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THESIS TITLE: WATER QUALITY ASSESSMENT OF THE TURAG RIVER

Project & Thesis

CE-400

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Section: (21B)
Semester: (Spring-2024)

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A thesis submitted to the Department of Civil Engineering in partial fulfilment for the degree of Bachelor of Science in Civil Engineering



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The candidates have exhibited exceptional proficiency and excellence, surpassing the rigorous criteria established by the Board of Examiners. Consequently, they have been conferred with the Degree of Bachelor of Science in Civil Engineering on Defense Date. Their research on **“**Water Quality Assessment of The Turag River” presented during the degree ceremony exemplifies commendable academic achievement.

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DECLARATION

We, the undersigned students enrolled in the Civil Engineering Department, Section 21B, Semester Year 2024, at Sonargaon University, affirm that our thesis titled “Water Quality Assessment of The Turag River” represents our original work. The authenticity of the data, analysis, and conclusions presented herein is guaranteed, having not been previously submitted for any academic purpose. We express gratitude to all sources and references consulted during the research process.

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CERTIFICATION

This is to certify that this thesis entitled **"**Water Quality Assessment of The Turag River**"** submitted by Md. Tasnim Mahmud ID: CE2003021114 (21B), Md. Jahidul Islam ID: CE2003021090 (21B), Md. Alfaj Ahammad ID: CE2003021086 (21B) in partial fulfillment of the requirements for the Award of the degree of B. Sc in Civil Engineering at Sonargaon University, 147/ Green Road , Dhaka-1215, Bangladesh, is a record of the student's own work conducted during the period September 2023 to April 2014 under my supervision and guidance. To the best of my knowledge, this thesis has not been submitted in part or full elsewhere in any other University or Institution for the award of any degree. It is further understood that by this certificate, the undersigned do not endorse or approve any statement made, opinion expressed, or conclusion drawn therein but approve the thesis only for the purpose for which it is submitted.

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DEDICATION

To

We dedicated this thesis to our beloved parents, our honorable supervisor And a Street child living by picking food from garbage & Muslims deprived of human rights in Palestine.

ACKNOWLEDGMENTS

Completion of this thesis would not have been possible without the support, guidance, and encouragement of a few individuals to whom I would like to express our deepest gratitude:

First and foremost, we are immensely grateful to our thesis advisor, Kamrun Nahar Mim, for her invaluable mentorship, unwavering support, and insightful feedback throughout the entire research process. Her expertise and dedication have been instrumental in shaping this work. I extend my sincere appreciation to the faculty members of the BSc in Civil Engineering for their scholarly guidance and constructive criticism, which have enriched the quality of this thesis. I am thankful to my colleagues and friends for their encouragement, brainstorming sessions, and moral support, which have provided me with the motivation and inspiration to pursue this research endeavor. I would like to acknowledge the contributions of those whose assistance in data collection, analysis, and discussions have significantly contributed to the completion of this thesis. Lastly, I also extend my appreciation to all the Lab Assistants at Sonargaon University, 147/I Green Road, Dhaka-1215, Bangladesh, for affording me the opportunity to undertake this dissertation work.

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Thank you all for being a part of this journey.

Thank You

1.

2.

3.

ABSTRACT

The Turag River system is in the southern part of the north central region of Bangladesh, passing through west and south of Dhaka, the capital of Bangladesh. The river receives wastewater from numerous numbers of sources along its way, which are discharged as industrial effluents, municipal sewage, household wastes, clinical wastes, and oils. The purpose of this study is to investigate the impact of this wastewater on the river water and thus to provide an updated report on the state of water quality of the river Turag. The water samples were collected During the year 2024 from different points along the river and analyzed for various physiochemical quality parameters, directly into the river or into drains and canals which The Turag River having a length of 72 km is been reports that the river is being polluted by located in the southern part of the North Central Region discharge of industrial effluents, municipal wastewaters, of Bangladesh, close to the confluence of the turag household wastes, clinical and pathological wastes, oils (Ganges) and Upper Balu Rivers. It is tide-influenced and human excreta. In recent years, the river has become river passing through west and south of Dhaka City, then dumping ground of all kinds of solid, liquid and capital of Bangladesh the average flow of the chemical wastes which are generated by the activities in river varies between 140 cubic meters/sec in dry season and around the river. (November to May) and 700 cubic meters/sec in wet the largest share of pollution load into the river season (June to October) The average depth and Turag appears to be from about width of the river is 13.5 m and 82 m respectively. Industries in the Tangi and Ashulia area many people and industries depend on (nearly 10,000 people rely directly on this industrial the Turag River for various social and economic cluster for their source of income).

Studies show that up purposes. The major land use along the banks of the river to 15,000 cubic meters of liquid wastes, 19,000 kilograms is for residential and commercial purposes, e.g. bazaars of solid wastes and 17,600 kilograms of Bio logical Oxygen (markets), industries, warehouses, and hospitals. Many Demands load go into the Turag each day from people who live along the river use the river water for these industries Moreover, previous studies swimming, washing, bathing, and boating (both for identified that each day 3,500 cubic meters of wastes from recreation and communication).

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CHAPTER-1

INTRODUCTION

1.1 General

Turag River is a river in Dhaka and Gazipur districts of Bangladesh. The length of the rivers is 72 km, the average width is 72 m, and the nature of the river is serpentine. Identification number of Turag River given by Bangladesh Water Development Board or "Paubo" is river no. 25 of North-Central region. [1] It is one of the four rivers that flow through the city of Dhaka. The depth of this river is 13.5 meters. The area of the river basin is 1 thousand 21 sq km. It flows throughout the year. Water flow is low from January to March. Then in Mirpur the measurement is 124 cubic meters / second, and the depth is 4.5meters. But during the monsoon season in August this flow increased to 1138 cubic meters / second. There are tidal effects in the lower reaches of the Turag River. Water quality testing is an important part of environmental monitoring when water quality is Poor, affects not only aquatic life but the surrounding ecosystem as well. Also, humans can know about the permissible limit and about some details of water and they could be aware of taking the water which is beyond its permissible limit.

1.2 Background

Dhaka has now been turned into one of the busiest and densely populated cities. The dwelling places required for the large number of people are quite inadequate. As a result, the residential areas of Dhaka city are turning into overcrowded dirty localities day by day and recreating an unhealthy environment. The pressure of population of Dhaka should be reduced by developing the surrounding area of Dhaka in a planned way and establishing more and better permanent residential accommodation for the vast population. The Turag River is of great economic importance to Dhaka. It provides a river connection. Water Pollution in this area is as its highest.

The most significant source of pollution appears to be from tanneries and other industries. In the dry season, the dissolved oxygen level becomes very low or non-existing condition the

river and lake become toxic. The study has been conducted to find out the existing condition of Turag River to find out some solutions to save the lake.

Rustompur which serves very important hydrologic functions of draining and detaining storm water from a large area of Dhaka city, also serves as a significant contributor to the inflow of Nde gate. Asa part of a restoration project to save Turag River from pollution and degradation, eleven specially designed sewage diversion structures (SSDSS) have been constructed at eleven major storm sewers out fall locations around Turag. The SSDs are connected to a peripheral diversion sewer" network. Although designed to carry storm water, the storm sewers discharging into Turag carry both storm water and dry weather flow. However, since the storm sewers carry both storm water and sewage, during the dry season, the entire f low carried through the storm sewers up to Berulia Bridge are diverted downstream long the peripheral diversion sewer into this n. Khal system is the largest and most important drainage system of Dhaka city. To overcome the present as well as future water logging problem of Dhaka City, it is necessary to assess whether the existing storm water drainage canals are capable to meet the present and as well as the increasing storm water runoff due to climate change. Some studies related to the river system and water logging of Dhaka city, causes and effect of water logging in Dhaka city, rehabilitation of canals, flood management and vulnerability of Dhaka city and some other relevant studies have been conducted. But very few studies have been conducted to assess the capacity of drainage canals of the city (Matinetal, 2010; BRTC, 2013) which are limited to 5-year return period rainfall event only and operation of as a storm water detention system was not considered. Furthermore, predicted precipitation variability due to climate change was not considered. That's why the study focuses assessing the storm water drainage capacity of the-Khal drainage system considering precipitation variability due to climate change and different operational scenario of H.

1.3 Objective

I. The main objective of this work to find out the water quality parameters of Turag River.

II. To compare the experiment at water quality parameter according to Bangladesh standard and WHO Standard for Surface and Drinking Water.

