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Investigation of Some Selected Water Quality Parameters of the Kirtankhola River, Bangladesh.

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ABSTRACT :
The study aimed to assess the physical and chemical water quality parameters of Kirtankhola River in Bangladesh, which is crucial for various purposes such as drinking, irrigation, aquatic life, and economic development. The researchers collected water samples from four different locations along the river during dry seasons, and measured various parameters including Color and Odor,Water Transparency,Temperature, pH, EC, TDS, TSS, TS, Turbidity, DO, BOD, COD, Nitrate (NO2- and NO3-), Ammonia, Free Chlorinein laboratory-based analysis.The mean values of these parameters were compared with the water quality standards set by EQS guideline, ADB, and the Department of Environment (DoE) in Bangladesh.The findings of the study can provide insights for policymakers and stakeholders to take necessary actions to ensure the sustainable management of the Kirtankhola River and protect its water quality for the benefit of the people and the environment.The results of the study indicated that the water quality of the Kirtankhola River is deteriorating due to various anthropogenic activities such as industrialization, urbanization, and agricultural practices. The values of physiochemical parameters such as BOD, COD, nitrate, and ammonia were found to be higher than the standard limits set by the EQS guideline, ADB, and DoE, indicating a high level of organic and inorganic pollution in the river water. The researchers suggested that proper management and regulation of industrial and agricultural activities, as well as proper disposal of waste and sewage, can improve the water quality of the river.In conclusion, the study highlights the importance of monitoring and assessing the water quality of rivers such as Kirtankhola in Bangladesh to ensure sustainable development and protect the environment and human health. The findings of the study can guide policymakers and stakeholders to take necessary actions to mitigate the impacts of human activities on the river water quality and promote its sustainable management.

KEYWORDS: *Water quality, Pollution, Industrialization, Urbanization, Agricultural practices, Organic pollution, Inorganic pollution, Dilution effect, Sustainable management, Human health, Environmental protection, Policy, Stakeholders*

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I. INTRODUCTION

Water is a necessity in today's day and age, not only for humans but also for other living beings. Human beings require a small amount of water on a daily basis. Surface and groundwater have been used for many decades in our activities, however, our bad habits result in the wastage of a large amount of water and degradation of water quality. It is very tough to restore contaminated water by using modern technology, In many cases, it may not be possible to restore contaminated water using modern technology. The quality and quantity of water maintain ecological balance.

Different municipal waste and industrial effluent are responsible for a greater portion of contaminated water. Nowadays, water pollution has proven to be a very serious and very visible form of environmental contamination, as water bodies are used indiscriminately as dumps (Francis, 1994)[1].Kirtankhola is a river that starts at Sayeshtabad, in the district of Barishal, Bangladesh, and ends in Gajalia, near the Gabkhan canal. It is the most important river in that particular area in terms of irrigation, fisheries, transportation, recreational uses and so on.

Rabbani, M. L., &Sarker, S. (2017) showed in their work that the condition of the Turag River's water quality, particularly regarding solid waste from municipal and industrial sources, is indeed very serious. The presence of solid wastes in the river had detrimental effects on the aquatic ecosystem, including living fish and plants.[15]. As a result of increasing urbanization, industrialization, and development activities, the deterioration of Kirtankhola's water quality has increased at an alarming rate. Kirtankhola river is the main place used to receive millions of liters of sewage, domestic waste, industrial and agricultural effluents from Barishal city and its nearby area. These changes in water quality due to industrial waste, agricultural pollution, and human waste are creating an unfavorable environment for the aquatic ecosystem. Moreover, the food chain will be affected by polluted water. Inorganic, organic, and biological pollutants will impact natural water, and in some cases, the presence of toxic elements such as cadmium (Cd), chromium (Cr), copper (Cu),manganese (Mn), nickel (Ni), lead (Pb),uranium (U), and zinc (Zn), etc., will spread toxicity. On the other hand, some pollutants do not affect water quality directly, but their presence can impact the quality on which the water depends. For example, biodegradable organic matter in water is often not toxic, but the consumption of oxygen during its degradation prevents the water from supporting fish life (Trivedi, 1992)[2]. An acceptable range of pH is essential to the particular organisms involved. Chemical processes used to coagulate sewage or remove cyanide ion require that the pH be controlled within rather narrow limits (Nahar, 2000)[3]. The fluctuation in river water temperature usually depends on the season, geographic location, sampling time, and temperature of effluents entering the stream (Ahipathy, 2006)[4]. For public health, chlorides up to 250 mg/l are not harmful but values greater than this are indication of organic pollution (Nahar, 2000)[3].Free oxygen(O_2) or DO is needed for respiration in most aquatic organisms without this most of them will be abolished. DO levels below 1ppm will not support fish, levels of 5 to 8 ppm are usually required for most fish population. The average value of DO levels (6.5 mg/l) indicates the average quality of river water(APHA. 1995)[5]. Color, Odor, Temperature, pH, TSS, TDS, TS, BOD, COD, DO, Turbidity, EC and Salinity these are the important water quality parameters.The purpose of this experiment was to examine the water quality parameter of the Kirtankhola river and to determine their exactness for fish and other aquatic organisms.

II. MATERIALS AND METHODS

Study Area:

The study was conducted between then Chorkawyakheya Ghat, Barishal river port terminal, 30 Godown, Barishal University.

Fig.1. Google Map showing Sampling Location.

GPS Location of Sampling Points:

Serial Number	Sample Location	GPS Co-ordinates	
		Latitude	Longitude
1	Chorkawyakheya Ghat	22° 40' 53.424"	90° 23' 3.166"
2	Barishal River port terminal	22° 41' 59.122"	90° 22' 31.288"
3	30 Godown	22° 40' 46.62"	90° 21' 52.223"
4	Barishal University	22° 39' 35.9"	90° 21' 43.424"

Table.1. GPS Co-Ordinates of sampling points of Kirtankhola River

Preparation of sample bottles:
The 250 ml plastic bottles were washed well to remove any impurities or contaminants. Then, the bottles were rinsed with 1-2 ml of 2% industrial HCl to ensure that any residual contaminants were removed. Finally, the bottles were rinsed again with the sampled water to ensure that the samples collected were not contaminated by the cleaning agent.
Collecting water samples:
The water samples were collected securely and sealed with proper labeling to prevent any contamination during transportation. Aeration during sampling was avoided as far as possible to prevent any changes in the water chemistry due to the exposure to air.
Transporting samples:
The water samples were carefully transported to the laboratory to ensure that they were not damaged or contaminated during transit.
Preserving samples:
The water samples were preserved for physical and chemical analysis. This could involve adding preservatives to the samples to prevent any changes in the water chemistry.
Sampling location:
To ensure representative water quality assessment, samples were collected from various locations along the river in the study area.
Testing of Water Parameter:
***Color and Odor*:**This test involves observation and the sense of smell.
Water Transparency:
Water transparency is an important indicator of the health and quality of aquatic environments. To measure water clarity, we used a simple but effective tool called the Secchi Disc.

