pH of Balu river is measured to see how acidic or basic water is on a scale of 0to 14. The concentration of hydrogen ions is measured using the pH scale. The pH values in the water sample are determined using a pH meter. A reasonably tiny and transportable meter was used for the laboratory water testing. The pH meter has a logarithmic scale from 1 to 14, with 1 to 6 being acidic and 8 to 14 being alkaline. 7 is thought as being neutral. Materials: Sample of water, pH meter, distilled water, buffer solution etc.

Procedure: We took a calibrated beaker and pour 200 ml sample water to be tested for After switched on the pH meter it allowed to warm up the sample water for half an hour. We made cautious to verify the exposure to air as much as we could because if it were alkaline, it might react with the carbon dioxide in the air and produce carbonic acid. We cleaned the probe, configured the pH mode, and calibrated it by dipping it into a neutral buffer solution (pH 7). Similar to that, we dipped it in a pH 4 buffer solution. The meter might then be calibrated for acidic solutions as a result. Before using, we thoroughly mixed the buffer solution. The device was then inserted into the water sample, and a reading was taken by pressing the measure. We thoroughly cleaned and dried the electrode. After that, we positioned the electrode against the sample, hit the measure button, and held it there for two minutes. The pH value of our water sample was then determined. We repeated the process for a second water sample and received the results. After using, we cleaned the electrode.

Precautions we followed: The pH meter's electrodes were quite fragile, so we handled it with great care. The pH measurement may be influenced by temperature. The temperature may be caused by varying electrode output temperatures. We let the electrode soak in a weak solution of hydrochloric acid prior to testing.

3.2.3.2 Dissolved Oxygen (DO)

There are three analysis methods available to measure DO levels. An old-fashioned technique, a colorimetric technique, and a modern technique. Considering that it was simple and took less time, we adopted the new approach. using optical sensors in contemporary methods. When performing spot sampling, the dissolved oxygen sensors are fastened to a meter or a data logger. In the lab or out in the field, a dissolved oxygen meter might be useful. Uses of DO sensors include spot sampling, monitoring, and BOD (biochemical oxygen demand) tests. Temperature, pressure, and salinity all have an impact on dissolved oxygen concentrations. The interaction of oxygen with specific luminous dyes is measured by this DO meter.

Materials: Sample water, DO meter etc.

Procedure: First, a beaker was filled with the water sample from the bottle. The DO meter was then submerged in the test sample water. Each water sample underwent a DO test. For 40 minutes, the DO meter was submerged. The DO reading was then taken from two of the sample waters.

Precaution we followed: It was crucial to avoid contaminating the sample with ambient oxygen while it was being taken.

3.2.3.3 Biochemical Oxygen Demand (BOD)

The amount of oxygen needed to stabilize waste water is among its most critical properties. The word "oxygen demand" refers to a quantity that can be calculated either as biological oxygen demand or chemical oxygen demand. BOD is the amount of oxygen needed, which can be measured using a standard procedure, to stabilize wastewater in the presence of microorganisms that consume chemical contaminants and oxygen in the sample. The amount of soluble oxygen required by aquatic organisms is determined by the biochemical oxygen demand process. River oxygen dissolve directly relates to biological oxygen requirement. The same elements that influence dissolved oxygen also have an impact on biological oxygen demand. The measurement of BOD involves two steps: the first measurement of DO (dissolved oxygen) and the subsequent incubation in a laboratory for five days to determine how much remaining dissolved oxygen (final). The samples were maintained for five days in a dark location to guarantee that photosynthesis did not take place. Then, after incubating the DO sample for five days, we obtained the final BOD readings.

3.2.3.4 Chemical Oxygen Demand (COD)

The COD is the quantity of oxygen necessary to oxidize the organic material in water. The amount of organic matter in a water sample and the amount of oxidation that will take place are both determined by chemical oxygen demand testing. Finding out how many inorganic compounds are present in a sample is another purpose for chemical oxygen demand testing.

COD is significant because it serves as a predictor of the amount of oxygen needed to treat incoming waste streams, which ultimately determines the need for aeration equipment and electricity. Users can adjust their power usage and reduce their energy costs by being aware of the COD levels. In a higher sense, COD is also a crucial indicator of the effect that discharged water would have on the receiving body. Biological oxygen demand (BOD) is frequently estimated using COD because it is a much more reliable and straightforward measurement. It is reasonably easy to infer a BOD concentration from a COD test in cases where the ratio of BOD to COD has been established.

3.2.3.5 Electric Conductivity (EC)

A test for electrical conductivity reveals the soluble ions present in the water. For a water quality investigation, this test is necessary. The temperature of a water sample has a considerable impact on the conductivity of that water sample. Because a riverside sample of the test water has been taken. EC meters and probes can be used to test electrical conductivity as well. Metal electrodes make up the meter's structure. The electrodes are subjected to a continuous voltage, which causes an electrical current to pass through the aqueous water sample. It is possible to quantify the electrical conductivity because the current flowing through a water sample is proportional to its dissolved ion concentration. Conductivity measurements increase in proportion to the amount of dissolved salt or ion concentration in the water.

