OBSERVATION OF DRINKING WATER QUALITY PARAMETERS OF SELECTED AREA NEARBY DAFFODIL SMART CITY

Submitted By:

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A Thesis Submitted to the Department of Civil Engineering, Daffodil International University in Partial Fulfilment of the Requirements for the Degree of **Bachelor of Science in Civil Engineering**

Department of Civil Engineering
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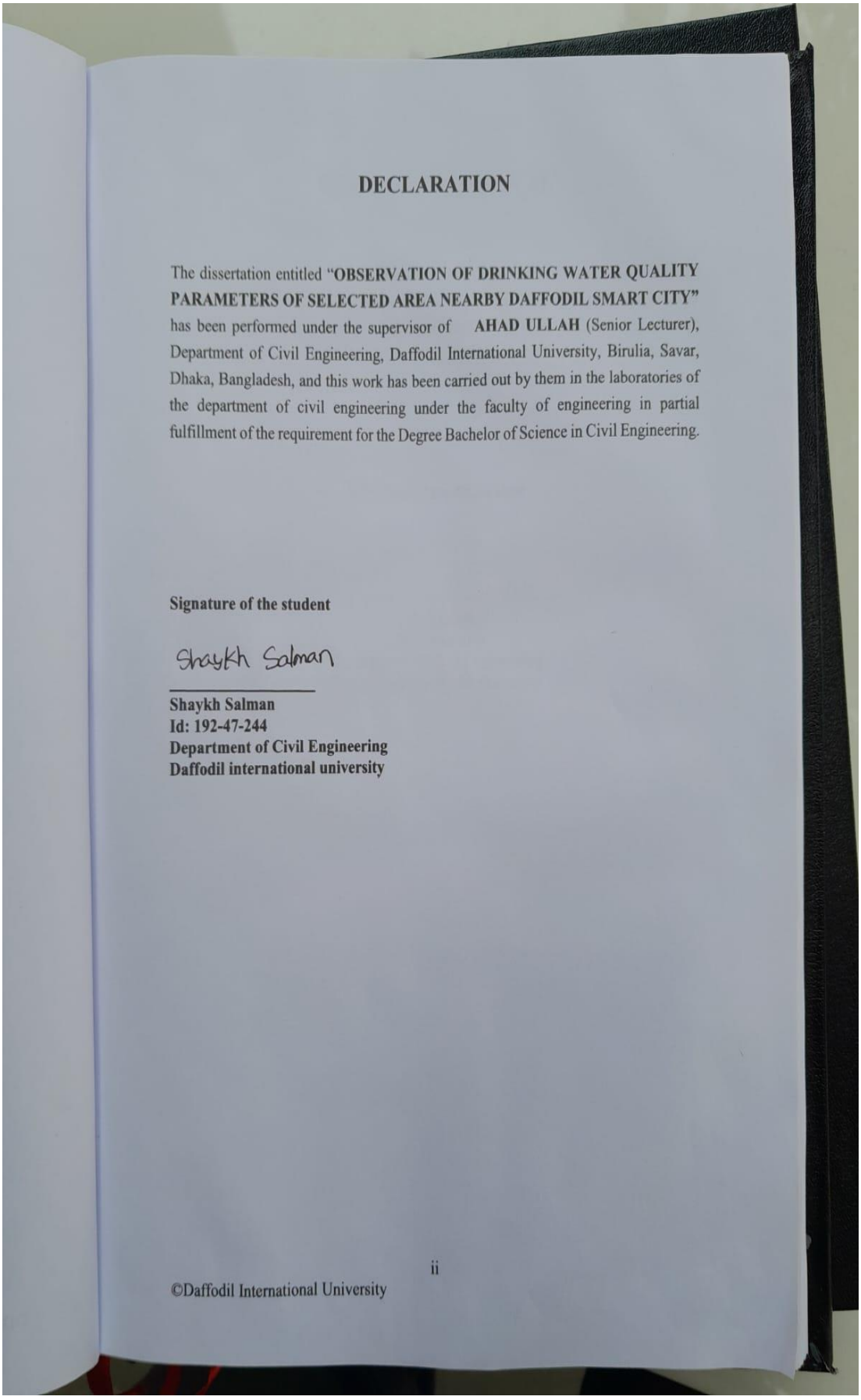

DECLARATION

The dissertation entitled "**OBSERVATION OF DRINKING WATER QUALITY PARAMETERS OF SELECTED AREA NEARBY DAFFODIL SMART CITY**" has been performed under the supervisor of **AHAD ULLAH** (Senior Lecturer), Department of Civil Engineering, Daffodil International University, Birulia, Savar, Dhaka, Bangladesh, and this work has been carried out by them in the laboratories of the department of civil engineering under the faculty of engineering in partial fulfillment of the requirement for the Degree Bachelor of Science in Civil Engineering.