pH:

pH stands for "potential of hydrogen" and it is a measure of the acidity or basicity of a solution. The pH scale ranges from 0 to 14, where 0 is highly acidic, 7 is neutral, and 14 is highly basic. To measure pH, a pH meter is used. The pH meter consists of a glass electrode that is sensitive to changes in hydrogen ion concentration, and a reference electrode. The pH meter is first standardized using a known solution of either distilled water or buffer solution. This ensures that the pH meter is reading accurately before measuring the sample. To measure the pH of a sample, a clean plastic beaker is used to hold the sample. A volume of 50 ml of the sample is poured into the beaker, and the pH meter is immersed in the sample, making sure that the electrodes are completely submerged. The pH meter is allowed to stabilize for at least five minutes to ensure an accurate reading. Once the pH reading stabilizes, it is recorded in a notebook. Before measuring the pH of the next sample, the pH meter is rinsed in either distilled water or buffer solution to remove any residual sample that may be on the electrodes. This ensures that the pH meter does not give inaccurate readings due to contamination from the previous sample. This process is repeated for all other samples to obtain their pH values. It is important to maintain a clean environment and to handle the samples carefully to avoid any contamination that may affect the accuracy of the pH measurements.

EC, TDS and Temperature:

EC (Electrical Conductivity) and TDS (Total Dissolved Solids) are measures of the ability of a solution to conduct electricity. EC measures the conductivity of all ions in the solution, while TDS measures the total amount of dissolved solids in the solution. The temperature of the solution can also affect its conductivity, so it is important to measure the temperature as well.To measure EC,TDS, and temperature,a conductivity/TDS meter is used. The meter consists of a probe that is sensitive to changes in electrical conductivity, and a temperature sensor. Before using the meter, the probe should be washed with distilled water to remove any impurities that may interfere with the readings. The cell constant of the meter should also be checked to ensure that it is properly calibrated.

To measure EC, TDS, and temperature, a sample of 100 ml is taken in a 150 ml measuring cylinder. The electrode of the conductivity/TDS meter is immersed in the sample, making sure that the electrodes are completely submerged. The meter is allowed to stabilize for at least 10 seconds to ensure accurate readings. Once the readings stabilize, the EC, TDS, and temperature values are recorded in a notebook.It is important to handle the samples carefully to avoid any contamination that may affect the accuracy of the readings. Additionally, the meter should be properly calibrated and maintained to ensure accurate readings.

TS and TSS:

A clear dry glass beaker with a 150ml capacity was taken, and an identification mark was appropriately placed on it. The weight of the beaker was measured. A 100ml thoroughly mixed sample was measured using a measuring cylinder, and poured into the beaker. The beaker was then placed in an oven maintained at 100°c for 24 hours. After 24 hours, the beaker was cooled and weighed. The weight of solids in the beaker was found by subtracting the weight of the clear beaker determined previously.

Total Solids, TS(mg/l)= $\frac{mg\ of\ solids\ in\ besker}{volume\ of\ sample} \times 1000$

From TS and TDS, we are able to determine TSS (total suspended solid) by subtracting total dissolved solid from total solid.

Total Solids, TSS(mg/l)=TS-TDS

DO (Dissolved Oxygen):

The measurement of DO in water is typically done using a DO meter. However, it's crucial to calibrate the DO meter before use to ensure accurate results. Once the DO meter is calibrated, the sensor is immersed in the water sample, and the meter is allowed to stabilize for several minutes. The DO reading is then recorded, and the sensor is rinsed with distilled water to remove any residue before taking the next measurement.

Fig.2. Digital DO Meter.

BOD (Biochemical Oxygen Demand):

First, a water sample is collected in a BOD bottle that is sealed and kept in the dark to prevent the entry of light and air. The initial dissolved oxygen (DO) concentration of the water sample is measured using a DO meter. A nutrient solution is added to the water sample to promote microbial growth. The BOD bottles are then incubated at a specific temperature, usually 20°C or 25°C, in the dark for a set period of time, typically 5 days. After incubation, the final DO concentration of the water sample is measured using the DO meter. The difference between the initial and final DO concentrations provides a measure of the amount of oxygen consumed by microorganisms in the water sample.

COD (Chemical Oxygen Demand):

We are selecting the wet chemistry method for COD determination involves collecting representative water or wastewater samples, ensuring sample homogeneity, and performing dilution if needed. Reagents, including potassium dichromate and an acid mixture, are prepared accurately. A measured sample volume is mixed with the reagents in a reaction vessel and allowed to react under controlled conditions. After the reaction, a portion of the solution is transferred to a cuvette for colorimetric measurement using a spectrophotometer or colorimeter at a specific wavelength. The instrument is calibrated with known standards, and the measured absorbance or turbidity is converted to COD concentrations using a calibration curve. Quality control measures, such as duplicate measurements and blank samples, ensure the method's precision and accuracy. The reliable COD measurements obtained using this wet chemistry method are valuable for water quality monitoring and environmental assessment. This procedure serves as a standard protocol for researchers and analysts involved in COD determination, offering a robust and comprehensive approach.

Turbidity:

The HACH turbidimeter model 2016 is a device used to measure the turbidity of water samples. To use the turbidimeter, first calibrate it according to the manufacturer's instructions using a standard solution of known turbidity. Next, collect a representative water sample and pour it into a clean, calibrated sample cell or vial. Ensure the sample is at room temperature before taking measurements. Insert the sample cell or vial into the turbidimeter, making sure the optical surfaces are clean and free of any bubbles or debris. Close the lid and press the "read" button to take a measurement. The turbidimeter will display the turbidity value in nephelometric turbidity units (NTU). the turbidity value and any relevant details, such as the date, time, and location of the sample. Clean the sample cell or vial with distilled water and dry it before using it for the next sample. Clean the optical surfaces of the turbidimeter regularly to ensure accurate measurements. The turbidity determination procedure is a vital step in assessing water quality and ensuring safe drinking water.

Free Chlorine:

After calibrating the CL-2006 colorimeter, DPD powder is mixed with each water sample and shaken for 20 seconds. The samples are then placed into the colorimeter, and the final recorded result is taken after waiting for the reading. The concentration of chlorine is measured in each sample one after another.

Ammonia:

The materials required for this test include: Ammonia test kit (Product Number:2428700), Sample container, Deionized water, Pipette, Test tube, Color comparator.

The following steps should be followed to measure ammonia levels in surface water:

Collect a water sample in a clean container. The container should be rinsed with deionized water before collecting the sample. Add 1 mL of the collected water sample to a test tube using a pipette. Add 10 mL of the ammonia test reagent to the test tube and mix well. Wait for 5 minutes for the color to develop. Compare the color of the solution in the test tube with the color comparator provided in the kit. The comparator has a color chart with different shades of yellow. The color of the solution in the test tube should be matched with the color chart.

Record the ammonia level in the water sample based on the color chart. The ammonia level is expressed in parts per million (ppm).