1.4 Organization of the thesis

Chapter 1: Introduction and Objective: This chapter provides the background and motivations of the research. The overall objectives and expected outcomes are also described in this chapter.

Chapter 2: Literature Review: This chapter reviews the related works in the water test field with a special focus on quality.

Chapter 3: Methodology: This chapter describes the methodology adopted to carry out the research.

Chapter 4: Results and Discussion: This chapter describes the results of the water test and discussion.

Chapter 5: Conclusions and Future Work: This chapter summarizes the conclusions and major contributions of this study and provides recommendations for future studies.

CHAPTER-2

LITERATURE REVIEW

3.1 Introduction

Introduction: Bangladesh is a low-lying riverine country located in South Asia. There are about seven hundred (700) rivers and tributaries. Dhaka is the capital of Bangladesh, and it was founded about four hundred (400) years ago on the northern bank of the river Turag, about thirteen (13) kilometer above its confluence with the Turag River (23° 43 North Latitude and 90° 24' East Longitude) The earliest available map shows that, Dhaka extending over an area of about 1.5 square kilometer near the junction of the Buriganga and Turag River. The river flows through the capital Dhaka, a city of 12 million people, which largely depends on fishing and carrying merchandise. More than fifteen hundred fishermen living near Turag River had to change their profession, some were day laborers, and some were rickshaw pullers. This is because of the water pollution caused by using industrial waste and excess pesticides in agriculture. -6 The Turag is of great economic importance to Dhaka. It provides river connection by launch and country boats, but large steamers can no longer ascend the river in the dry season. .in 1972 a bridge was built over the river for vehicles and pedestrians. In 2001, a second bridge over the river was also built at Ashulia for vehicles and pedestrians. Water pollution in the river Turag is at its highest. The most significant source of pollution appears to be from garment factories and sparing mill in the Ashulia and Gazipur area. In the dry season, the dissolved oxygen level becomes very low or non-existent and the river becomes toxic. Study Has Been Conducted To Find Out T Existing Condition Of Turag And to Find Out Some Solutions to Save Turag River .The water of the Turag now has a terrible to us .It’s3 not drinkable and causes skin rashes for anyone bathing in it. It is so polluted that the water cannot be used for agricultural purposes either. The Turag is of great economic importance to Dhaka. It provides river connection by launch and country. We know many launches and steamers carried many supplies and many other things which are needed daily to peo3ples of Dhaka city). Authorities are quick to lay the blame on the garments industry stating that the factories at the garments industry estate do not follow regulations. It’s the heart of business of Dhaka city. Millions of people earn source at Turag River. This river is the major contributor to of all Bangladesh's GDP-7

3.2 Literature Review:

Study Title	Summary of the book	Journal name	Authors
Assessment of river water quality	This book describes about impact of river water due to polluted environment.	International journal of Environmental science and Technology	S.K Mandal S.Kole dutta S.Paramanik R.R kole
River water quality Assessment and Management in India.	How to improve river water quality against polluted environment and industrial wastage.	Earth and Environmental science library	Shalini Yadav Abdelazim M.Negar Ram.Narayan yadav.
Surface water quality of the River, Bangladesh	The river side industrial area's wastage dissolved in water and polluted the river water and effect of the toxic element in water.	Study on the concentration profile of some toxic metals and essential elements in water qualities from the Sitalakhya River, Bangladesh	Muhammad Islam Rofiqul Islam Sham shed B.Quraishi

Summary: By studying the said literature, we can know the simple methods of water testing. Normal and abnormal values of PH, CO_2, alkalinity, turbidly, chlorine, TDS, TSS in water. How to improve surface water quality and contribute to environmental balance.

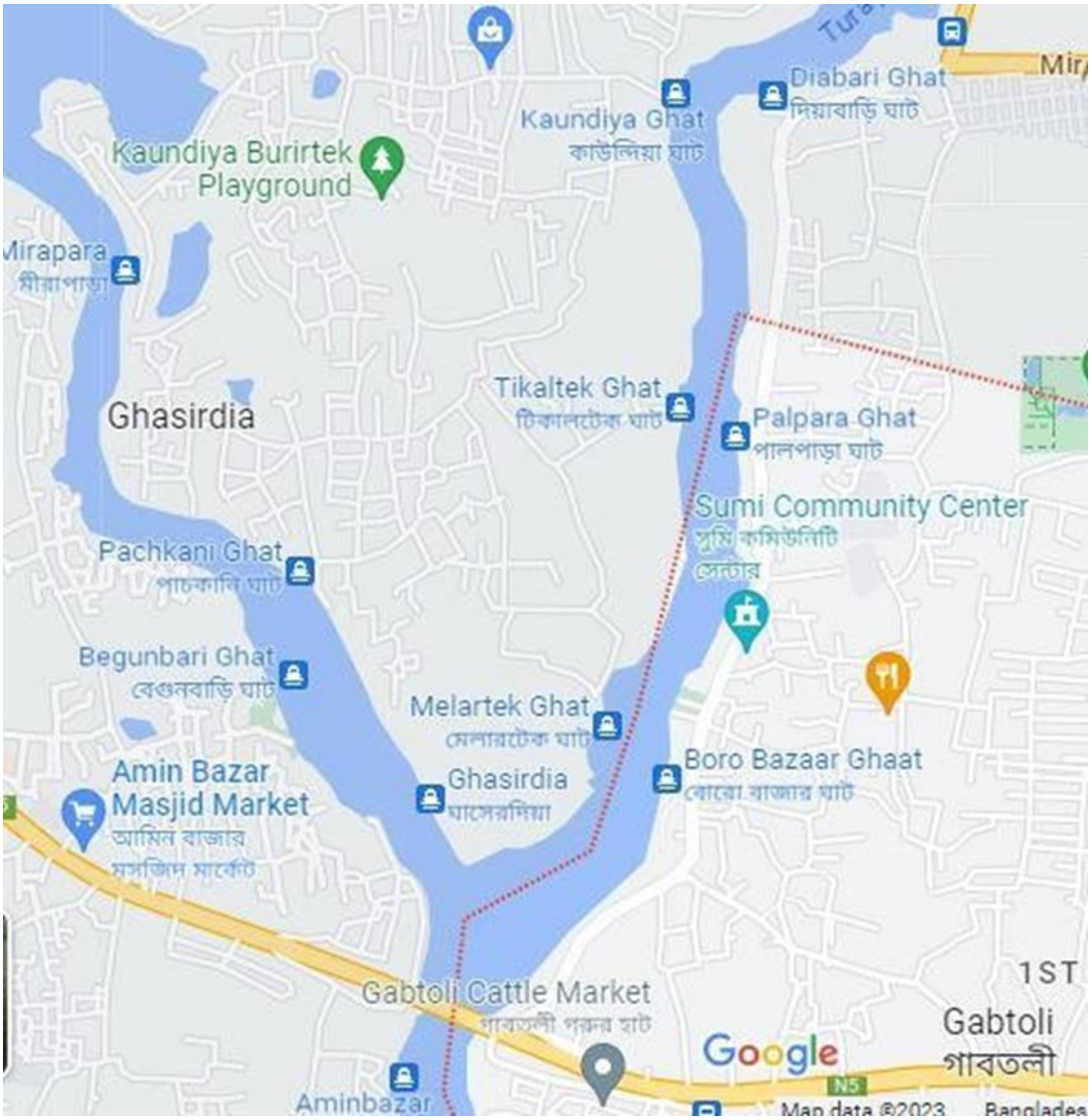


Fig-1 : Map of Turag River

CHAPTER-3

METHODOLOGY

3.1 Methodology

The lake & surrounding areas have been surveyed to realize the present situations expired find the Reasons of the problems and pollutions of the lake. To determine the suitable locations of the water collection entire lake areas have been visited. Water samples have been collected such that the samples represent the characteristics of the whole lake.

The methodology of the study is given bellow: -

- The river and surrounding areas have been surveyed to realize the present situation, find the reason for the problem and pollution of the river.
- To determine the suitable locations of water sample collection the entire River area has been visited.
- Water Samples have been collected to such point that the samples represent the characteristics of the whole River.
- Ready to Instrument.
- Follow all the processing.
- Maintain all the procedure of water Test.
- Collection all the test results.

I) PH

PH is the most important parameter in detecting the corrosive nature of water. The lower the PH value, the higher is the corrosive nature of water. It is also positively related with electrical conductance and total alkalinity. The reduced rate of Photosynthetic activity and the presence of carbon dioxide and bicarbonates are responsible for the increase in PH. (3) The low oxygen values coincide with the high temperature during the summer month. Various factors cause changes in the value of the PH of water. The higher PH value detected

recommends that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physiochemical condition.