Materials: Beaker, Water samples, EC meter.

Procedure: The technique used to measure water samples from locations 1, 2, and 3 together with a waste beaker to rinse the copper electrodes and a wash bottle filled with lab water. The LED lit up when the EC meter was turned on and dipped into the water solution. The EC meter was set up on the beaker and lowered below the liquid's surface. We then took a reading and converted it to ppt units. After that, we changed the unit into ppm. (1ppt = 1000 ppm).

Precautions we followed: We stayed away from potential temperature change areas while conducting measurements at room temperature. The conductivity cell was cleaned. We submerged the cell in the sample to the point where the electrodes were swimming in the liquid. We carefully examined the sample water to see if any bubbles remained. While transferring the electrodes from one solution to another, contaminated solutions should be avoided.

3.2.3.6 Turbidity

Water clarity in streams, rivers, lakes, and the ocean is gauged by turbidity. The amount of light that is dispersed or obstructed by suspended particles in a water sample is known as turbidity. Cloudy or muddy water has a higher turbidity level than clear water, which has a low turbidity. Particles of soil, organic debris, metals, or other similar materials suspended in the water column are what generate turbidity.

Materials: Turbidity meter, Water sample.

Procedure: Nephelometric Turbidity Units are frequently used to measure turbidity (NTU). The nephelometric approach contrasts the amount of light scattered in a reference solution with how light is dispersed in a water sample. Turbidity is frequently measured with an electronic hand-held meter. A comparable equipment can be used to conduct measurements as well.

Precautions:

I. It is not recommended to use turbidity tubes to measure less than 5 NTU.

II. When taking measurements in a lab, gloves are recommended.

III. Remember that vibration can result in unreliable readings. Measurements should be performed on a flat, stationary surface that is not moved by machines or motors.

3.2.3.7 Temperature

The rate of chemical and biological processes is influenced by water temperature, which also has an impact on other measured parameters (e.g. as temperature increases, the maximum amount of dissolved oxygen decreases). One of the most crucial factors for aquatic creatures is water temperature. Many creatures are acclimated to a particular range of temperatures, and those that are too warm might stress or even kill them. For instance, trout, a cold-water fish, struggle to survive in water that is warmer than 20 °C.

Materials: Water sample, thermometer etc.

Procedure: Place the thermometer two thirds below the water's surface to determine the temperature of the liquid. Measure where there is a central flow of traffic. Before taking the thermometer out of the water, give it at least one minute to acclimatize to the water's temperature.

3.2.4 Water Sample Data

pH, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Electrical Conductivity, Turbidity, Iron, and Temperature test result data were summarized at table 1.

3.2.5 Water Sample Data Analysis

All of the sample data was recorded in table 3.1. Data analysis table below:

Table 3.1: Lab test result of water quality parameter at different locations.

Location	pH	DO (mg/l)	BOD (mg/l)	COD (mg/l)	EC (µS/cm)	Turbidity (NTU)	Iron mg/l	Temperature (°C)
Meradia bazar	6.8	3.9	19	80	340	189.67	1.25	33.3
Poschimgaon	6.8	4.3	3	16	125	13.54	0.95	32.8
Demra	6.7	4.6	6	24	125	13.94	0.8	33.1

CHAPTER 4

RESULT AND DISCUSSION

In this chapter the result from our research works are summarized. All of the parameters shown in graph. Based on table 3.1.

4.1 pH

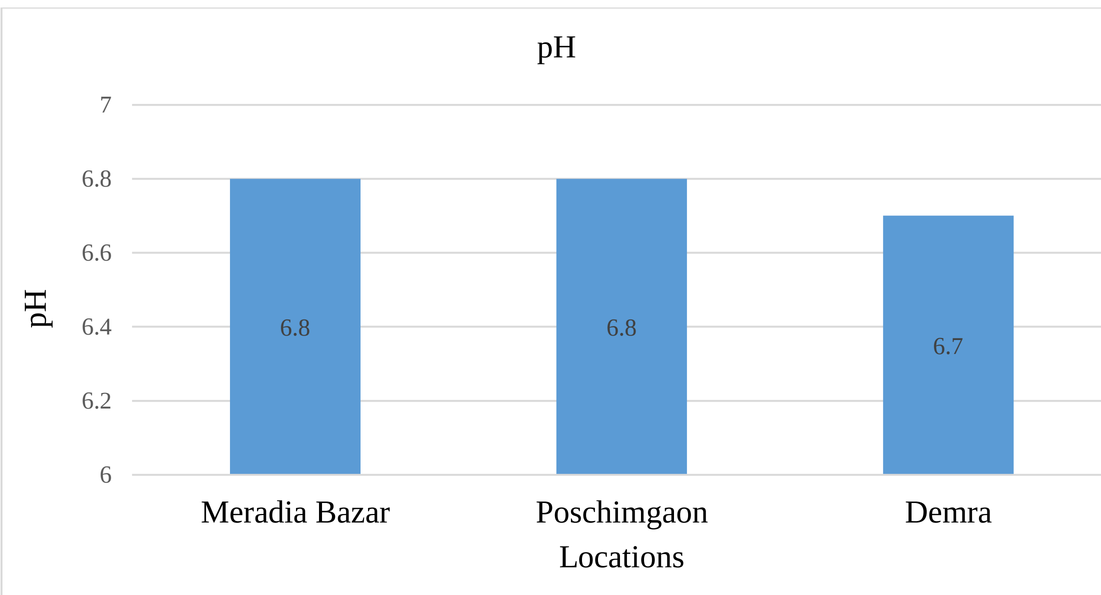


Figure 4.1: Comparison of pH value**s** at different locations.