Nitrate (NO^{2-} and NO^{3-}):

To perform the nitrate test, first fill the nitrate test vial with 5 ml of the water sample to be tested. Then, add one nitrate test reagent powder pillow to the vial and gently swirl to mix. Wait for 2 minutes for the reaction to occur. After that, compare the color of the solution in the vial to the color comparison chart provided with the test kit. Hold the vial up to the chart and match the color of the solution to the corresponding color on the chart. Identifying the correct color will allow you to record the nitrate concentration in parts per million (ppm) based on the color chart. Nitrate levels can vary over time, so ongoing monitoring is required to ensure that they remain at safe levels. Overall, nitrate testing is a simple yet essential step in ensuring that our water is safe to drink, and potential sources of contamination are identified and addressed promptly.

Fig.3. Chemical Test.

Instruments used for different Tests:

Parameters	Instruments
PH	Digital PH Meter
Color and Odor	Eye observation and feeling smell
Transparency	Secchi Disc
Turbidity	HACH turbidimeter model 2016
Electric Conductivity	Digital EC Meter
TDS	Digital TDS Meter
Temperature	Thermometer
BOD	Digital DO Meter
COD	COD Analyzer
DO	Digital DO Meter
Nitrate	Surface Water Test Kit (Cat. No. 25598-33)
Ammonia	Surface Water Test Kit (Cat. No. 25598-33)
Chlorine	Surface Water Test Kit (Cat. No. 25598-33)

Table.2. Methods and/or instruments used for the analysis of different parameters.

III. RESULTS AND DISCUSSIONS

Physical Parameters

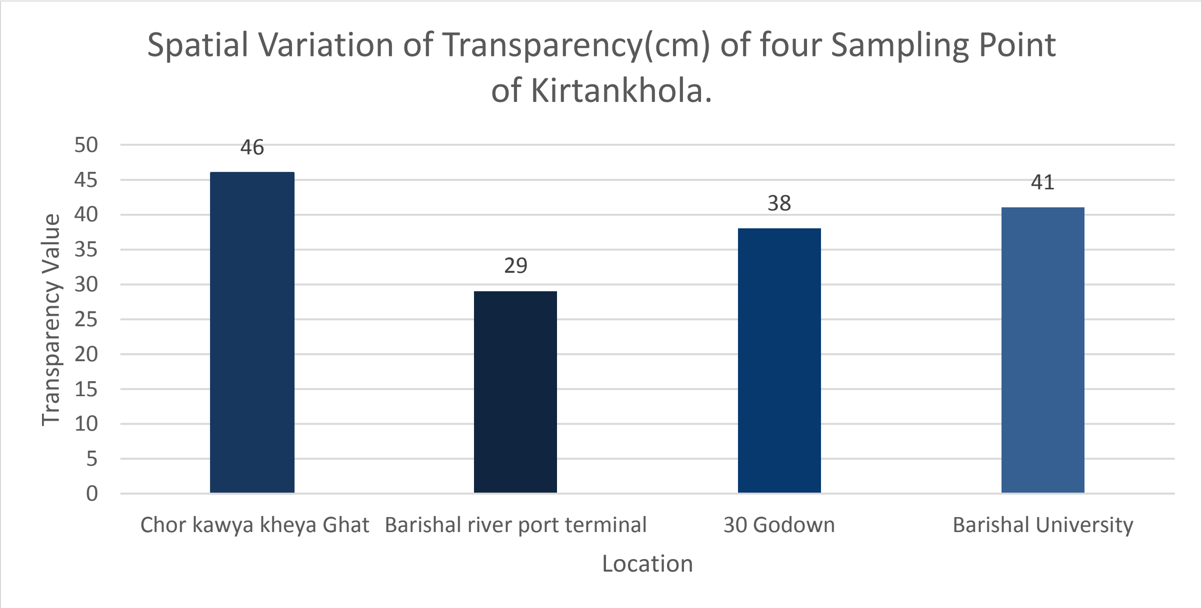
***Color and Odor*:**

Water quality is a critical factor for both human and aquatic life. Unfortunately, the water quality in some of the sampling stations in the Barishal area has been found to be poor, especially during the dry season. For example, the water at the Barishal river port terminal appears black or dark-colored, which is a sign of impairment and could be indicative of a high level of organic matter or pollutants.However, it's important to note that not all discoloration of water is necessarily a sign of impairment. Phytoplankton-enriched water that appears dark greenish-blue, red, or brown can actually be a good sign for fish populations, as it indicates a healthy level of nutrients and productivity in the water. In fact, water at the ChorKawyaKheya Ghat, 30 Gudaon, and Barishal University sampling stations appears blue or greenish-blue, which could suggest a healthy level of dissolved oxygen and nutrients.The odor of the river at the Barishal river port terminal during the dry season was found to be bad, which could be indicative of decay or pollution. However, the odor at the other sampling stations was approximately good for that season, which is a positive sign.

***Water Transparency*:**

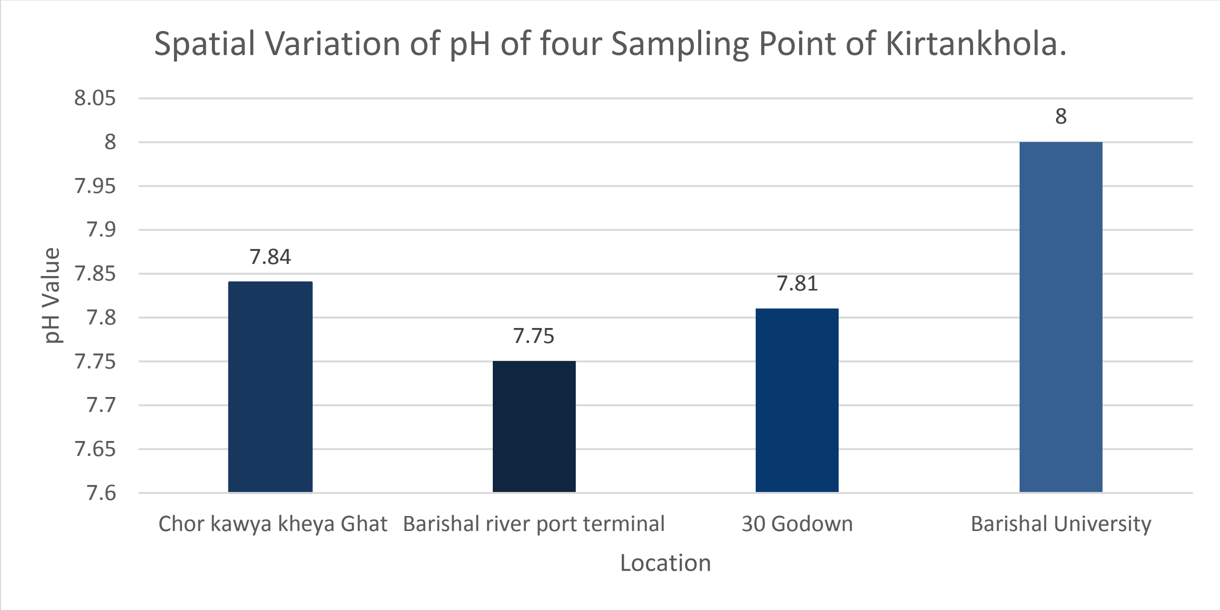
During the dry season, measurements of water transparency at four stations along the Barishal river were taken. The results showed that the highest transparency values were recorded at ChorKawyaKheya Ghat (46 cm) and Barishal river port terminal (29 cm). According to Rahman and Rana (1992)[6], productive water bodies should have a transparency of at least 40 cm. Therefore, these results suggest that the water quality at these stations may be suitable for supporting productive ecosystems.