II) Alkalinity

It consists primarily of carbonate (CO32-) and bicarbonate (HCO3-), which acts as a stabilizer for PH. Alkalinity, PH and hardness affect the toxicity of various substances in the water. It can be simply detectable by diluted HCI titration in the presence of phenolphthalein and methyl orange indicators. Alkalinity in boiler water results from the presence of hydroxyl and carbonate ions. Hydroxyl alkalinity (causticity) in boiler water is significant to protect the boiler against corrosion. Too high a causticity causes other operating problems, such as foaming. Excessively high causticity levels can result in a type of caustic attack of the boiler called" embrittlement.

III) Turbidity

The turbidity of the water is caused by insoluble and colloidal compounds of inorganic origin (clay minerals, silica oxide, hydrated oxide of iron and magnesium, etc.), or of organic origin (organic colloids, bacteria, plankton etc.). In the groundwater, turbidity is caused mainly by the presence of inorganic substances. Turbidity causes an undesirable appearance of drinking and surface water.

IV) Chloride

It is measured by titrating a known volume of sample with standardized silver nitrate solution using potassium chromate solution in water or eosin/fluorescein solution in alcohol as an indicator. The latter indicator is an adsorption indicator while the former makes a red colored compound with silver as soon as the chlorides are precipitated from solution (Milacron Marketing Co.)

V) TSS and TDS

Total solids (TS) are dissolved solids plus suspended and settled solids in water. In stream water, dissolved so lids (TDS) consist of calcium, chlorides, nitrates, Phosphorus, iron, sulfur, and other ion particles that will pass through a filter with pores of around 2 microns (0.002 cm) in size. Whereas, suspended solids (TSS) include silt and clay particles, plankton, algae, fine organic debris, and other particulate matter. These are particles that will not pass through a 2-micron filter. A high concentration of total solids will make drinking water unpalatable and might have an adverse effect on people who are not used to drinking such water. As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life. Suspended solids absorb heat from sunlight, which increases water temperature and subsequent by decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). TSS can also destroy fish habitat -5 because it can harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease. Most people consider water with a TSS concentration of less than 20 mg/L to be clear. Water with TSS levels between 40 and 80 mg/L tends to appear cloudy, while water with concentrations over 150 mg/L usually appears dirty. As per APHA (1998), solids refer to the matter that is suspended or dissolved in the water or wastewater. The total suspended solids (TSS) are a portion of total solids (TS) retained by a filter while the total dissolved solids (TDS) are the in filterable solids, mostly inorganic salts and a small amount of organic matter dissolved in the water. These have been proved to be very useful parameters in determining the productivity of water, and of biological and Physical wastewater treatment processes. A limit of 500 mg/L TDS is permissible in drinking water. The concentration of total dissolved solid gives an idea about the suitability of this water for various uses including portability of water (Trivedi,1995).

3.3 Sample collection:



Figure 2: Collected water from side of Gabtoli Bridge at Turag River(Bank of the River).



Figure 3: Collected water from side of Gabtoli Bridge at Turag River. (Middle of the River)



Figure 4: Collected water from Sosan Ghat beside a Garments Factory at Turag River. (15 ft from Bank)



Figure-5: Collected water from Diabari Ghat at Turag River. (Bank of the River)



Figure-6: Collected water from Diabari Ghat at Turag River. (Middle of the River)

CHAPTER-4

RESULTS & DISCUSSION

PH Test: PH is the most impartment parameter in detecting the corrosive nature of water. In chemistry, pH is a measure of the activity of dissolved hydrogen ions. Ph. basically refers to the concentration of hydrogen irons. The pH of pure water at 25°C is 7 which is considered as the neutral value on the pH scale.

PH Paper Strips:

Consider the following steps when using pH paper strips:

1. Dip the PH test strip for two seconds in the fluid which you want to measure.
2. Wait for ten seconds.
3. Because the strip contacts an acidic or alkaline substance, the strip discolors. The more acidic the fabric, the redder the strip becomes, and the more alkaline the fabric, the bluer the strip becomes.
4. Use the indicator scale with the different colors on the box provided.
5. Determine how acidic or alkaline the liquid you measured is.

Method for determination of pH:

1. First, take 2/3 of the water whose pH is to be determined in a 100 ml glass beaker.
2. Then take a pH strip (pH paper).
3. Now leave the pH paper inside the water. However, it should be noted that the colored side should be inside the water.
4. After keeping it in the water for 15-20 seconds, remove the pH paper and wait for 20-30 seconds. Now lo
5. Ok carefully and match the color of pH paper with the color chart on the box of pH paper. It should be noted here that the pH value is also written on the box along with the color chart.
6. The color of the pH paper matches the color of the color chart in the box, which is the pH value of the water.



Figure 7: pH Tester

Table-1: pH Test Result

Name of Sample	Sample Location	PH Value
Sample -1 (Gabtoli Ghat)	Bank of the River	7.7
Sample -2 (Gabtoli Ghat)	15 ft from Bank	7.3
Sample -3 (Gabtoli Ghat)	Middle of the River	7.0
Sample - 4 (Sosan Ghat) Factory	Bank of the River	7.9
Sample - 5 (Sosan Ghat) Factory	15 ft from Bank	7.6
Sample - 6 (Sosan Ghat) Factory	Middle of the River	7.2
Sample – 7 (Diabari Ghat)	Bank of the River	6.7
Sample – 8 (Diabari Ghat)	15 ft from Bank	6.9
Sample – 9 (Diabari Ghat)	Middle of the River	7.0

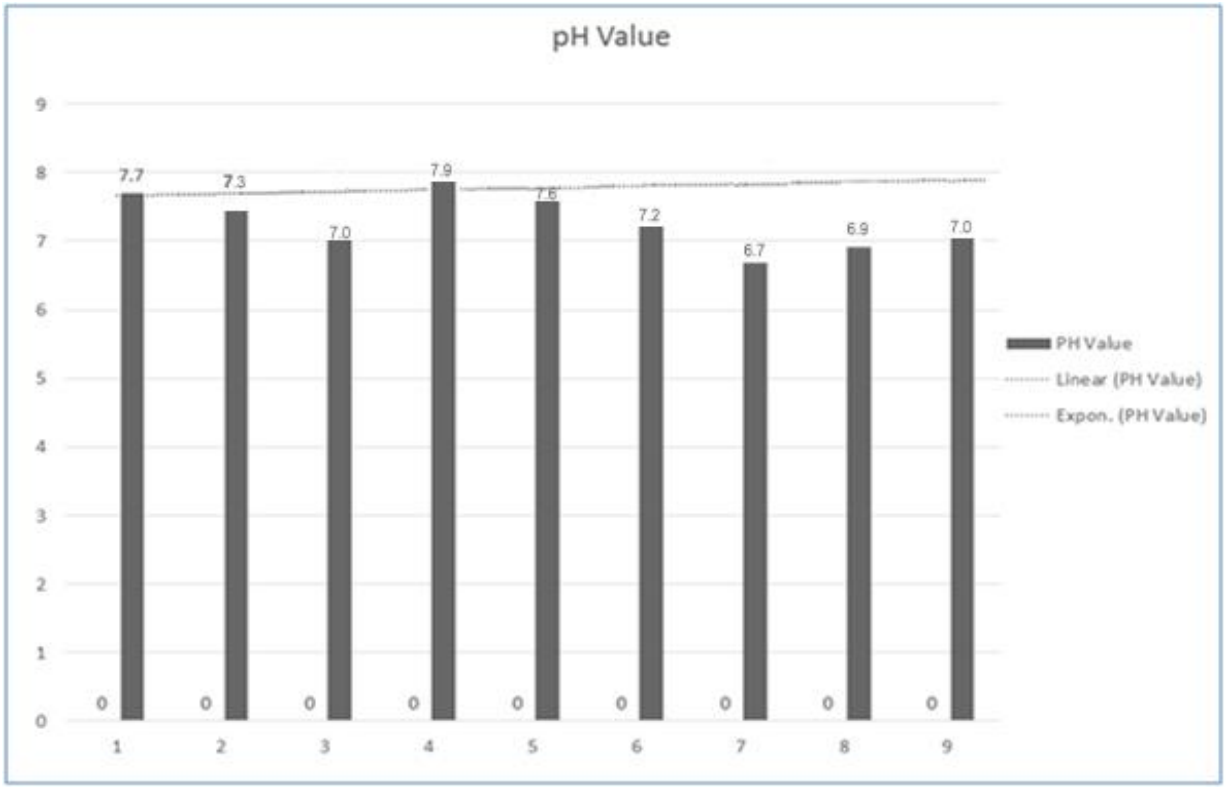


Figure 8: Chart Title pH Test

Sample-4: As it is a tourist spot, the silt dirt is high, so the acidity is high, so the pH value is low.