pH greatly affects our environmental biological activity. It also affects the water body properties, activity of organisms and toxic substances. Our present research found out the pH values are, Meradia bazar 6.8, Poschimgaon 6.8 and Demra 6.7 which are within the WHO standard limits. These pH range are acceptable and suitable for drinking water, irrigation and aquatic life.

4.2 Dissolved Oxygen (DO)

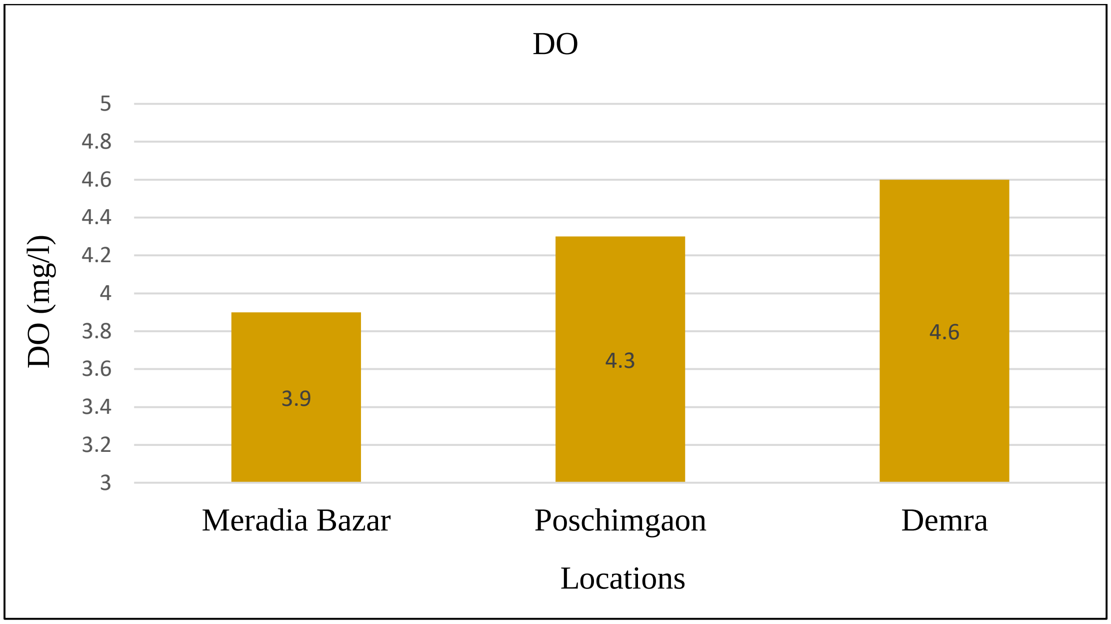


Figure 4.2: Comparison of DO values at different locations.

DO supply is essential for survivor of aquatic organisms. It is needed for waste degeneration of micro-organisms. Excessive dissolved gases affect the fish life which may cause bubble disease. The values of DO at different sampling points of the Balu river water were within the range of 0 to 5 ppm. We got DO values at Meradia bazar 3.9, Poschimgaon 4.3 and Demra 4.6. For domestic and industrials activities DO level 4 to 6 ppm is acceptable (Rahaman et al, 2012). For aquatic life DO range is 5 ppm. On the basis of this research, Poschimgaon and Demra are acceptable for domestic and industrial activities but not suitable for aquatic organisms. Meradia bazar is not suitable for anything. Here, oxygen level is very poor.

4.3 Biochemical Oxygen Demand (BOD)

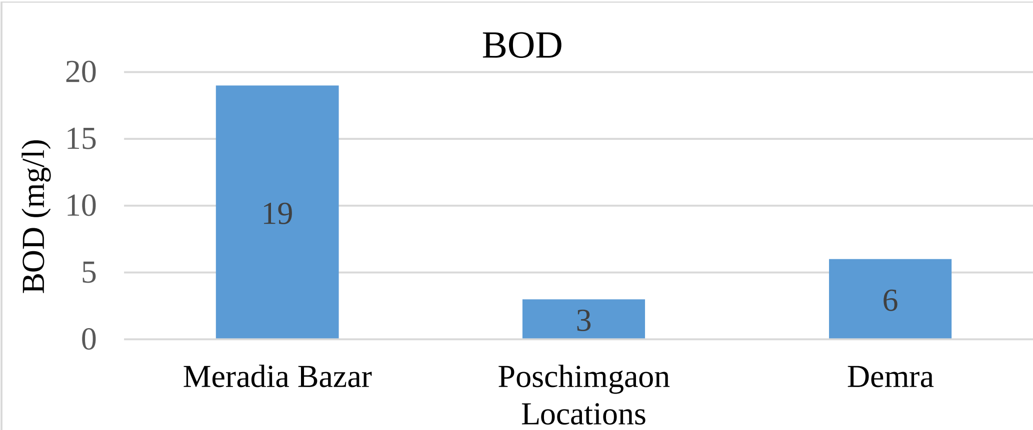


Figure 4.3: Comparison of BOD values at different locations.