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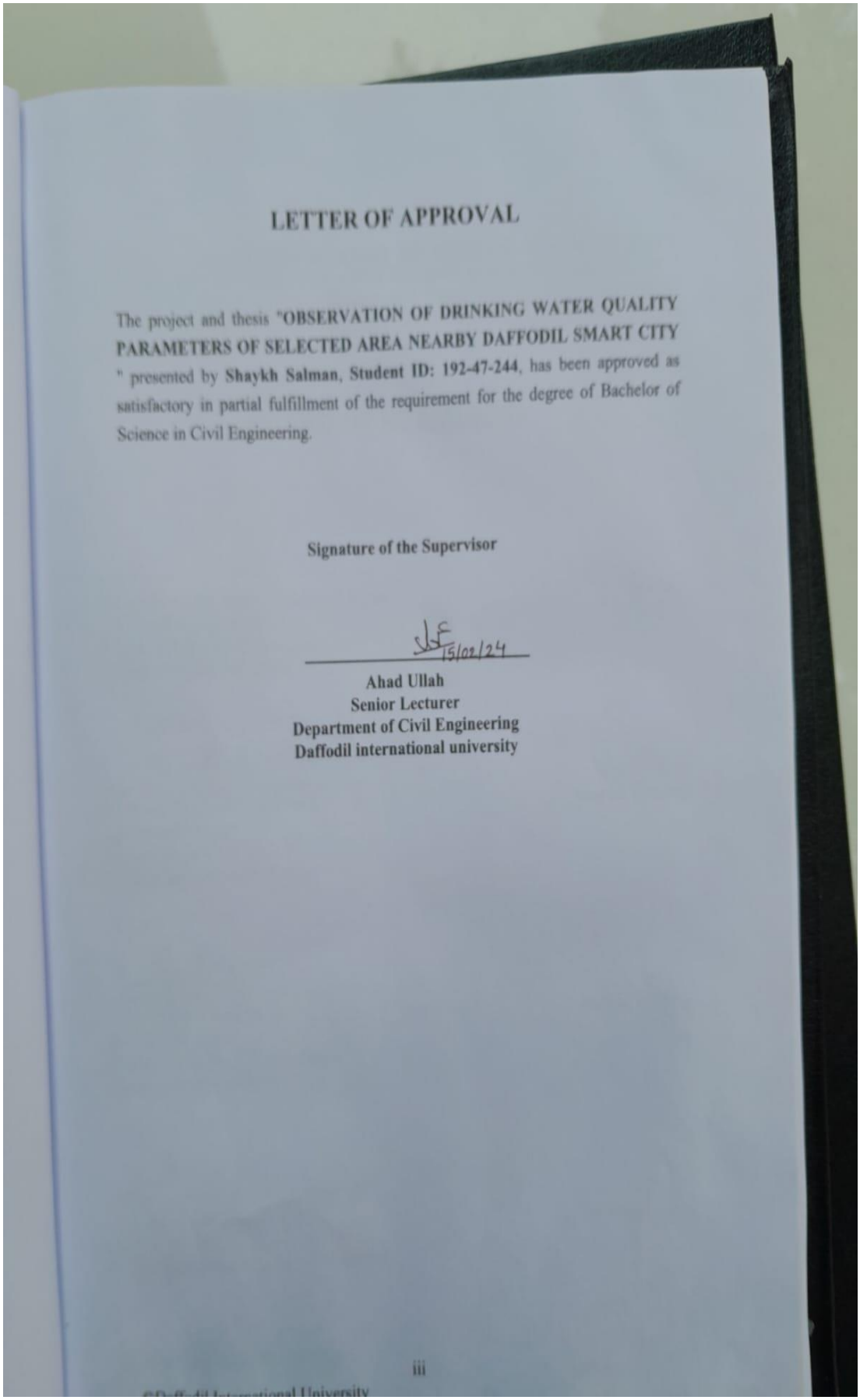

LETTER OF APPROVAL

The project and thesis "**OBSERVATION OF DRINKING WATER QUALITY PARAMETERS OF SELECTED AREA NEARBY DAFFODIL SMART CITY** " presented by **Shaykh Salman**, **Student ID: 192-47-244**, has been approved as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering.

Signature of the Supervisor

15/02/24

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The project and thesis "**OBSERVATION OF DRINKING WATER QUALITY PARAMETERS OF SELECTED AREA NEARBY DAFFODIL SMART CITY** " presented by **Shaykh Salman, Student ID: 192-47-244**, has been approved as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering.

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First, I want to thank the Almighty Allah for his blessings, approval, protection, mental strength, and wisdom in every area of our lives. We also want to applaud Allah for finishing this thesis.

We are very appreciative of the direction and leadership shown to us during the thesis period by our honorable supervisor, Ahad Ullah, Senior Lecturer, Department of Civil Engineering, Faculty of Engineering, Daffodil International University. This endeavor was made feasible by his unwavering patience, intellectual leadership, unceasing encouragement, active supervision, constructive criticism, useful guidance, and reading numerous drafts and improving them at every level.

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ABSTRACT

The fundamental requirement for good health and a fundamental human right is access to clean drinking water. It has a close connection to both the economy and the health of the country. Water contamination can harm people's health in a variety of ways. Vomiting, diarrhea, kidney, liver, and stomach cramps are a few of the most common health problems brought on by drinking water. This investigation's goal was to select an area with drinking water quality. I took thirty water samples from three different places: Khagan Bazar, Dattapara, and Changaon, Each sampling area contains ten separate sampling points. The physicochemical properties of the samples were odor, temperature, pH, turbidity, iron, dissolved oxygen (DO), and biological oxygen demand (BOD). All the evaluated characteristics were compared to domestic and international drinking water quality standards to ascertain the study region's overall drinking water quality status. The pH range for standard drinking water has been determined by my research in the Khagan Bazar, Dattapara, and Changaon yielded data that fell within this range. The outcomes for Changaon, Khagan Bazar, and Dattapara, however, some point fall outside of this range. Here, we can observe that the pH levels of the local water are quite near to the average. Additionally, some of the BOD readings from our testing in Khagan Bazar, Dattapara, and Changaon met the requirements. BOD levels in a few different samples were higher than usual. Other parameters EC, Turbidity, Iron, Temperature, DO, and Odor satisfy the drinking water quality.

DEDICATION

I dedicate this effort to my parents and our dear teacher

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CHAPTER ONE
INTRODUCTION

1.1 General

For the health and welfare of people, drinking water quality is a crucial problem. All living things need water to survive, and it's also crucial for human well-being and prosperity. One essential element for human survival is fresh water. Drinking water quality has long been a significant problem in many nations, particularly emerging nations like Bangladesh.