Sample-7: Due to factories in Sosan Ghat, a lot of waste is released and chemical waste. so, the pH value is high.

TURBIDITY TEST:

The Turbidity of the water is caused by insolublecompounds of inorganic origin or of organic origin in the ground water. Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of both water clarity and water quality.

TURBIDITY TEST PROCEDURES

1. Rinse the test cell 3 times with sample water. Fill the test cell to the neck of the sample cell with your sample water. Always handle the sample cell from the top to avoid fingerprints on the cell. Wipe the cell with lint-free cloth to remove water spots and fingerprints.
2. Rotate and invert the cell to remove air bubbles. Make sure that the cell surface is free of dirt, fingerprints, and moisture prior to measuring. Wipe the cell again with a lint-free cloth. Put one or two drops of silicone oil on the sample cell and distribute the oil evenly over the cell using the lint-free cloth. This should be done once a day. If the sample cell is scratched, throw it away.
3. Press the I/O button. The instrument will turn on. Place the instrument on a flat, sturdy surface. Do not hold the instrument while taking measurements.
4. Insert the sample cell in the instrument cell compartment so that the diamond mark is facing forwards and is aligned with mark on the front of the cell slot. Close the lid.
5. Look at the instrument display to make sure that the automatic range (AUTO RNG) option is on. If the display does not show AUTO RNG, select the automatic range by pressing the RANGE key.
6. Look at the instrument display to make sure that the signal averaging (SIG AVG) option is on. If the display does not show SIG AVG select the signal averaging mode by pressing the SIGNAL AVERAGE key.
7. Press the READ button. The instrument will show --- NTU, then the turbidity in NTU. A lamp symbol will appear on the display and the NTU will flash until the average has been taken. When the lamp symbol turns off and the NTU stops flashing, RECORD the turbidity results on the log sheet.
8. Repeat steps 1-7 to ensure you get the same result. If the result is different, repeat steps 1-7 and record the average reading.
9. Rinse the cell with distilled water 3 times after use and clean the outside of the cell as required. Wrap the cell in the lint-free cloth and store it in the case. Cells should be cleaned as required with weak vinegar and water and a laboratory grade brush. If cells are discolored or scratched, do not use the cell.



Figure 9: Turbidity Meter.

Table 2: Turbidity Test Result

Sample No	Sample Location	Turbidity (NTU)	Standard Value of Turbidity
1. (Gabtoli Ghat)	Bank of the River	27.5 NTU	10 NTU
2. (Gabtoli Ghat)	15 ft from Bank	27.5	
3. (Gabtoli Ghat)	Middle of the River	22	
4. (Sosan Ghat) Factory	Bank of the River	45.8	
5. (Sosan Ghat) Factory	15 ft from Bank	35	
6. (Sosan Ghat) Factory	Middle of the River	30.1	
7. (Diabari Ghat)	Bank of the River	32	
8. (Diabari Ghat)	15 ft from Bank	30	
9. (Diabari Ghat)	Middle of the River	26	

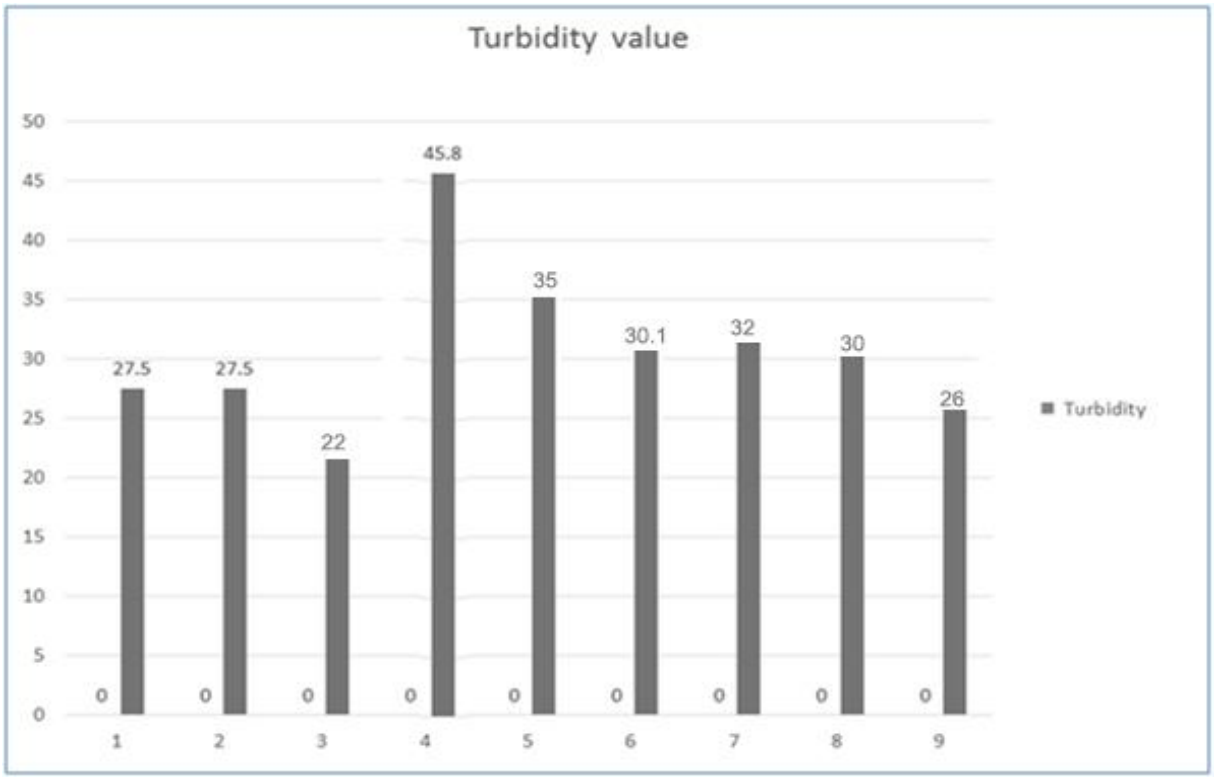


Figure 10: Turbidity value

Sample-3: The turbidity of the water in the middle of Gabtali Ghat is low because the width of the river is high, the depth is high and the current is high, so dirt cannot accumulate. As a result, its value is low.

Sample-4: The width of the river is less at Sosan Ghat. The depth is low, but the pollution is high. So, there is more turbidity.

Carbon dioxide (CO2):

Carbon dioxide is an acidic gas, it dissolves in water $CO_2 + H_2O = H_2CO_3$ (carbonic acid) to form weak carbonic acid; As a result, the solution of this gas turns blue litmus red. A solution of carbon dioxide in water is called soda water or carbonate water (H_2CO_3). The carbon dioxide solution is made into soda water, which is used to make soft drinks (eg; Coca-Cola, Pepsi Cola). When liquid carbon dioxide is rapidly vaporized, some of it condenses to form a solid state. It is called dry ice. Chemical fire extinguishers impede the supply of oxygen to the fire. Carbon dioxide does not burn itself and does not help others to burn. For this, liquid carbon dioxide is used in fire extinguisher cylinders.