However, it's important to note that transparency alone is not necessarily indicative of overall water quality. Other parameters, such as dissolved oxygen levels, pH, and levels of pollutants and contaminants, also play important roles in supporting healthy ecosystems.



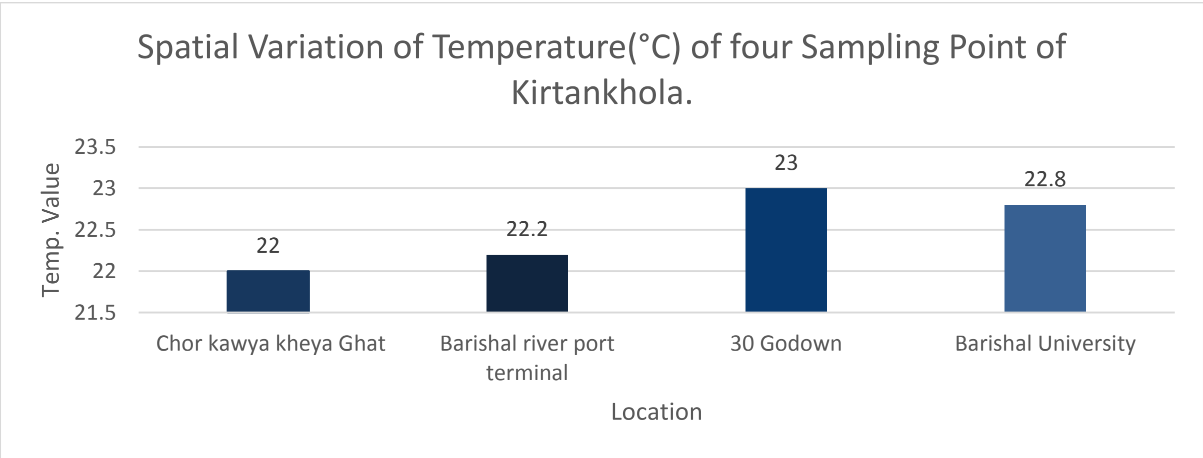
pH

The pH level of water is an important factor in determining its suitability for various purposes, including irrigation. The permissible range of pH for irrigation is defined by various standards, including Ayers and Westcot (1985), FAO (1992), ADB (1994), and GOB (1997)[7,8,9,10], which suggest values ranging from 6.0 to 8.4, 6.5 to 8.5, 6.0 to 8.5, and 6.0 to 9.0, respectively. High values of pH typically indicate the presence of alkaline substances such as chloride, bicarbonate, and carbonate. This study examines the pH levels in the Kirtankhola river water across various sampling stations. The results show a significant variation in pH levels across the different stations, with values ranging from 7.5 to 8.0. The average pH value of the samples collected was 7.85, with a standard deviation of 0.092466210044535. The findings of this study provide important insights into the pH levels of Kirtankhola river water, which may have implications for its suitability for irrigation purposes. The results suggest that the pH levels fall within the permissible range as defined by the various standards. However, further research is needed to examine the presence of specific alkaline substances in the water and their potential impact on crop growth and soil quality.



Temperature:

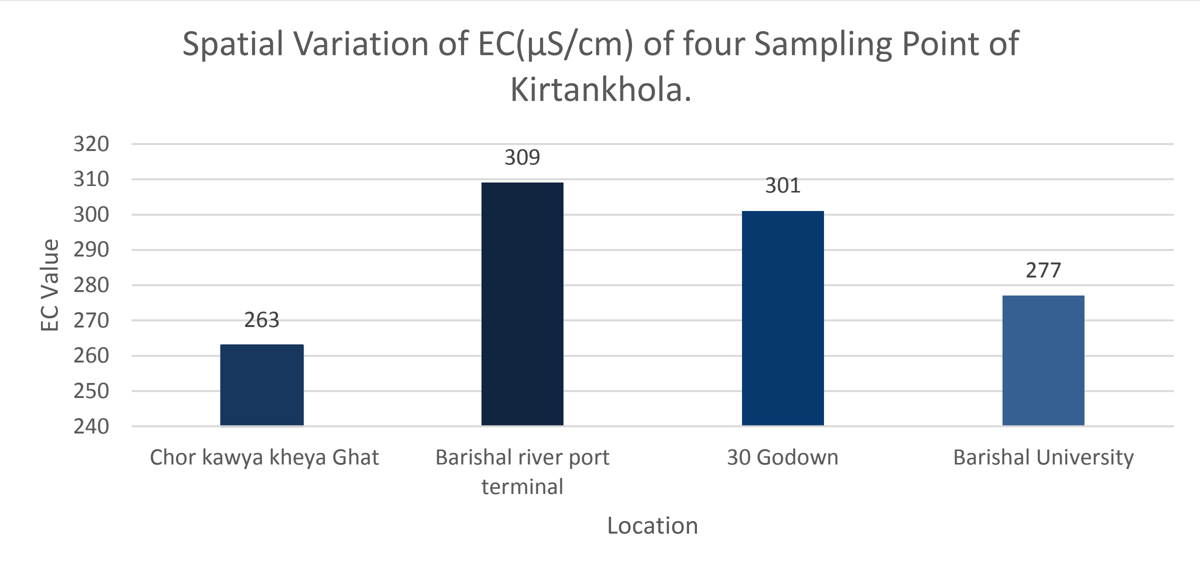
Water temperature is an important factor that can affect the dissolved oxygen (DO) and biological oxygen demand (BOD) in polluted water. While temperature may not be as critical in pure water due to the wide range of temperature tolerance in aquatic life, in polluted water, it can have significant impacts. The fluctuation in water temperature is influenced by various factors such as season, geographic location, sampling time, and temperature of effluents entering the stream (Ahipathy and Puttaiah, E.T. 2006)[11]. This study investigates the temperature of Kirtankhola River water across different sampling stations. The results show significant variations in water temperature across the different stations, with fluctuations influenced by factors and location of the station. The findings suggest that water temperature can have a profound impact on dissolved oxygen and biological oxygen demand, particularly in polluted water. The study highlights the importance of considering water temperature in assessing the suitability of water for various purposes, including aquatic life and human consumption. The results can inform decision-making processes related to water management, pollution control, and environmental conservation. Further research is needed to examine the specific impacts of water temperature on DO and BOD and the long-term implications for water quality and ecosystem health.