Drinking water quality has significantly decreased due to pollution from a variety of sources, including household sewage. This thesis launches a thorough examination of the variables affecting water quality. The study aims to provide information on the existing water quality in these places, the variables affecting their water chemistry, and any possible repercussions on the environment and human communities.

1.2 Objective of This Study

- To observe the Drinking water quality parameters of the selected area nearby Daffodil smart city.
- To Determine the quantity of pollutants in the water that is being consumed.

1.3 Scope of The Study

- We can observe the present situation of our selected area.
- We can find out the water quality of this selected area. Also, we can compare them.

1.4 Structure of The Thesis

Chapter One: Basic idea of the work that has been done under this research.

Chapter Two: Literature Review and Drinking Water Standard Guide Line.

Chapter Three: Workflow and all test names.

Chapter Four: Results of the All Areas and Variation of The Water Quality Parameters.

Chapter Five: Conclusion, Recommendation for Future Study.

CHAPTER TWO

LITERATURE REVIEW

2.1 General

Bangladesh's steadily declining water quality conditions pose serious health risks to the populace. A review of the existing literature has been done to investigate the sample area. It has been noted to appreciate the current circumstances and look into the local water problem.

2.2 Literature Review

The group examines the river Buriganga's water quality. The study aims to analyze this effluent's effects on the river water. The water samples were taken in 2008–2009 from various locations along the river during both the dry and wet seasons, and their physiochemical quality parameters were examined. According to data analysis results, the Buriganga River's water quality is unacceptable from the standpoint of aquatic ecosystems for metrics including DO, BOD, COD, NH 3 N, and throughout both the dry and wet seasons, as well as for EC during the dry season (Ashiqur & Dhia, 2010). [1]

Water is a necessary component for all living things and is important for many vital processes. It needs to be unrestrained and unhindered. Lakes and groundwater are the two most significant freshwater reservoirs on earth. The groundwater's physicochemical parameters in the study area were compared to drinking water standards set by the World Health Organization (WHO) and the Bureau of Indian Requirements (BIS) to evaluate whether the water was fit for human use (Selvam, et al., 2023). [2]

The groundwater is contaminated as a result of industrial and human activity. This is the current major issue. Therefore, it is crucial to analyze the water quality to conserve and improve the natural ecosystem. The current effort aims to evaluate the groundwater quality in Indore City and its industrial area according to the water quality index. For a physiochemical investigation, groundwater samples were taken from all of the wards' chosen stations. The examination of the water quality revealed that most of the metrics were somewhat better during the wet season than during the dry season (Dohare, et al., 2014). [3]

The objective of this review is to evaluate Malaysia's drinking water quality at present. Physical metrics (pH, turbidity, total suspended particles, total dissolved solids, temperature, and conductivity) were all within the range of the Malaysian National

Drinking Water Quality Standard's reference ranges overall. Some of the variables that contribute to an increase in the number of contaminants in drinking water are population growth and the rapid advancement of industry. Malaysia's water quality is generally acceptable (Zurahanim, et al., 2020). [4]

The study aimed to determine the variations in drinking water quality in Sri Lanka's Kurunegala district's rural districts. Seven water quality measures were tested on a laboratory scale for this study. The Environmental Laboratory will determine the selected water quality metrics (Samarasinghe & Samarakoon, 2018). [5]

The current investigation aimed to expose drinking water samples to groundwater samples for bacteriological examination and to assess the physico-chemical characteristics. The purpose of the study was to evaluate the Noakhali groundwater sources' quality as sources of potable water. Twelve water samples in total were taken from three distinct sites. Each sampling site has four distinct sampling points. Color, taste, odor, temperature, pH, electric conductivity (EC), total dissolved solids (TDS), hardness, and salinity of the collected samples were measured. Total Viable Bacterial Count (TVBC), Total Coliform (TC), coli, and Salmonella spp. were also examined as microbial parameters. The World Health Organization (WHO) drinking water standards were then used to compare the results. According to the findings, practically every physicochemical parameter and the microbiological parameter of the sample water did not meet suggested levels and were outside of permissible ranges. The study's findings showed that practically all samples from various places were unfit for consumption or use as drinking water without any initial treatment, such as boiling, filtering, or adding bleaching powder to the water. (Prosun, A. T., Rahaman, S. M., Rikta, Y. S., & Rahman, A. M. (2018). [6]

2.3 Drinking Water Standard Chart

Table 2.1: Drinking Water Standard Guide Line

No	Water Quality Parameters	Ban. Stan Guideline	WHO Guide Line
01	pH	-	6.5-8.5
02	Electric Conductivity	µs/cm	-
03	Turbidity	10 NTU	-
04	Iron	0.3-1.0	-
05	Temperature	20-30C	-
06	Dissolved Oxygen	6	-
07	Odor	Odorless	-
08	Biological Oxygen Demand	0.2	-

CHAPTER THREE

METHODOLOGY

3.1 General

To determine the quality of the water in the chosen places, samples of water were taken from Khagan Bazar, Dattapara, and Changaon for testing in the lab. pH, Electric Conductivity (EC), Turbidity, Iron Test, Temperature, Dissolved Oxygen (DO), Odor, and Biological Oxygen Demand (BOD) are the chosen criteria. The Daffodil International University Lab was used for the lab test.