- When carbon dioxide reacts with water Carbonic acid is formed. from which hydrogen ion dissociates increasing the acidity of the system.
- Hence in addition to any greenhouse effect, carbon dioxide emission to the atmosphere can increase the acidity of the atmosphere and precipitation.
- When carbon dioxide reacts with water a weak acid is formed.
- As carbon dioxide is present in the air is blown into the flask containing an indicator sensitive to small changes in the PH.
- There are consequent color changes observed.
- The chemical reaction between water and carbon dioxide is:

  $CO_2(g) + H_2O(I) \rightleftharpoons H_2CO_3(aq)$

- Carbon dioxide WHO Standard value is 10 mg/L



Fig- 11: CO2 tester

Table 3: CO_2 Test Result

Sample No	Sample Location	CO_2 mg/L
1. (Gabtoli Ghat)	Bank of the River	9.1 mg/L
2. (Gabtoli Ghat)	15 ft from Bank	9.0 mg/L
3. (Gabtoli Ghat)	Middle of the River	8.8 mg/L
4. (Sosan Ghat) Factory	Bank of the River	12.1 mg/L
5. (Sosan Ghat) Factory	15 ft from Bank	11.9 mg/L
6. (Sosan Ghat) Factory	Middle of the River	11.1 mg/L
7. (Diabari Ghat)	Bank of the River	7.8 mg/L
8. (Diabari Ghat)	15 ft from Bank	7.5 mg/L
9. (Diabari Ghat)	Middle of the River	7.1 mg/L

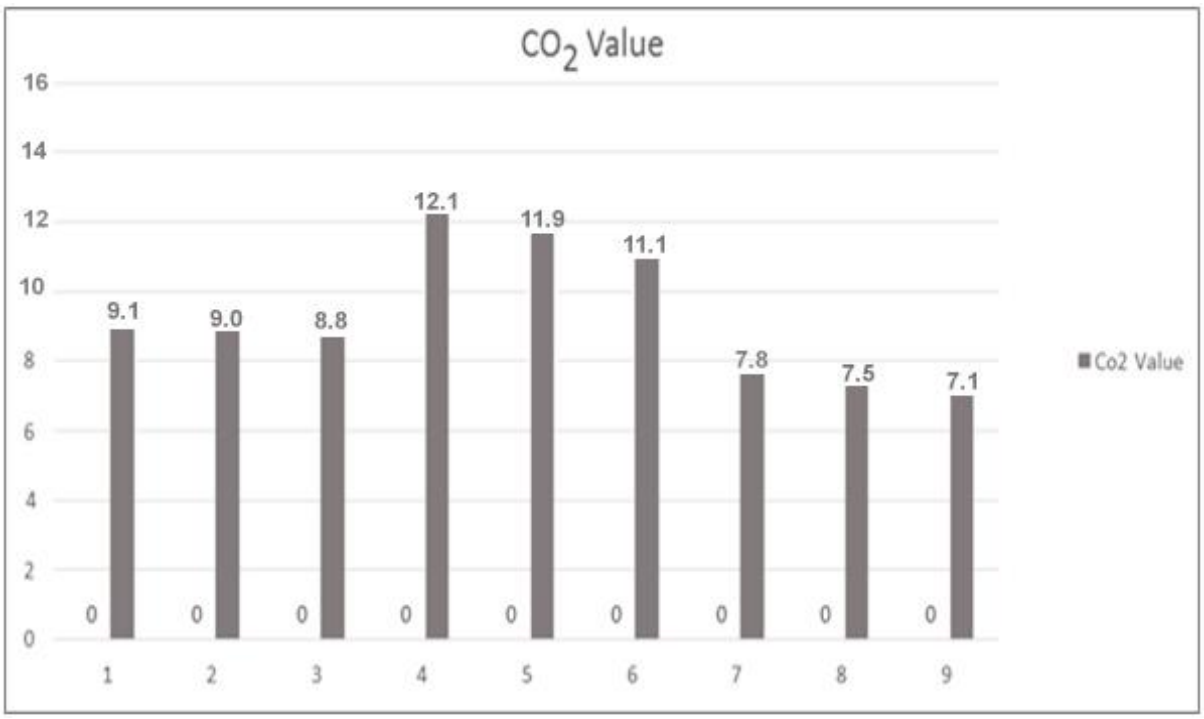


Figure 12: Value of CO_2

Sample-4: Due to excess amount of factory waste and use of chemical solvents in Sosan ghat factory area, carbon dioxide level is high.

Sample-9: The reason for getting more carbon dioxide in the middle of Gabtoli Ghat is because the river is wider. Water flow is low.

Alkalinity Test

Alkalinity Test: Another name for alkalinity is basicity. It is also called carbonate hardness (KH). Alkalinity is the ability of water to resist the pH rise and fall of water. Alkalinity is usually measured using sulfuric acid with a digital titrate. Sulfuric acid is added to the water sample in measured amounts until the three main forms of alkalinity (bicarbonate, carbonate, and hydroxide) are converted to carbonic acid. At pH 10, hydroxide (if present) reacts to form water.

Alkalinity measurement

High alkalinity does not necessarily mean bad water quality. Everybody of water will have its own unique normal level of alkalinity. It is measured in terms of an equivalent concentration of calcium carbonate in a water sample:

- 10 mg/L : Very Low
- 11-50 mg/L : Low
- 51-150 mg/L : Moderate
- 151-300 mg/L : High
- > 300 mg/L : Very High

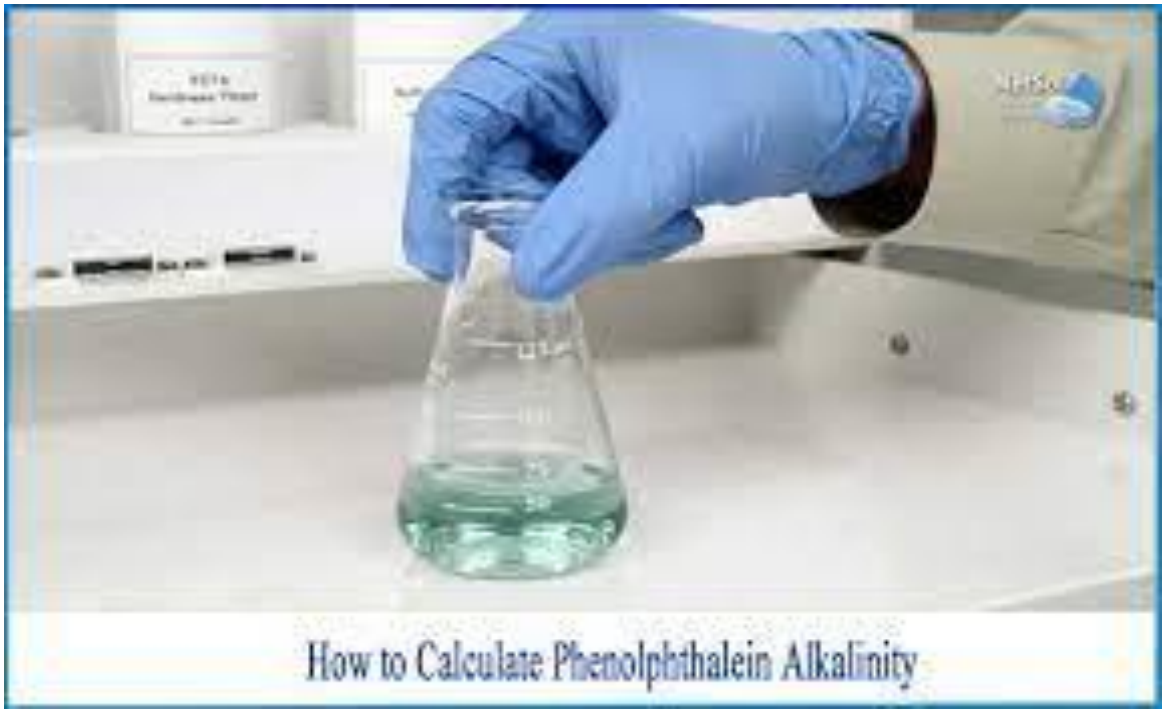




Fig- 13: Alkalinity test



Fig-14: Alkalinity test

Table 4: Alkalinity Test Result

Sample No	Sample Location	Alkalinity (mg/L)	Standard Value of Alkalinity
1. (Gabtoli Ghat)	Bank of the River	165 mg/L	
2. (Gabtoli Ghat)	15 ft from Bank	156 mg/L	
3. (Gabtoli Ghat)	Middle of the River	150 mg/L	
4. (Sosan Ghat) Factory	Bank of the River	170 mg/L	150 mg/L
5. (Sosan Ghat) Factory	15 ft from Bank	163 mg/L	
6. (Sosan Ghat) Factory	Middle of the River	154 mg/L	
7. (Diabari Ghat)	Bank of the River	144 mg/L	
8. (Diabari Ghat)	15 ft from Bank	148 mg/L	
9. (Diabari Ghat)	Middle of the River	150 mg/L	