EC

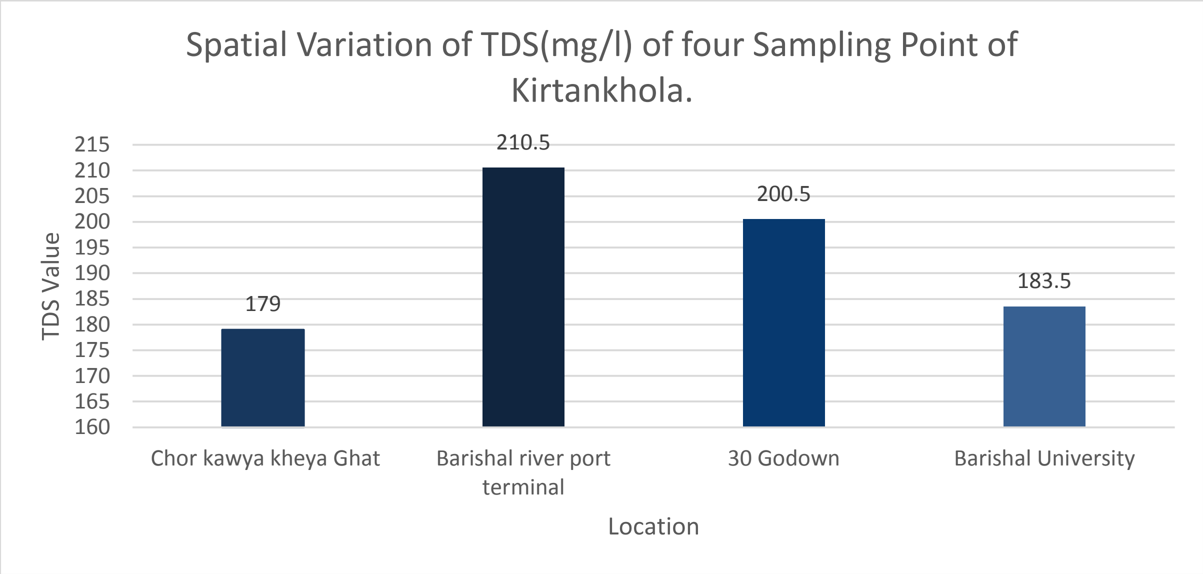
The value of electrical conductivity (EC) in water is dependent on several factors, including the concentration and dissociation of ions, temperature, and migration velocity of the ions in the electric field. EC is used as a measure of ion concentration in water, which is influenced by various environmental factors such as movement and sources of water. Soluble ions in surface water originate mainly from the dissolution of rock materials.

In most natural water, specific conductance generally ranges from about 50 to 1500 µS/cm. The study area of Kirtankhola River showed an EC range between 301 to 263 µS/cm, most of which fall within the standard level of EC for most natural waters. The average and standard deviation of EC were significant. The recommended threshold for EC is 0.70 dS m−1 (FAO, 1992), 0.75 dS m−1 (ADB, 1994), or 1.2 dS m−1 (GOB, 1997)[8,9,10]. Therefore, EC is a crucial indicator of water quality and can provide valuable information for monitoring and managing water resources in the study area.



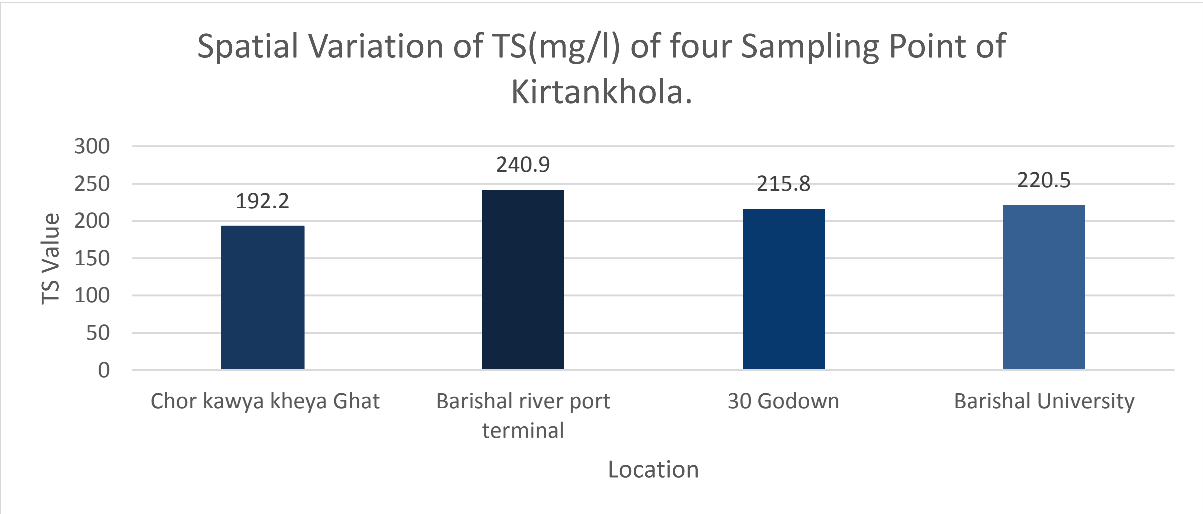
TDS

Total Dissolved Solids (TDS) is a measure of the total concentration of all dissolved components in water. In natural water, TDS primarily consists of Na+, K+, Ca2+, Mg2+, Cl-, SO42-, PO43-, H4SiO42-, and HCO3-. High TDS levels in water can render it unsuitable for common uses. In the study area, TDS levels ranged from 179 to 210.5 ppm. A comparison between the average and standard values revealed only a small variation, with the field value falling below the standard. These findings suggest that the river water in the study area is moderately suitable for common uses despite containing TDS. The standard TDS value for river water varies depending on the regulatory agency and purpose of use. For example, the World Health Organization (WHO)[12] recommends a maximum TDS level of 1000 mg/L for drinking water, while the United States Environmental Protection Agency (EPA) sets a secondary maximum contaminant level of 500 mg/L for TDS in drinking water. In terms of irrigation, the acceptable range of TDS in river water is 500-2000 mg/L according to the Food and Agriculture Organization (FAO). Additionally, the Indian Standard Institution (ISI) recommends a maximum TDS level of 2000 mg/L for irrigation water. For research purposes, it is important to consult the relevant regulatory agency and guidelines to determine the appropriate standard TDS value for the specific study.