3.2 Workflow

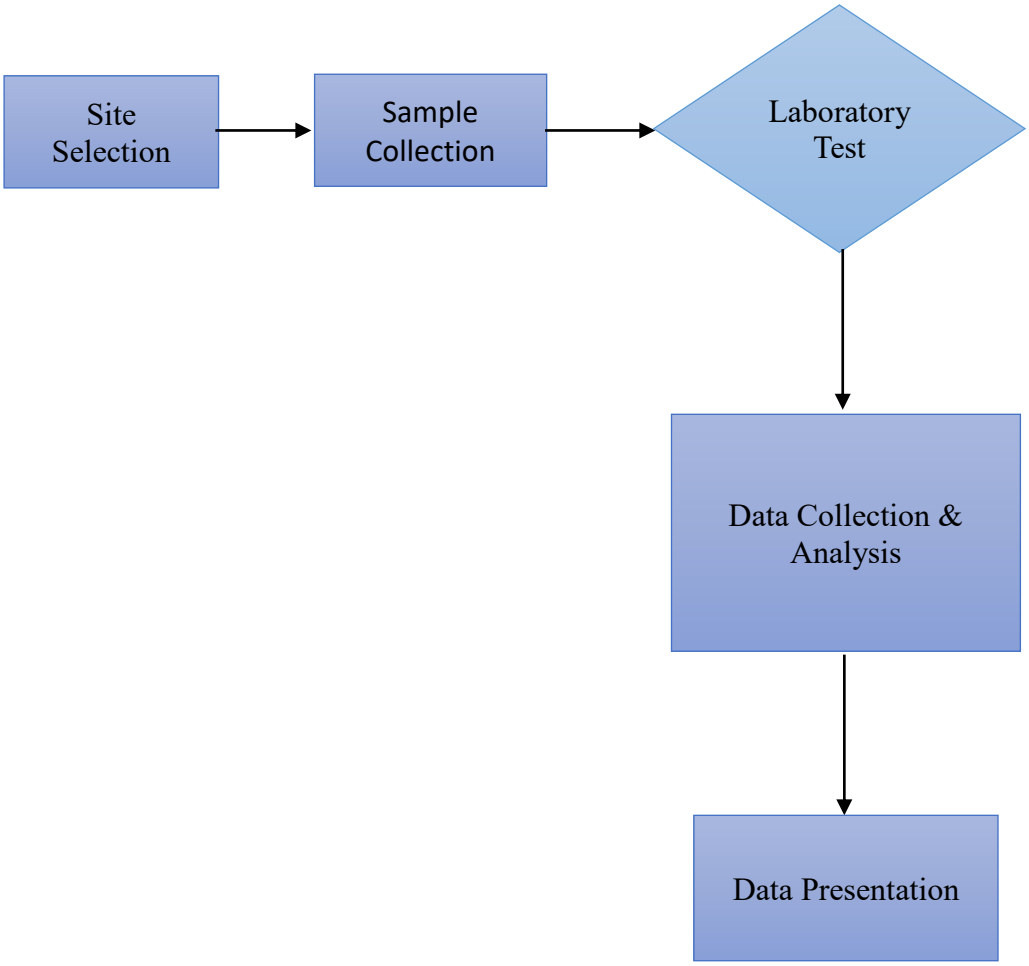

Fig 3.1: Diagram of the workflow

3.3 Water Sample Collection

Khagan Bazar:

Table 3.1: Khagan Bazar Water Collection Points

Sample No	Latitude	Longitude
01	23°52´30.3´N	90°18´41.5´E
02	23°52´30.6´N	90°18´38.4´E
03	23°52´31.6´N	90°18´40.3´E
04	23°52'32.7"N	90°18'51.7"E
05	23°52'30.6"N	90°18'49.2"E
06	23°52'31.5"N	90°18'46.2"E
07	23°52'32.8"N	90°18'43.0"E
08	23°52'28.7"N	90°18'35.2"E
09	23°52'31.1"N	90°18'33.8"E
10	23°52'28.1"N	90°18'37.5"E

Fig 3.2: Khagan Bazar Water Collection Area

Dattapara:

Table 3.2: Dattapara Water Collection Points

Sample No	Latitude	Longitude
01	23°52´30.3´N	90°18´41.5´E
02	23°52´30.6´N	90°18´38.4´E
03	23°52´31.6´N	90°18´40.3´E
04	23°52'15.6"N	90°19'06.2"E
05	23°52'16.1"N	90°19'16.1"E
06	23°52'22.7"N	90°19'14.1"E
07	23°52'21.1"N	90°19'11.6"E
08	23°52'22.9"N	90°19'10.3"E
09	23°52'22.3"N	90°19'07.0"E
10	23°52'20.8"N	90°19'06.4"E

Fig 3.3: Dattapara Water Collection Area

Changaon:

Table 3.3: Changaon Water Collection Points

Sample No	Latitude	Longitude
01	23°52´30.3´N	90°18´41.5´E
02	23°52´30.6´N	90°18´38.4´E
03	23°52´31.6´N	90°18´40.3´E
04	23°52'57.1"N	90°19'08.6"E
05	23°52'54.4"N	90°19'11.3"E
06	23°52'59.6"N	90°19'13.3"E
07	23°53'00.9"N	90°19'17.1"E
08	23°52'59.4"N	90°19'18.7"E
09	23°52'59.5"N	90°19'22.9"E
10	23°52'55.3"N	90°19'14.1"E

Fig 3.4: Changaon Water Collection Area

3.4 Methods of Collecting Water Samples

- We collected 30 water samples from Khagan Bazar, Dattapara, and Changaon.
- After gathering water samples, we went to the lab to analyze these samples.
- We have tested pH, EC, Temperature, Turbidity, Iron, DO, Odor, and BOD of water.
- Finally, we have calculated the value of (pH, EC, Temperature, Turbidity, Iron, DO, Odor, and BOD).

3.5 Sampling

water samples were taken at ten sites in each location. A total of thirty water samples from various locations are distributed among three areas. The jars were carefully cleaned with water from a particular location before the samples were collected, and they were labeled with the appropriate information.