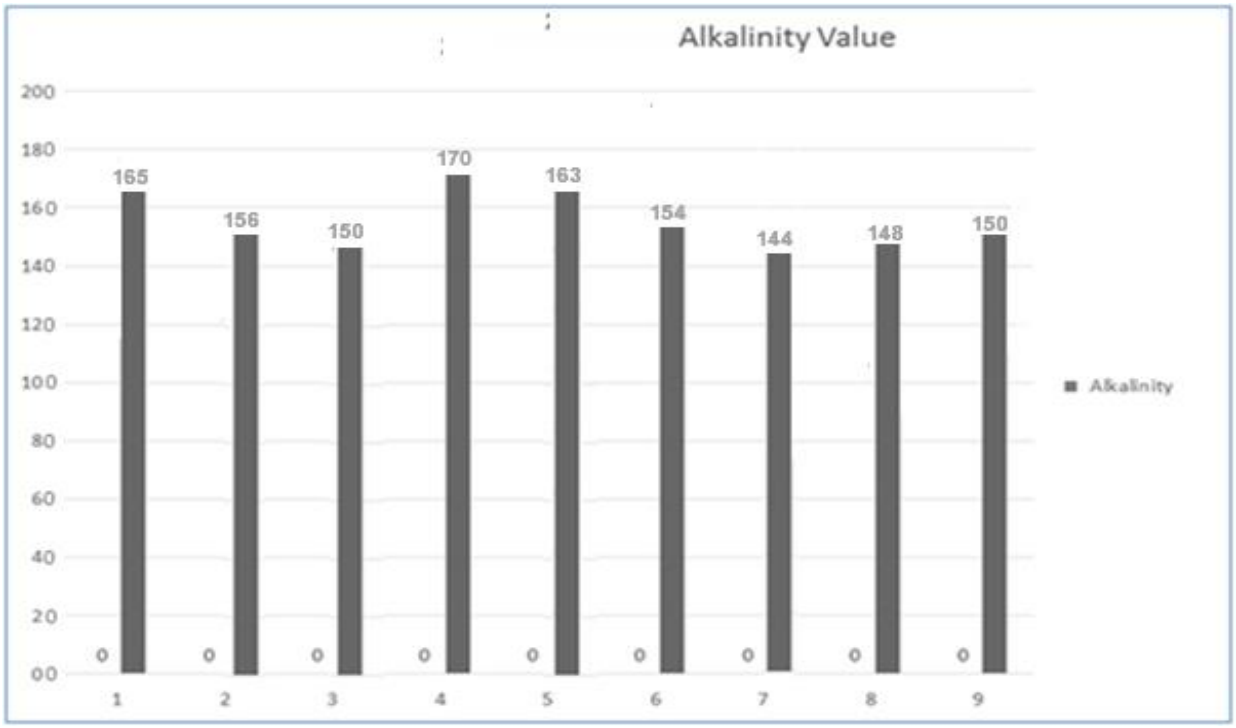


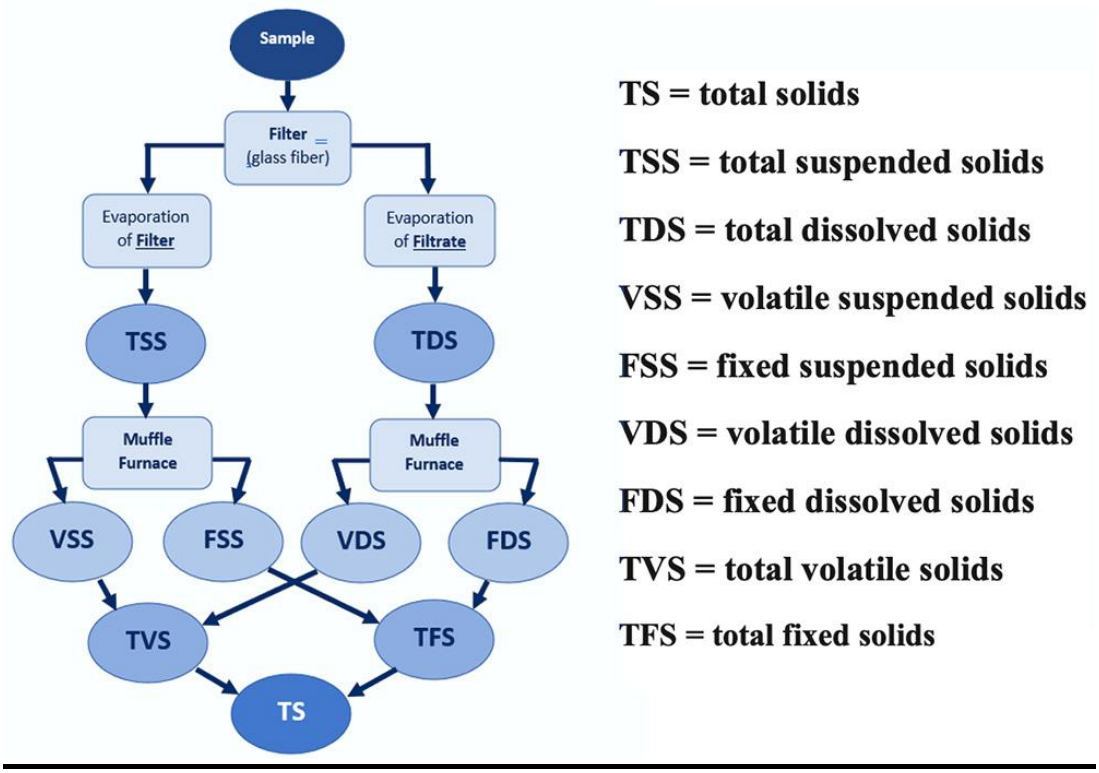
Figure 15: Alkalinity Value

Sample-4: Due to factories in Sosan Ghat, a lot of waste is released and chemical waste. Here alkalinity value 170 mg/L. This value is high.

Sample-7: The value of the bank Diabari Ghat is low value 144 mg/L. The amount of waste here is relatively less. Rainwater is discharged here.

TS Test

TSS+TDS = TS



TS Value

Constituents	Low	Medium	High
TS (total solids)	390	710	1260

Table 5: TS Test Result

Sample No	Sample Location	TS (mg/L)
1. (Gabtoli Ghat)	Bank of the River	310 mg/L
2. (Gabtoli Ghat)	15 ft from Bank	280 mg/L
3. (Gabtoli Ghat)	Middle of the River	460 mg/L
4. (Sosan Ghat) Factory	Bank of the River	230mg/L
5. (Sosan Ghat) Factory	15 ft from Bank	430 mg/L
6. (Sosan Ghat) Factory	Middle of the River	390 mg/L
7. (Diabari Ghat)	Bank of the River	230 mg/L
8. (Diabari Ghat)	15 ft from Bank	410 mg/L
9. (Diabari Ghat)	Middle of the River	230 mg/L

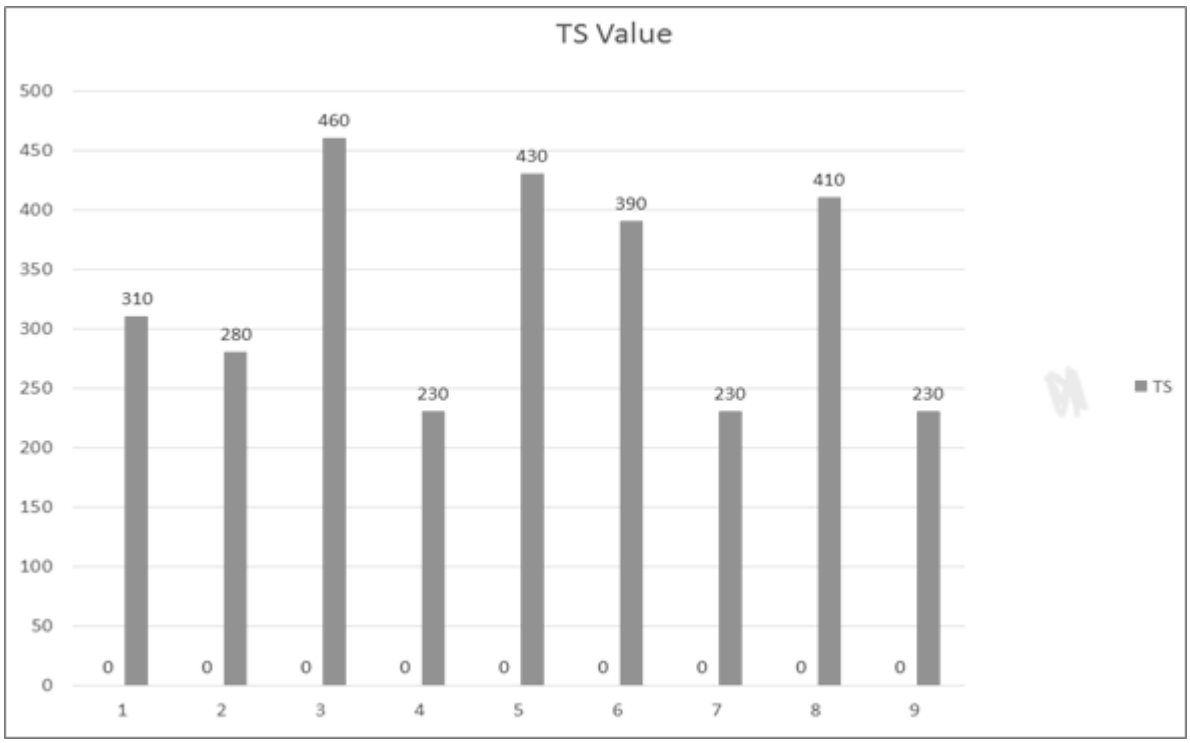


Figure 16: TS Value

TDS Test

Total Dissolved Solids (TDS)