BOD is most important parameter for surface water quality. We got BOD values at Meradia bazar 19 (mg/l), Poschimgaon 3 (mg/l) and Demra 6 (mg/l). The permissible limit for BOD for recreational water is 3 (ppm), fish culture is 6 (ppm) and irrigation is 10 (ppm) in Bangladesh standard (ECR, 1997).

4.4 Chemical Oxygen Demand (COD)

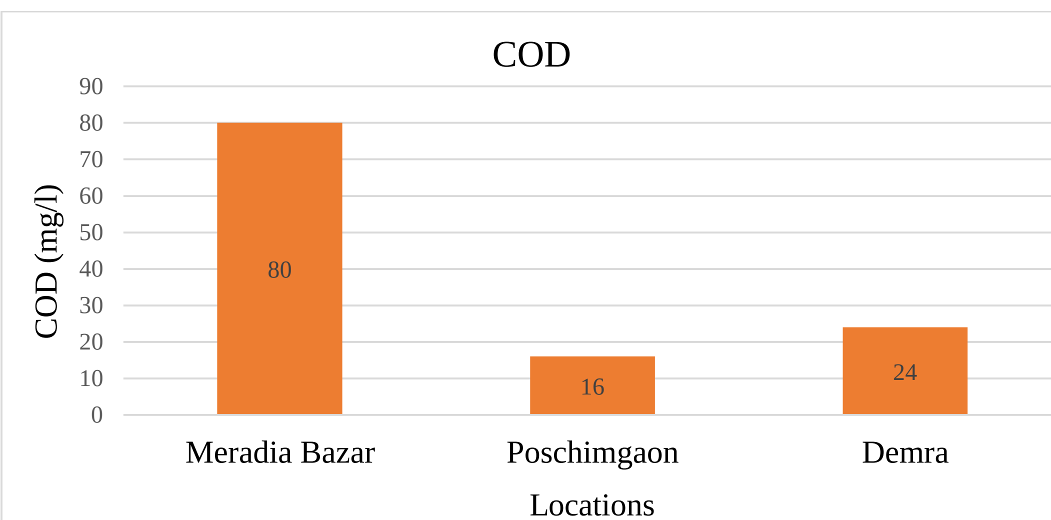


Figure 4.4: Comparison of COD values at different locations.

COD is also important parameter for surface water quality. The chemical oxygen demand is commonly used to indirectly measure the amount of organic compounds in water. Our result on COD was 80 mg/l at Meradia Bazar, 16 mg/l at Poschimgaon and 24 mg/l at Demra. Meradia bazar has highest COD values. The acceptable COD value 4 mg/l for drinking water in Bangladesh standard.

4.5 Electrical Conductivity (EC)

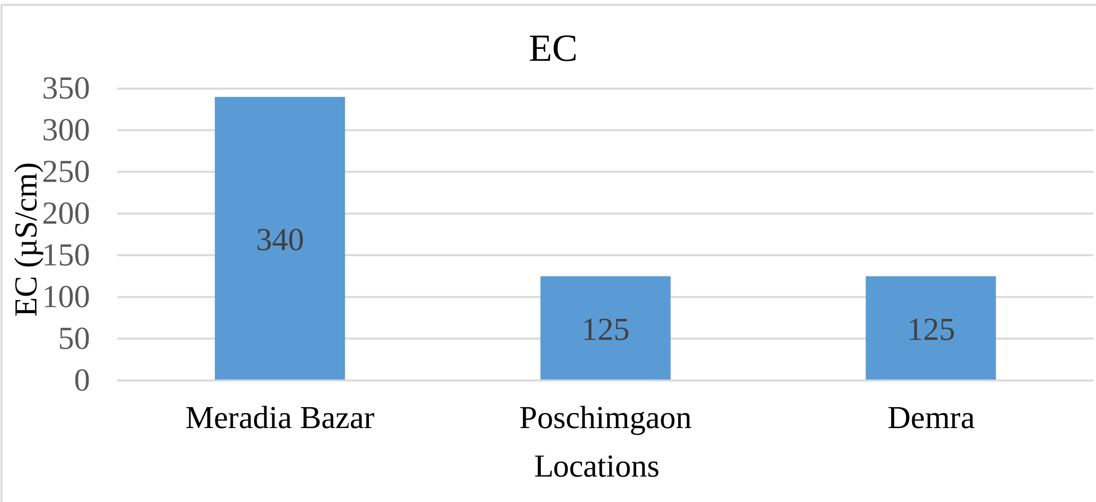


Figure 4.5: Comparison of EC values at different locations.