Fig 3.5: Water sample collection

Fig 3.6: Collected Water Sample

3.6 Water Quality Parameter Test

Table 3.4: Water Quality Parameter

NO	**Parameters**	**Instruments Model**
1	pH	Hanna Romania
2	Electrical Conductivity	Hanna Romania
3	Turbidity	TV-2016, Lutiron Taiwan
4	Iron	Iron test kit
5	Temperature	Thermometer
6	Dissolved Oxygen	Lution,DO,5509
7	Odor	Odor Less
8	Biological Oxygen Demand	5 days Incubation

3.7 Water Quality Parameters

3.7.1 pH (Potential of Hydrogen)

pH is a crucial component of the water quality parameter that assesses a liquid's acidity or alkalinity. The pH scale goes from 0 to 14, with 7 being neutral (the typical pH range for drinking water is 6.5–8.5). The liquid is acidic when the PH value is below 7, and alkaline when the value is over 7. Acidity ranges from 0 to 3 while alkalinity ranges from 11 to 14.

Fig 3.7: Testing pH in the lab

3.7.2 Electric Conductivity (EC)

How well electricity may travel through water is determined by a property called electric conductivity.

Electricity cannot travel through pure water. Typically, dissolved metal and salt in the water are to blame for this.

Fig 3.8: Testing Electrical Conductivity in the lab

3.7.3 Turbidity

Turbidity refers to the cloudiness or haziness of water. It typically depends on the water sample's total dissolved solids content and chemical composition. Higher turbidity water samples have an unpleasant look and are a sign of poor water quality.

Fig 3.9: Testing Turbidity in the lab

3.7.4 Iron

When evaluating water quality, iron is a crucial parameter that is frequently checked. Water with a high iron content tastes metallic. 0.3 to 1 is the range for standard iron.

Fig 3.10: Testing Iron in the lab

3.7.5 Temperature

The physical, chemical, and biological properties of aquatic habitats are influenced by water temperature, which is a crucial water quality measure. For the preservation of aquatic life, upholding standards for water quality, and guaranteeing that water is suitable for varied uses, monitoring and managing water temperature is crucial. Water should be between 20 and 30 c.

Fig 3.11: Testing Temperature in the lab

3.7.6 Dissolved Oxygen (DO)

One of the most crucial components of the natural water system is dissolved oxygen. Dissolved oxygen, or DO for short, refers to the volume of oxygen that has been dissolved in the water sample. Aquatic animals, aquatic plants, and microorganisms all require sufficient amounts of dissolved oxygen to survive. Low values for dissolved oxygen indicate bad water quality. Dissolved oxygen should be at a concentration of 6 mg/l.

Fig 3.12: Testing DO in the lab

3.7.7 Odor

The presence of disagreeable or unpleasant odors in water is related to the subjective water quality indicator known as odor. Even though odor is not a direct predictor of water quality, it can be a key sign of possible problems or pollution.

3.7.8 Biological Oxygen Demand (BOD)

A vital indicator of water quality, biological oxygen demand (BOD) quantifies how much-dissolved oxygen is absorbed by microbes during the breakdown of organic matter in water. BOD is a crucial measure of the amount of organic pollution in a body of water and offers information about how well the water can support aquatic life.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 General

All of the laboratory test results for a few ground drinking water quality indicators in the area we selected are included in this chapter.

4.2 Result

Khagan Bazar:

Table 4.1: Test Result of Khagan Bazar

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
pH	6.6	6.5	6.4	6.6	6.6	6.5	6.6	6.6	6.4	6.4
Electrical Conductivity (µs/cm)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.07
Turbidity (NTU)	1.85	1.77	1.58	1.95	1.72	2.71	1.62	1.57	3.46	0.40
Iron (mg/L)	1	1	1	1	1	1	1	1	1	1
Temperature (C°)	29.4	29.4	29.4	29.5	29.5	29.6	29.4	29.4	29.6	29.6
Dissolved Oxygen (mg/L)	0.8	0.7	0.7	0.6	0.5	0.5	0.6	0.5	0.5	0.4
Odor (mg/L)	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less
Biological Oxygen Demand (mg/L)	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.2

After testing the samples from Khagan Bazar, I can see the value of all parameters was within the standard range, Except for pH at some points and BOD at some points.

Dattapara:

Table 4.2: Test Result of Dattapara

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
pH	6.6	6.5	6.4	6.6	6.5	6.5	6.6	6.5	6.5	6.6
Electrical Conductivity (µs/cm)	0.04	0.04	0.04	0.05	0.04	0.03	0.04	0.06	0.04	0.04
Turbidity (NTU)	1.85	1.77	1.58	1.35	1.95	1.81	2.13	2.17	3.91	1.93
Iron (mg/L)	1	1	1	1	1	1	1	1	1	1
Temperature (C°)	30	30	30	29.8	29.8	30	29.9	30	29.9	29.9
Dissolved Oxygen (mg/L)	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.6
Odor (mg/L)	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less
Biological Oxygen Demand (mg/L)	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.2

After testing the samples from Dattapara, I can see the value of all parameters was within the standard range, Except for pH at some points and BOD at some points.

Changaon:

Table 4.3: Test Result of Changaon

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
pH	6.6	6.5	6.4	6.5	6.4	6.4	6.4	6.5	6.4	6.5
Electrical Conductivity(µs/cm)	0.04	0.04	0.04	0.04	0.08	0.08	0.04	0.07	0.03	0.03

Turbidity (NTU)	1.85	1.77	1.58	1.79	0.63	0.98	1.15	1.53	1.67	1.14
Iron (mg/L)	1	1	1	1	1	1	1	1	1	1
Temperature (C°)	30	30	29.8	29.6	29.8	30	29.7	29.9	29.8	29.7
Dissolved Oxygen (mg/L)	0.8	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.6
Odor (mg/L)	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor Less	Odor less	Odor Less	Odor Less
Biological Oxygen Demand (mg/L)	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2

After testing the samples from Changaon, I can see the value of all parameters was within the standard range, Except for pH at some points and BOD at some points.