As previously described, TDS are the particulates that are small enough to pass through the glass-fiber filter utilized in the TSS test (in theory, particulates less than 1.5 μm in size), and are captured in the flask along with the remaining filtered wastewater. Again, if the concentration (mg/L or ppm) of TS is known, then the concentration of TDS can be calculated by rearranging the equation:

$$TS = TSS + TDS$$

to solve for TDS:

$$TDS = TS - TSS$$

However, if the concentration of TS is not known, then a measured volume of well-mixed wastewater from the sidearm capture flask can be subjected to the same procedure described for the TS test later in this publication. The resulting TDS concentration can then be added to the TSS concentration, and a TS value can be calculated.

TDS Testing procedure:

1. Rinse beaker and meter probe twice in water to be tested.

2. Check that there are no air bubbles on probe. If bubbles are present, swirl meter to dislodge them. Keep the meter from touching the side or bottom of the beaker.

3. Record value after reading stabilizes (at least 1 minute).

4. Rinse meter probe with distilled water. Cap and turn off.



Fig-17: TDS Tester



Fig-18: TDS Test

Table 6: TDS Test Result

Sample No	Sample Location	TDS (mg/L)	Standard Value of Alkalinity
1. (Gabtoli Ghat)	Bank of the River	950 mg/L	
2. (Gabtoli Ghat)	15 ft from Bank	910 mg/L	
3. (Gabtoli Ghat)	Middle of the River	890 mg/L	
4. (Sosan Ghat) Factory	Bank of the River	1210 mg/L	
5. (Sosan Ghat) Factory	15 ft from Bank	1180 mg/L	1000 mg/L
6. (Sosan Ghat) Factory	Middle of the River	1110 mg/L	
7. (Diabari Ghat)	Bank of the River	790 mg/L	
8. (Diabari Ghat)	15 ft from Bank	750 mg/L	
9. (Diabari Ghat)	Middle of the River	710 mg/L	

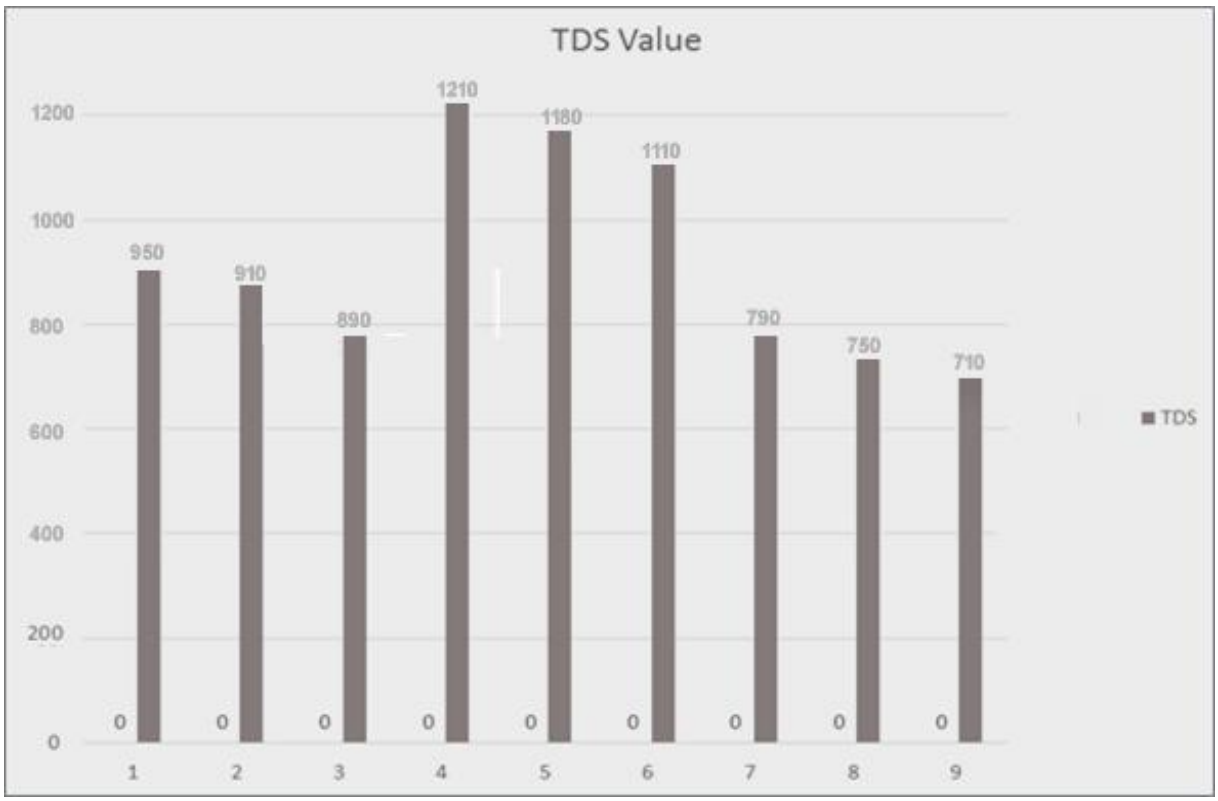


Figure 19: Value of TDS Test

Sample-4: TDS value 1210 mg/l is high in Sosan Ghat because of alkalinity level high.

Sample-9: TDS value 710 mg/l is low because of this area's apparently clear other points.

Chloride Test

Chloride Test: The test for chloride ions described here is based on precipitation of an insoluble chloride salt. When a few drops of a silver nitrate solution are added to a slightly acidic aqueous solution that contains chloride ions, a white precipitate of silver chloride will form.

Background:

Chloride in the form of chloride (Cl-) ion is one of the major inorganic anions in water and wastewater. The chloride concentration is higher in wastewater than in raw water because sodium chloride is a common article of diet and passes unchanged through the digestive system (Average estimate of excretion: 6 g of chlorides/person/day; additional chloride burden due to human consumption on wastewater: 15 mg/L). Along the seacoast chloride may be present in high concentration because of leakage of salt water into the sewage system. It also may be increased by industrial process. In potable water, the salty taste produced by chloride concentration is variable and depends on the chemical composition of water. Some waters containing 250 mg/L Cl- may have a detectable salty taste if sodium caption is present. On the other hand, the typical salty taste may be absent in waters containing as much as 1000 mg/L when the predominant captions are calcium and magnesium. In addition, a high chloride content may harm metallic pipes and structures as well as growing plants.

Benefits of testing for TDS:

- **Taste/ Health**: High TDS results in undesirable taste which could be salty, bitter, or metallic. It could also indicate the presence of toxic minerals.
- **Filter performance:** Test your water to make sure the reverse osmosis or other type of water filter or water purification system has a high rejection rate and know when to change your filter (or membrane) cartridges.
- **Hardness:** High TDS indicates hard water, which causes scale buildup in pipes and valves, inhibiting performance.
- **Aquariums/Aquaculture:** A constant level of minerals is necessary for aquatic life. The water in an aquarium or tank should have the same levels of TDS and pH as the fish and reef's original habitat.