Electrical conductivity (EC) estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water. Our test result on EC at Meradia bazar 340 µS/cm, Poschimgaon 125 µS/cm and Demra 125 µS/cm. The maximum EC value found at Meradia bazar. The standard EC is 1200 µS/cm for inland surface water (ECR, 1997). The acceptable range of EC for recreational water is 500 µS/cm. for irrigation 750 µS/cm and aquaculture is 800 to 1000 µS/cm (ADB, 1994).

4.6 Turbidity

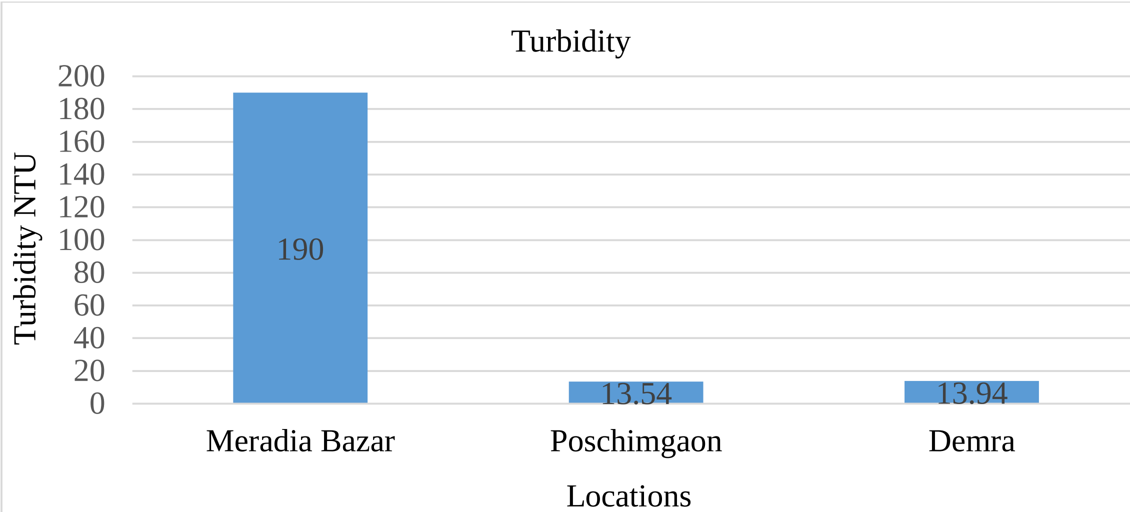


Figure 4.6: Comparison of Turbidity values at different locations.

Turbidity is a significant water quality parameter. We found Turbidity value at Meradia bazar 190 NTU, at Poschimgaon 13.54 NTU and Demra 13.94. Meradia bazar has highest Turbidity value. The acceptable Turbidity value is 10 NTU (ECR, 1997). WHO standard turbidity value is 5 NTU (WHO, 2004).

4.7 Temperature

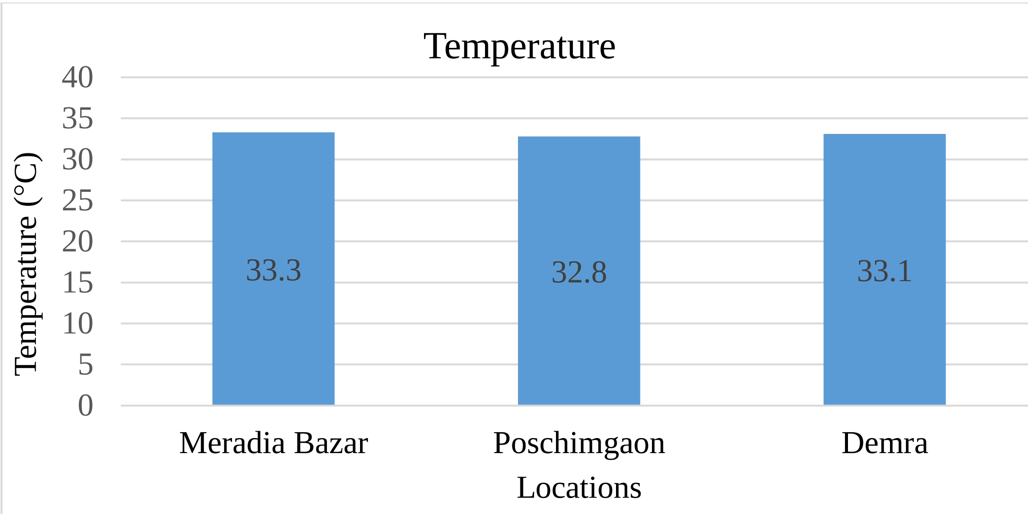


Figure 4.7: Comparison of Temperature values at different locations.