4.3 Analysis

Changes to the water quality metrics in some places Data on all chosen parameters for each station have been properly obtained from the laboratory test. All the metrics (pH, BOD, EC, turbidity, iron, temperature, DO, odor). The standard values for drinking water in Bangladesh (ECR 1997) were used to create these mean values. The current water quality in the area has emerged from this comparison.

4.4 Variation of The Water Quality Parameters

pH (Potential of Hydrogen)

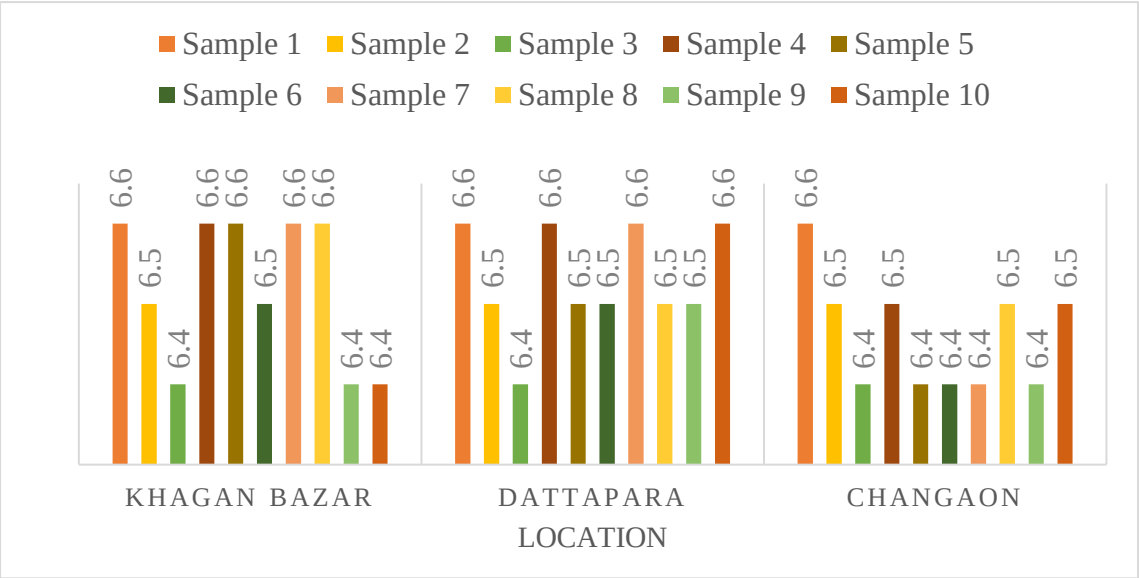

Fig 4.1: pH level at different locations

Fig 4.1 provides the pH value for Khagan Bazar, Dattapara, and Changaon, which are some points outside of this standard range, and the rest of the points are found within the standard range.

Electric Conductivity**:**

Fig 4.2: EC level at different locations

Fig 4.2 provides the Electric Conductivity value for Khagan Bazar, Dattapara, and Changaon, all of the points are found within the standard range.

Turbidity:

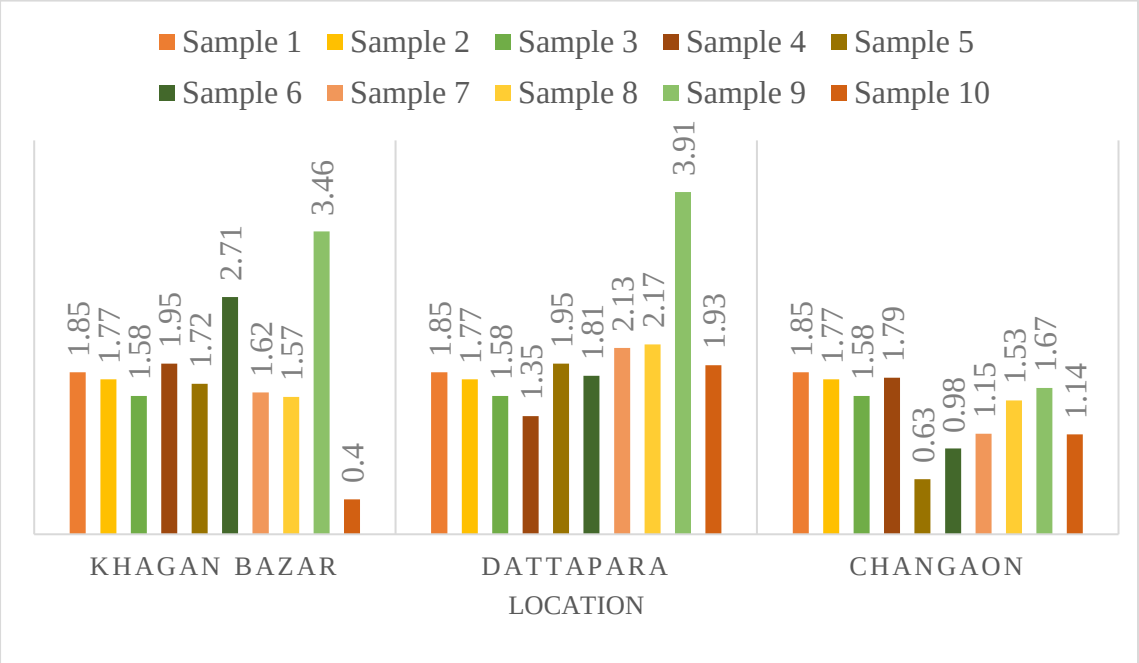

Fig 4.3: Turbidity level at different locations

Fig 4.3 provides the Turbidity value for Khagan Bazar, Dattapara, and Changaon, all of the points are found within the standard range. (Bangladesh standard 10NTU).