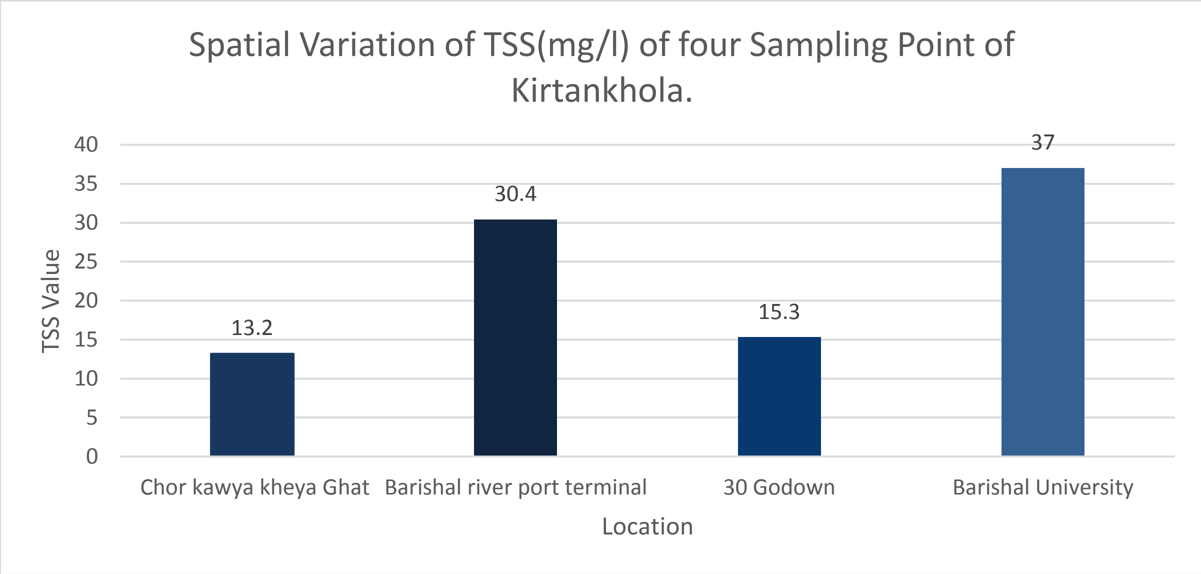
TS

From the test, the total solid value varies from 192 to 220. This can lead to water quality degradation and challenge water treatment. Monitoring and mitigation measures are required to protect river ecosystems and ensure the sustainability of water resources.



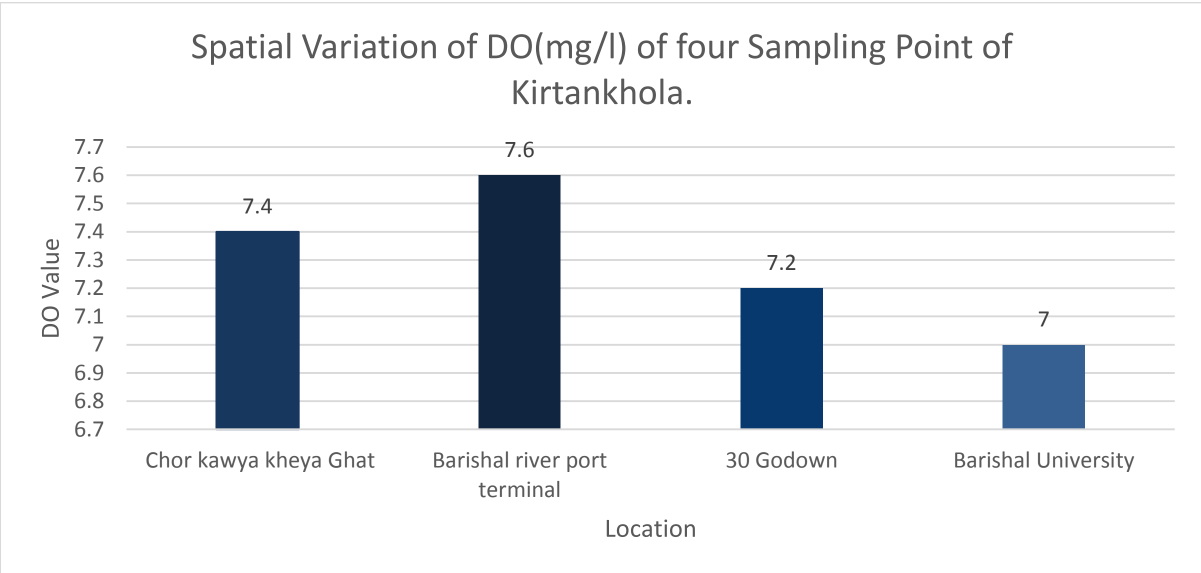
TSS

The presence of suspended solids in water holds significant importance due to various reasons. These solids can encompass algal growth, which serves as an indicator of severe eutrophication. Additionally, they can suggest the release of washings from sandpits, quarries, or mines. Moreover, suspended solids in water cause a reduction in light penetration within surface waters, subsequently affecting aquatic plant life. The provided data indicates a range of total suspended solids (TSS) ranging from 13.2 to 37 mg/L. These findings contribute to the body of knowledge surrounding water quality assessment and its ecological implications.



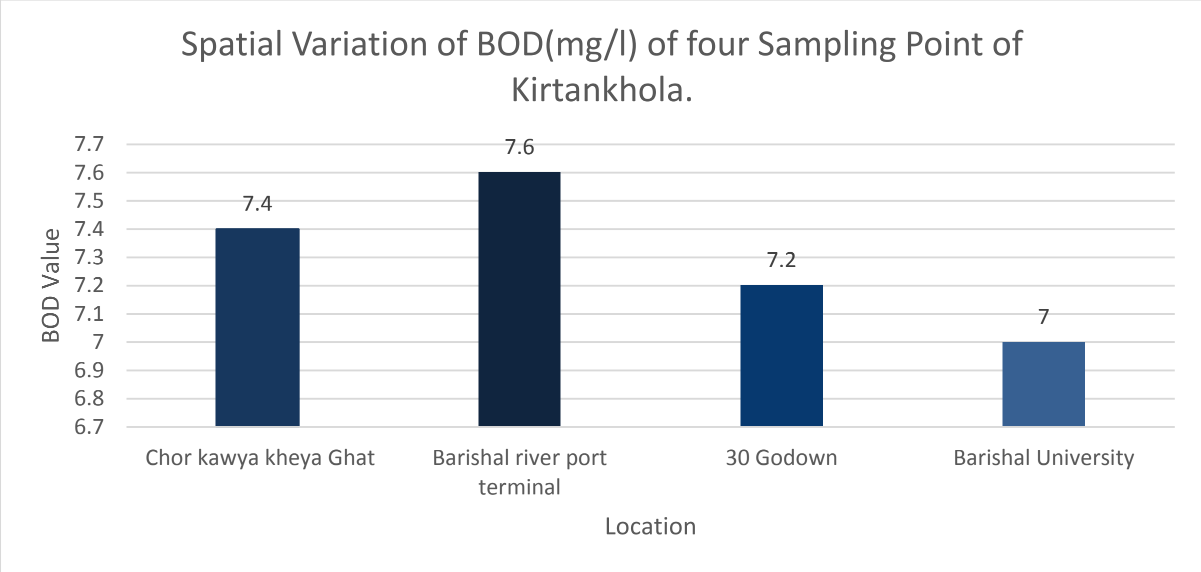
DO

Oxygen, specifically in the form of dissolved oxygen (DO), is a critical gas for the survival of most aquatic organisms. DO is required for respiration, and levels below 1 ppm are insufficient to support fish populations, while levels of 5 to 6 ppm are typically necessary for most fish species. The quality of river water can be assessed by measuring DO levels, with an average value of 6.5 mg/L considered typical for rivers according to the American Public Health Association (APHA, 2005)[13]. In the present study, DO values in the river water ranged from 7 to 7.6 ppm, with an average value of 7.3 ppm. However, this average value is significantly higher than the standard value of 6.5 ppm. This deviation between the average and standard values indicates that the quality of the river water is lower than typical conditions for fish and other aquatic life. Therefore, it is essential to monitor and maintain appropriate DO levels in river water to support healthy aquatic ecosystems.