PROCEDURE CHART

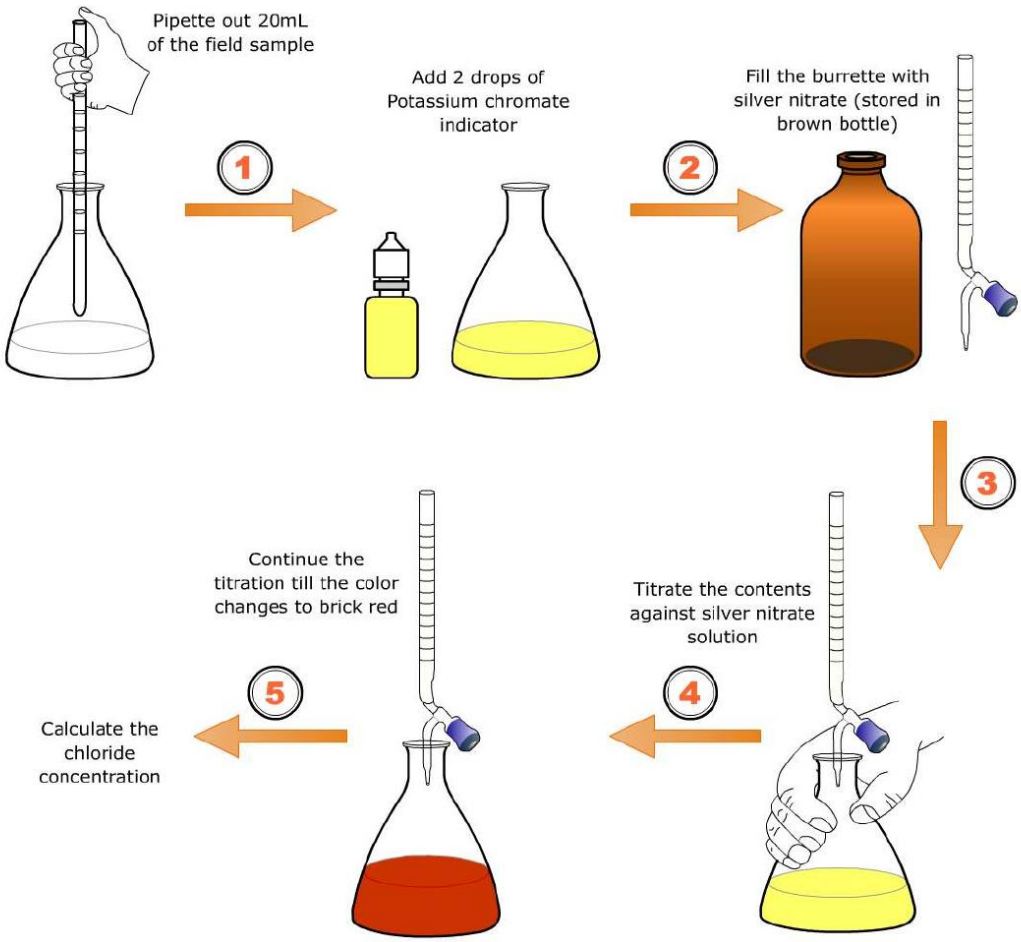


Fig-20: Chloride Test procedure Chart





Fig- 21: Chloride Test

Table-7: Chloride Test: It is measured by Titrating a known volume of sample with standardized silver nitrate solution usingpotassium chromate solution in water as an indicator**.**

Sample No	Sample Location	Chloride (mg/L)
1. (Gabtoli Ghat)	Bank of the River	5.7 mg/L
2. (Gabtoli Ghat)	15 ft from Bank	7.2 mg/L
3. (Gabtoli Ghat)	Middle of the River	6.9 mg/L
4. (Sosan Ghat) Factory	Bank of the River	6.1 mg/L
5. (Sosan Ghat) Factory	15 ft from Bank	7.0 mg/L
6. (Sosan Ghat) Factory	Middle of the River	7.9 mg/L
7. (Diabari Ghat)	Bank of the River	7.2 mg/L
8. (Diabari Ghat)	15 ft from Bank	4.9 mg/L
9. (Diabari Ghat)	Middle of the River	6.4 mg/L

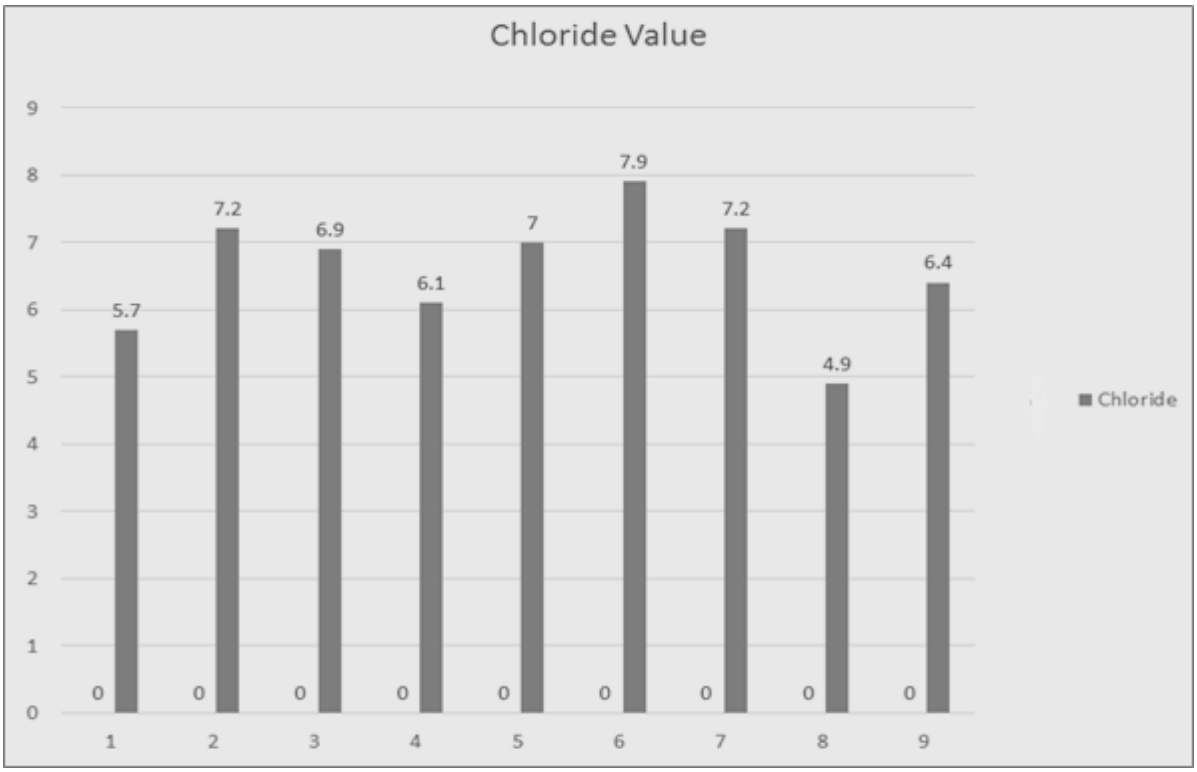


Figure 22: Value of Chloride Test

CHAPTER-5

CONCLUSIONS, RECOMMENDATIONS AND LIMITATION

5.1 Conclusions

- The Turag River is threatened by pollution, low flow in Turag River encroachment and land grabbing. The present liberalized industrial policy in Bangladesh ignores environmental protection the scope of the factories is gradually increasing. That is why our river pollution is increasing day by day. It is important to find alternatives to them very quickly. Otherwise, it is not possible to maintain the balance of the environment. I think that if the river is protected from harmful elements, the river will be environmentally friendly.
- By the increase of unplanned industry mills and factory create a new challenge to Bangladesh and socially and environmentally.
- The River Management is now very much necessary to protect theriver.
- The Average Value of PH Test is (7.26) result of this study satisfiedthe BD standard and satisfied WHO standard.
- The Average Value of Turbidity test result is 30.66 (NTU). This average result did not satisfy the BD standard and not satisfiedWHO.
- The average Value of Alkalinity Test is (152.78) mg/L. The result of this study satisfied the BDstandard and satisfied WHO standard.
- The average value of TS test result is 330 (mg/l). The average value of TDS test result is 160 (mg/l).The Average value of TSS is 170 (mg/L).
- The average Value of Chloride Test is 6.58 (mg/l) result of this study satisfied the BD standard and satisfied WHO standard.

5.2 Recommendations

By doing this analysis we found that, there are a lot of cause for the water pollution of the Turag River. But we specially identified that the water quality is very bad beside the Garments factory where the factory wastewater and chemicalwere discharged.

So, we can identify that the Factory are mainly responsible for Water Pollution in Turag River. We can reduce water pollution by taking some necessary immediate action, some are given bellow.

- Existing laws and regulations should be implemented properly.
- Illegal residential, factories, slums must be removed from the bank of the river.
- To continue the flow of the river, dredging is required.
- To control the pollution from industrial discharge efficient operation is required.
- After all public awareness should be increases.

5.3 Limitation of the study

- We have worked with sources of only one River.
- We have tested only seven parameters as we have some limitations related to chemicals availability used in Laboratory.
- We have not used any biological media as bacterial growth cannot be ensured in our Laboratory. TC, BOD, COD test not available in our Laboratory.

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