We found temperature values at Meradia bazar 33.3 °C, Poschimgaon 32.8 °C and Demra 33.1 °C. All values are almost close to each other. Average Temperature is 33 °C. The acceptable temperature for aquatic life 26 °C to 32 °C (Roy et al. 2019).

4.8 Iron

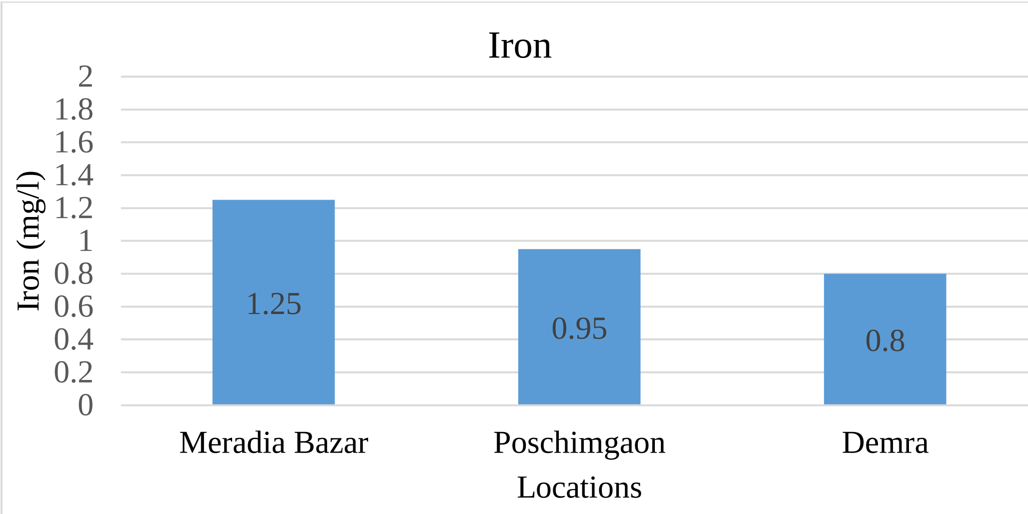


Figure 4.8: Comparison of Iron values.at different locations.

We found Iron values at Meradia bazar 1.25 mg/l, Poschimgaon 0.95 mg/l and derma 0.80 mg/l .Meradia bazar is most polluted location among them. This is why, Meradia bazar has highest value of Iron. In Bangladesh, permissible limit of Iron is 0.3-1.0 mg/l, whereas WHO standard level is 0.3 mg/l.

4.9 Observation of water quality parameters on aquatic life

All the study summarized in table 4.1. All the locations compared with Bangladesh standard values Water quality parameters are critical factors in terms of fish culturing or aquatic organisms. Optimal water quality varies by specie and must be monitored for the production of aquatic species. Water quality parameters that are commonly monitored listed in table 4.1.

Table 4.1: Mean values of water quality parameter.

Parameters	Units	Meradia Bazar	Poschimgaon	Demra	Mean values	Aquatic Life Standard (ECR, 1997)
pH		6.8	6.8	6.7	6.77	6.5-8.5
DO	(mg/l)	3.9	4.3	4.6	4.27	5 or more
BOD	(mg/l)	19	3	6	9.3	6 or less
EC	(µS/cm)	340	125	125	197	200-1000
COD	(mg/l)	80	16	24	40	
Turbidity	NTU	190	13.54	13.94	72	10
Temperature	(°C)	33.3	32.8	33.1	33	26-32
Iron	(mg/l)	1.25	0.95	0.80	1	1

4.9.1 pH on aquatic life

The pH of the water affects fish development and survival. pH is a crucial component of aquatic life and fish culture. pH measures the water's acid-base equilibrium. pH 7 is classified as neutral. On a scale of 1 to 14, alkaline is above 7, while acidic is below 7. For fish culture, a pH between 6.5 and 8.5 is ideal. Aquatic life may experience stress from above or below. On this research we found pH values at Meradia bazar 6.8, Poschimgaon 6.8, and Demra 6.7 which are acceptable range for fish culture. We found average value of pH is 6.77 which permissible for aquaculture, irrigation and drinking water. The pH level of Balu river is within acceptable range.

4.9.2 Dissolved Oxygen on aquatic life

The most important indicators for fish culture and aquatic organisms are DO. The primary supply of oxygen in the ocean comes from phytoplankton, which produce carbohydrates utilizing sunlight and release oxygen. By simple diffusion, some oxygen will dissolve from the atmosphere. The oxygen will permeate into water more quickly if there is any surface turbulence or agitation. This is the fundamental idea behind the majority of aerators. Fish surfacing in the fish pond, especially in the morning hours, is a clear indication of acute oxygen stress. The water's dissolved oxygen level needs to be checked every week. For fish culture, the DO standard value is 5 or above. On this research, we got DO values at Meradia bazar 3.90 mg/l, Poschimgaon 4.30 mg/l and Demra 4.60 mg/l. Meradia bazar has most below DO value of them. On this study the mean value of DO is 4.27 which is slightly lower than acceptable value.