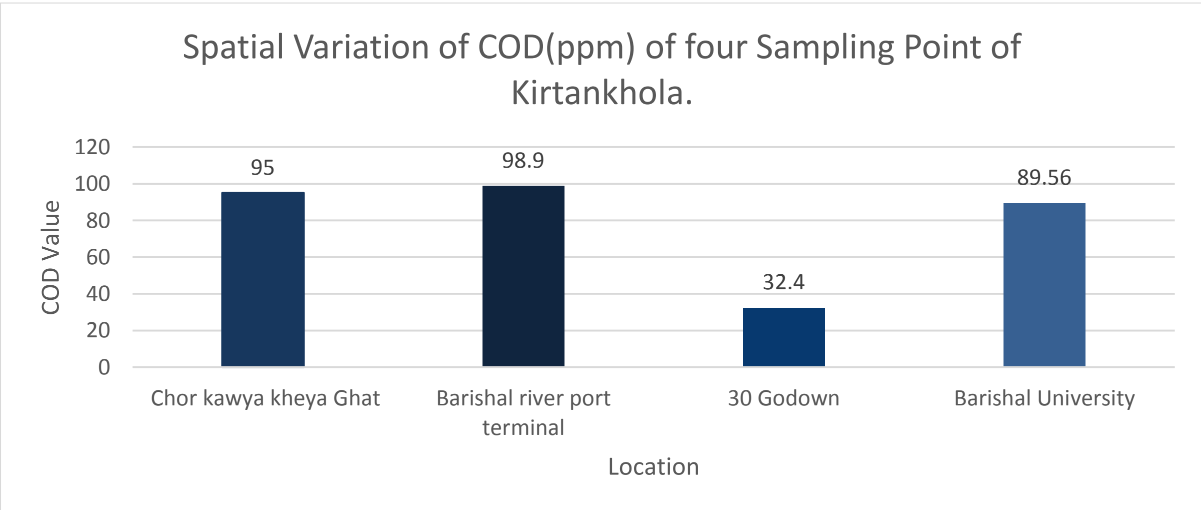
BOD

The measurement of biochemical oxygen demand (BOD) is an important indicator of water quality, particularly in terms of its impact on dissolved oxygen levels in rivers and streams. Typically, unpolluted natural waters will have a BOD of 5 mg/L or less. When BOD levels increase, the amount of dissolved oxygen in the stream decreases at a faster rate, ultimately leading to a decrease in oxygen available for higher forms of aquatic life. This decrease in available oxygen can cause aquatic organisms to become stressed, suffocate, and die. Sources of BOD include leaves, woody debris, dead plants and animals, animal manure, effluents from pulp and paper mills, wastewater treatment plants, feedlots, and food processing plants, failing septic systems, and urban stormwater runoff. In the present study, BOD values varied between 2.5 to 5.2 ppm. Comparison between the average value and standard value of BOD showed a higher deviation, indicating a lower quality of the river water and a higher rate of pollution. The higher the deviation, the lower the quality of water for fish and other aquatic life. In Bangladesh, the irrigation water quality standards proposed by ADB (1994) and GOB (1997)[9,10] suggest a BOD threshold of 10 mg/L. It is important to consider the appropriate BOD standards for the specific study, as different regulatory agencies and purposes of use may have varying acceptable levels.



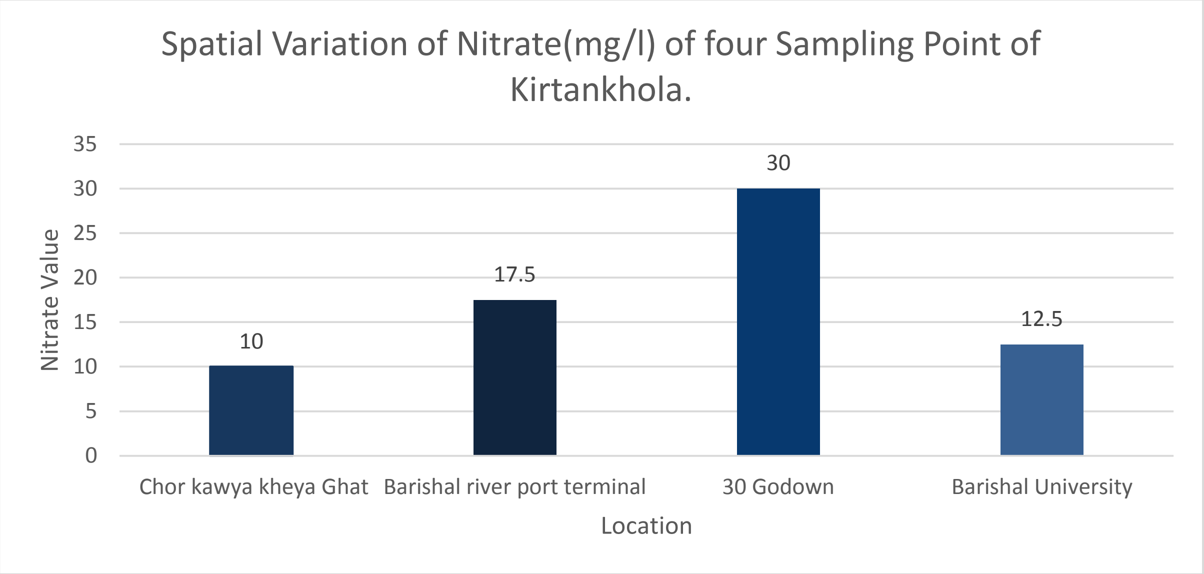
Chemical parameters
COD

The measurement of Chemical Oxygen Demand(COD) is an important method for determining the quantity of organic matter present in water. COD can be utilized as an effective indicator of organic pollution in surface water. The COD test, in combination with the BOD test, is helpful in identifying toxic conditions and the presence of biologically resistant organic substances (Sawyer et al., 2003)[14]. In the present study, COD values ranged from 32.4 to 98.9 ppm. Comparison between the average value of COD and the standard value a higher deviation, indicating a higher amount of organic compounds in the water, which demands higher COD and ultimately leads to lower water quality for fish and other aquatic life. It is important to note that COD standards vary depending on the regulatory agency and purpose of use. Thus, for research purposes, it is essential to consult relevant guidelines and regulatory agencies to determine the appropriate standard COD value for the specific study.