Iron:

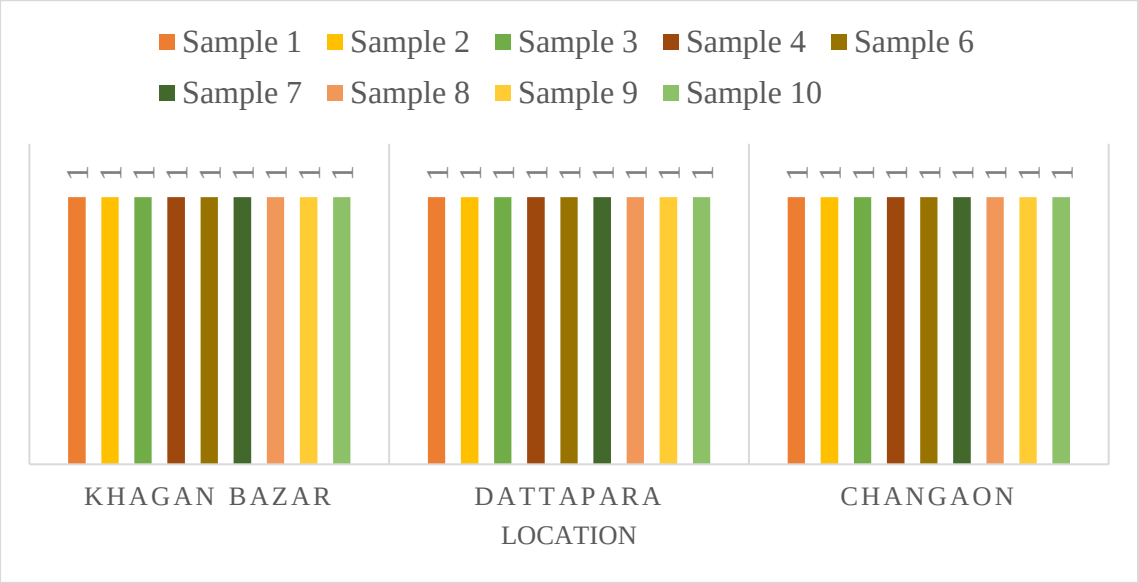

Fig 4.4: Iron level at different locations

Fig 4.4 provides the Iron value for Khagan Bazar, Dattapara, and Changaon, all of the points are found within the standard range. (Bangladesh standard 0.3-1.0).

Temperature:

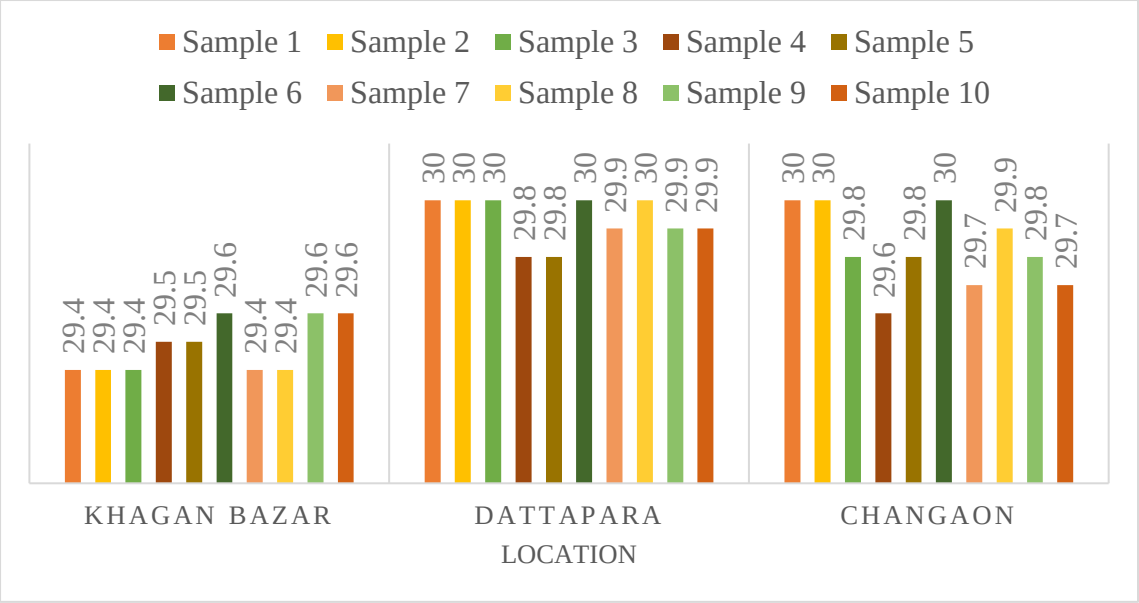

Fig 4.5: Temperature level at different locations

Fig 4.5 provides the Temperature value for Khagan Bazar, Dattapara, and Changaon, all of the points are found within the standard range. (Bangladesh standard 20-30C).

Dissolved Oxygen (DO):