4.9.3 Biochemical Oxygen Demand on aquatic life

The amount of dissolved oxygen (DO) consumed by biological organisms during the breakdown of organic matter in water is measured by the biochemical oxygen demand (BOD). A higher BOD indicates a greater need for oxygen, which leaves less available for oxygen-dependent organisms to consume and denotes poorer water quality. Conversely, a low BOD indicates that less oxygen is being taken out of the water, making the water in general purer. On this study, we found BOD values at Meradia bazar 19 mg/l, Poschimgaon 3 mg/l, and Demra 6 mg/l. Poschimgaon and Demra have desirable BOD value. Meradia bazar indicates too high BOD value at the moment.

4.9.4 Chemical Oxygen demand on aquatic life

The amount of oxygen used when the water sample is chemically oxidized is known as the chemical oxygen demand (COD). The amount of oxygen that can be consumed by reactions in a measured solution is shown by the COD measurement. It serves as a gauge for the amount of reducing agents in water, including organics, nitrite, sulfide, ferrous salts, etc., with organics predominating. Higher COD values indicate that the sample contains more oxidizable organic material, which will lower the dissolved oxygen (DO) levels. On this study, we found COD values at Meradia bazar 80 mg/l, Poschimgaon 16 mg/l and Demra bazar 24 mg/l. The average COD value is 40 mg/l. As usual Meradia bazar has worst value than other two parameters. Here, we can see COD value is higher than acceptable range.

4.9.5 Electrical Conductivity on aquatic life

A solution's electrical conductivity, a measurement of how well it conducts electricity, is connected with the amount of salt in the solution. Microsiemens per centimeter are the standard units used to measure conductivity. Freshwater fish may survive in a variety of electrical conductivity levels. To aid fish in maintaining their osmotic equilibrium, a minimum amount of salt content is preferred. A rough estimate of the total amount of dissolved solids in water is also provided by EC. During transport to the laboratory, conductivity may fluctuate slightly. The desirable range for fish culture in Bangladesh is 200 to 1000 µS / cm (ADB, 1994). On this study we found EC values at Meradia bazar 340 µS/cm, Poschimgaon 125 µS/cm, and Demra 125 µS/cm. The mean value of EC is 197 which is slightly lower than standard values.

4.9.6 Turbidity on aquatic life

A crucial indicator of water quality is turbidity. Turbidity is a metric used to assess a liquid's relative clarity. It is a measurement of the amount of light scattered by the components of water when light is shone through a water sample. It is an optical property of water. High turbidity denotes extremely poor water quality. Clearer water is indicated by low turbidity. On this research, we found turbidity values at Meradia bazar 190 NTU, Poschimgaon 13.54 NTU and Demra 13.94. The mean Turbidity value is 72 NTU. Meradia bazar indicates worst quality water. The acceptable Turbidity value is 10 NTU where, Meradia bazar present 190 NTU which is too higher than standards value.

4.9.7 Temperature on aquatic life

An essential indicator for fish culture is temperature. For aquatic life, water temperature is crucial. At greater temperatures, chemical reactions typically proceed more quickly. Higher temperatures enable more minerals from the surrounding rock to dissolve into water, especially groundwater, increasing its electrical conductivity. We found temperature values at Meradia bazar 33.3 °C, Poschimgaon 32.8 °C and Demra 33.1 °C. The mean Temperature value is 33 °C. The acceptable Temperature range for aquaculture is 26 °C to 32 °C. Temperature is close to acceptable range.

4.9.8 Iron on aquatic life

Iron is a metallic substance in water. High Iron indicates poor water quality and low amount Iron indicates safe water. Iron is also significant for fish culture. On this study, we found Iron values at Meradia bazar 1.25 mg/l, poschimgaon 0.95 mg/l and Demra 0.80 mg/l. mean value is 1 mg/l. WHO standard permissible Iron value is 0.2 mg/l for drinking water. For aquaculture the permissible Iron value is 1 mg/l or lower.

4.9.9 The reason why Meradia bazar has poor values

Meradia bazar located at Rampura khal which is joining to the Balu river. Basically Balu river based on khals. There are many khals joining to the Balu river. That’s why, we selected Meradia bazar as a location.

Meradia bazar is the most polluted area nearby. There are lot of domestic disposal and constructional effluence dumped into this location. Also, organic and inorganic materials caused to polluting this area. There is a local bazar called Meradia bazar which is responsible to polluting this location.

4.10 Result

This study involved three samples location. Locations were selected near industrial or polluted area in Balu river. Eight parameters were chosen to measure water quality. To access the water quality parameters of Balu river pH, DO, BOD, COD, EC, Turbidity, Temperature and Iron were determined and shown in table 3.1.

- The pH values were suitable for all locations. Average pH value was 6.77 which is within acceptable range.
- DO values were slightly lower. Acceptable values should be above 5 mg/l. Average DO value was 4.27.
- BOD and COD values were higher than standard range. Mean BOD values were 9.3 mg/l and mean COD values were 40 mg/l.
- Temperature was slightly higher than standard range. Mean Temperature was 33 °C.
- Turbidity values weren't acceptable range. The mean value was 72 NTU.
- Electrical Conductivity were not acceptable as well. Acceptable range for fish culture 200 to 1000 µS/cm. The mean value was 197 µS/cm.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This chapter concludes the overall summary of the research work. A summary of everything covered is shown in section 5.1 and 5.2 stated the findings of the research, research limitations, scope of the future work listed in below.