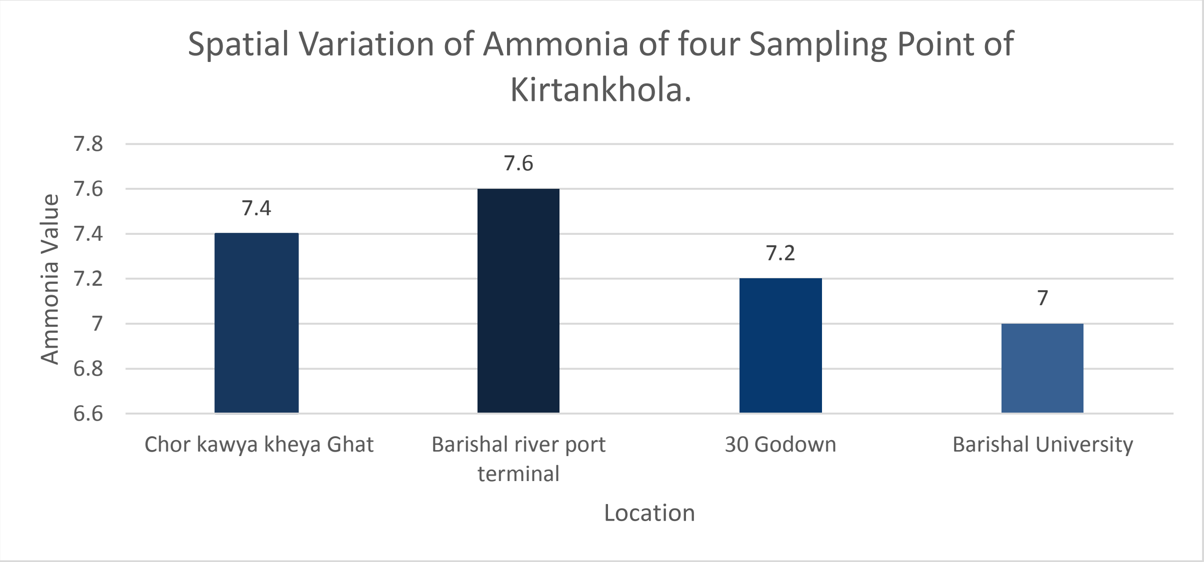
Nitrate ($NO2^-$ and NO^{3-})

The presence of nitrates in water is an important environmental concern due to its potential impact on both human health and aquatic life. Nitrate concentrations can vary widely depending on the source of the water and the surrounding land use. In domestic wastewater, nitrate concentrations are typically low, but in effluent from nitrifying biological treatment plants, concentrations of up to 30 mg can be found. In the present study, nitrate concentrations in the sample water ranged from 10 to 30 ppm, which is significantly higher than the standard value (Table 02). The comparison between the average value and standard value of nitrate showed a higher deviation, indicating lower water quality due to contamination from fertilizers, municipal wastewater, feedlots, and septic systems, leading to higher concentrations of nitrate. This highlights the potential negative impact on fish and other aquatic life, as well as human health for common uses. The FAO (1992)[8] has recommended a threshold value of 30 mg/l for nitrate concentration in water.



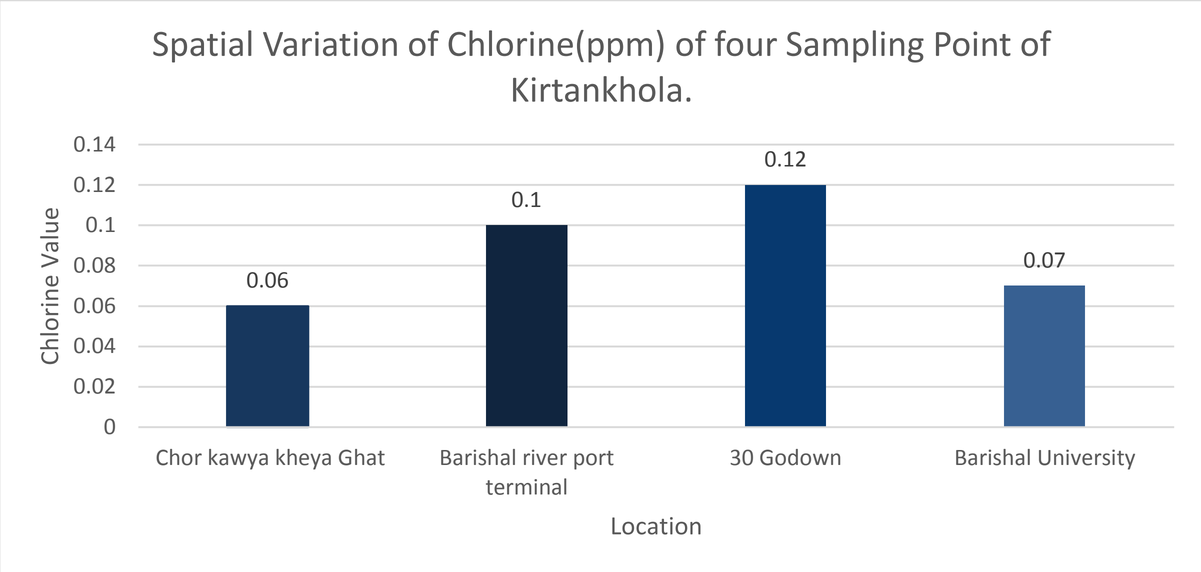
Ammonia

Ammonia concentration in water is an indicator of fecal matter presence, particularly from latrines. In this study, the measured ammonia concentration in sample water ranged from 0.003 to 0.008, which is significantly lower than the standard value. The comparison between the average value and standard value of Ammonia showed a lower deviation, indicating good quality of river water with a higher amount of organic matter content. Therefore, the results suggest that the level of fecal matter in the water is minimal, and the overall quality of the water is satisfactory for aquatic life and other uses.



Chlorine

Chlorine is often used as an indicator of salinity in water bodies. In cases where significant amounts of chlorine are present, it may indicate the possibility of contact with water of marine origin, as well as a high concentration of Na ions. Chlorine can be considered a conservative parameter from an environmental perspective, and can be used as an index of pollution from primary sources such as industrial and municipal outlets in natural freshwater systems. The study area's chloride concentrations for both seasons are presented here. Samples from the study area exhibited chloride contents ranging from 0.06 to 0.12 ppm. The comparison between the average value and the standard value of Chloride indicates a lower deviation, suggesting a lower level of impurities in the river water. This lower level of impurities makes the water unsuitable for common uses and aquatic life.



Conclusion:

Irrigation water criteria depend on both the chemical composition and the nature of plants to be irrigated, soil type, climate, amount and method of irrigation and drainage. The suitability of water for irrigation can be determined by the amount and kinds of present salt as well as the soil texture and the salt tolerance of crop. The suitability of surface water for irrigation is restrictive on the effects of mineral constitutes of water on both the plant and soil. Excessive amount of dissolved ions in irrigation water affects plants and agricultural soil physically and chemically, thus reducing the productivity. The physical effects of these ions are to lower the osmotic pressure in the plant structural cells, thus preventing water from reaching the branches and leaves. The chemical effects disrupt plant metabolism. River water quality parameters is used for various purposes such as aquatic life including fish and fisheries, domestic purpose, agriculture cultivations. River water quality is vital for fish because fish are highly sensitive to changes in parameters such as toxic substances, pH, temperature and presence ofgas. The level of dissolved oxygen, in the water is one the most important parameters that needs to be controlled in fish farming, because it is critical to health of the fish. The oxygen in the water must be as possible for healthy fish growth. When CO_2 levels in the water increase, the rate at which the fish releases CO_2 from its own metabolism.

All tested physical parameters; pH, temperature, BOD are much closer with standard value. on the other hand in chemical analysis it is found that Nitrate , Ammonia are not much closer with standard value. The overall test results reveal that the water of kirtankhola river is suitable for irrigation. Government needs to take proper steps to control the effluent discharge to the river. In this industrial era in Bangladesh, the government should strict to maintain of suitability of water in Kirtankhola river for surface irrigation.

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