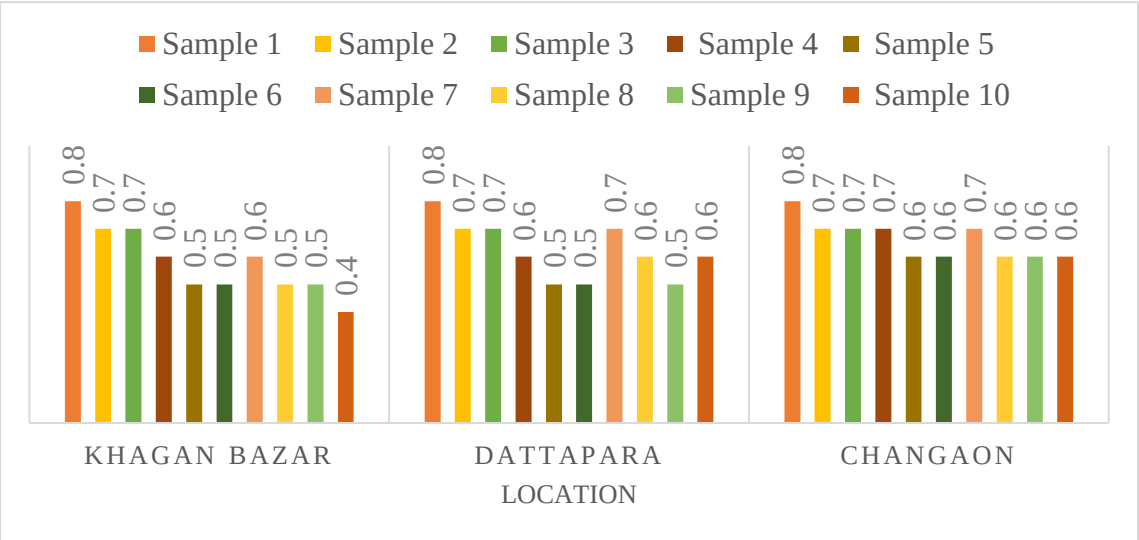

Fig 4.6: DO level at different locations

Fig 4.6 provides the Dissolved Oxygen value for Khagan Bazar, Dattapara, and Changaon, all of the points are found within the standard range. (Bangladesh standard 6 mg/l).

Biological Oxygen Demand (BOD):

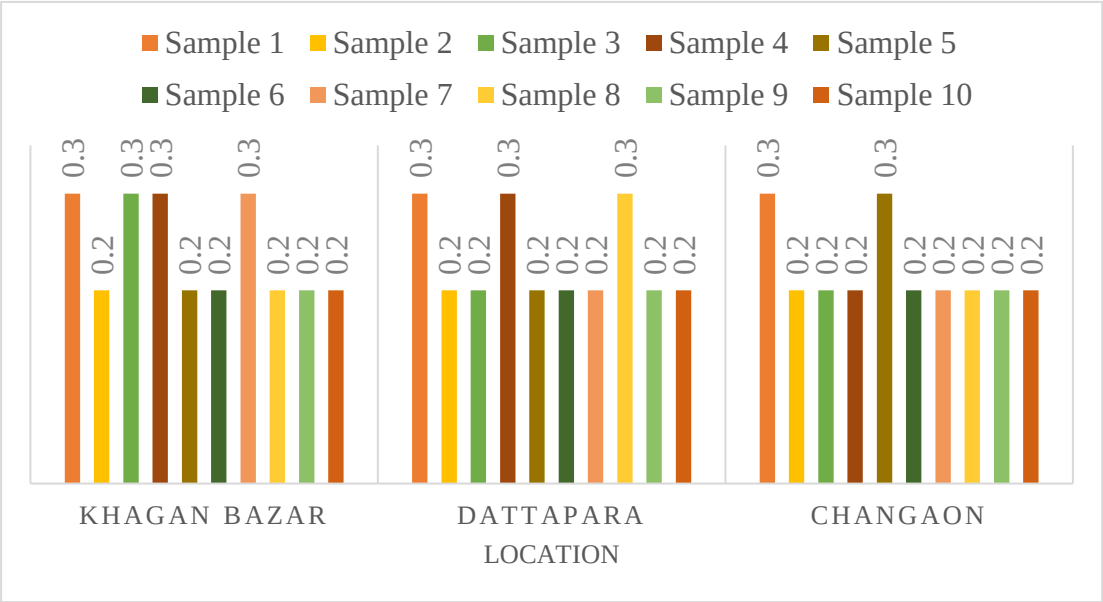

Fig 4.7: BOD level at different locations

Fig 4.7 provides the Dissolved Oxygen value for Khagan Bazar, Dattapara, and Changaon, some of its points complied with the standards. Some other samples had BOD values that were greater than the average.

CHAPTER FIVE
CONCLUSION & RECOMMENDATIONS

5.1 General

In this study, I have found at some point Khagan Bazar, Dattapara, and Changaon did not meet the standard requirement given by the Department of Public Health Engineering, Bangladesh. But most of the points fulfill the standard requirement.

5.2 Conclusion

- The typical pH range for drinking water is 6.5 to 8.5. We obtained results within this range from our research in Khagan Bazar, Dattapara, and Changaon. However, the results for Changaon, Khagan Bazar, and Dattapara, are some point outside of this range. In this instance, we can see that the pH values of the all area water are fairly close to the norm. We are therefore able to safely drink this water.

- The drinking water standard Electro Conductivity range is 3µs/cm of the water. In between, we have already got all the values in our test. Which means the water we tested is safe for drinking.

- The standard Turbidity for drinking water is less than 10NTU. In our research, we got less than 10NTU in all of our testing sites. Which means the water we tested is safe for drinking.

- The recommended iron concentration for drinking water is 0.3–1 mg/L. We found that the iron levels in every place were within the normal range after testing.

- The standard temperature for drinking water is 20°C to 30°C. The temperature we got from our collected water is within the standard value.

- The DO (Dissolved Oxygen) level of standard water is 6 mg/l. We found all our DO values within this range.

- The drinkable water should be odorless. None of our tested samples had any type of odor in it.

- Drinkable water has a standard BOD (Biological Oxygen Demand) of 0.2 mg/L. According to our testing, Khagan Bazar, Dattapara, and Changaon, some

of it points complied with the standards. Some other samples had BOD values that were greater than the average.

5.3 Recommendation for Future Study

Value of various locales Several important recommendations are provided below for future research on this area's drinking water quality assessment.

- Additional parameters such as Chloride, Nitrate, Lead, Sulfate, Arsenic, Coli form, and other relevant factors can be incorporated for comprehensive water quality assessment.
- Increasing the sampling point will enhance the precision of our water quality data, facilitating more accurate comparisons across different locations.

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