5.1 Conclusion

This study shows the variation of water quality parameters at three different locations. These are- Meradia bazar, Poschimgaon and Demra. From the observed physicochemical parameters. The mean values of these parameters are, pH 6.77, DO 4.27 mg/l, BOD 9.3 mg/l, COD 40 mg/l, EC 197 µS/cm, Turbidity 72 NTU, Temperature 33 °C and Iron 1 mg/l. The majority of the parameters are not within permissible range.

On the basis of this study, we found only two parameters pH and Iron are in acceptable range for aquatic life. Other all parameters are out of acceptable range. Balu river provides harmful water quality for aquatic life.

5.2 Recommendation for future works

- More sampling stations can give better result.
- Taking as many water samples can be better for comparison.
- Some other water quality parameters such as TDS, Hardness and heavy metals can be included.
- To get better result both dry and wet season need to determined.

REFERENCES

1. Lohani, B. N., Evans, J. W., Everitt, R. R., Ludwig, H., Carpenter, R. A., & Tu, S. L. (1997). Environmental impact assessment for developing countries in Asia: Volume 1-overview.

2. APHA, A. (1995). WEF (1998) Standard Methods for the Examination of Water and Wastewater. 19 edn. Washington, DC.

3. Chapman, D. (2021). Water quality assessments: a guide to the use of biota, sediments and water in environmental monitoring. CRC Press.

4. Garg, R. K., Rao, R. J., Uchchariya, D., Shukla, G., & Saksena, D. N. (2010). Seasonal variations in water quality and major threats to Ramsagar reservoir, India. African journal of environmental science and technology, 4(2).

5. Boyd, C. E. (1981). Water Quality in Warmwater Fish Ponds. Craftmaster Printing. Inc., Opelika, AL, USA, 359.

6. Amankwaah, D., Cobbina, S. J., Tiwaa, Y. A., Bakobie, N., & Millicent, E. A. B. (2014). Assessment of pond effluent effect on water quality of Asuofia Stream, Ghana. African Journal of Environmental Science and Technology, 8(5), 306-311.

7. Devi, P. A., Padmavathy, P., Aanand, S., & Aruljothi, K. (2017). Review on water quality parameters in freshwater cage fish culture. International Journal of Applied Research, 3(5), 114-120.

8. Namdev, G. R., Avinash, B., & Suman, M. (2011). Assessment of chemical fertilizers on the quality of water at Hathaikheda reservoir in Bhopal (MP). International Journal of Pharma and Bio Sciences, 2(3).

9. Yee, L. T., Paka, D. D., Nyanti, L., Ismail, N., & Emang, J. J. (2012). Water quality at Batang Ai hydroelectric reservoir (Sarawak, Malaysia) and implications for aquaculture. International Journal of Applied, 2(6).

10Tarzwell, C. M. (1957). Water quality criteria for aquatic life. US Department of Health, Education, & Welfare.

11. Neill, W. H., & Bryan, J. D. (1991). Responses of fish to temperature and oxygen, and response integration through metabolic scope. Aquaculture and water quality, advances in world aquaculture, 3, 30-58.

12. Devi, P. A., Padmavathy, P., Aanand, S., & Aruljothi, K. (2017). Review on water quality parameters in freshwater cage fish culture. International Journal of Applied Research, 3(5), 114-120.

13. Hepher, B., & Pruginin, Y. (1981). Commercial Fish Farming, A Wiley-Interscience Publication.

14. Rahman, M. D., & Hadiuzzaman, M. (2005). Pollution status and trends in water quality of the Shitalakhya and Balu rivers. B. Sc. Engineering Thesis, Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh.

15. Mowla, Q. A. (2010). Role of water bodies in Dhaka for sustainable urban design. Jahangirnagar Planning Review, 8, 13-30.

16. Kalimur Rahman, M. (2011). Assessment of heavy metal contamination of sediments of some polluted rivers.

17. Kamal, M. M., Malmgren-Hansen, A., & Badruzzaman, A. B. M. (1999). Assessment of pollution of the River Buriganga, Bangladesh, using a water quality model. Water science and technology, 40(2), 129-136.

18. Flood Action Plan (FAP) 8A. (1991). Master plan study for Greater Dhaka protection project.

19. Dara, S. S., & Mishra, D. D. (2006). A textbook of environmental chemistry and pollution control. S. Chand Publishing.

20. Mobin, M. N., Islam, M. S., Mia, M. Y., & Bakali, B. (2014). Analysis of physicochemical properties of the Turag River water, Tongi, Gazipur in Bangladesh. Journal of Environmental Science and Natural Resources, 7(1), 27-33.

21. Frieden, T. R. (2010). A framework for public health action: the health impact pyramid. American journal of public health, 100(4), 590-595.