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Study on Different Sources of Wastewater in the Korotoa River: Focus on Medical Wastewater

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Abstract

Wastewater originating from various sources has been gradually polluting the Korotoa river. Notably, medical wastewater contains hazardous chemicals, including harmful substances that may be used in treatment. In this study, it identifies the composition of waste present in medical wastewater, which is indiscriminately disposed of into the Korotoa river. Unfortunately, people who bathe or fish in the Korotoa river face serious health risks due to exposure to this contaminated water. Skin diseases are prevalent among those who come into contact with it. Additionally, several hospitals situated near the Korotoa river discharge chemical-laden wastewater directly into the river on a daily basis. To address this issue, it assesses the water quality of the Korotoa river and compare it against the standard values provided by the Bangladesh Environment Conservation Rules (BECR 1997). Different parameters such as PH, BOD, COD, DO, Turbidity, color, TS, TSS, TDS and Alkalinity are tested for the water sample collected from different hospitals effluent. All parameters exceed the standard value which is very much alarming. Furthermore, it proposes potential measures to mitigate pollution in the Korotoa river, which are detailed in this paper.

Keywords: Wastewater • Pollution • Environment ECR 1997 • Medical wastewater

Introduction

Water plays a vital role in various medical processes, but unfortunately, this activities often result in the generation of wastewater. This wastewater contains pollutants and contaminants that can adversely impact both human health and the environment. In the context of the Korotoa River, understanding the sources and characteristics of wastewater is crucial for effective management and conservation efforts [1]. Hospitals consume significant amounts of water for their operations, leading to the production of wastewater. Medical facilities (hospitals, clinics, laboratories) generate wastewater containing various contaminants, including pharmaceutical residues, pathogens and chemicals [2]. Proper management of medical wastewater is essential to prevent its harmful effects on water bodies. Treatment methods for medical wastewater may differ from those used for industrial effluents due to the specific nature of contaminants and the need for specialized handling. The increasing demand for water, coupled with limited freshwater resources, necessitates innovative approaches. Recycling and reusing wastewater can alleviate water scarcity and reduce pressure on existing water supplies [3].

Materials and Methods

Wastewater samples are collected from various hospitals to analyze their composition. Simultaneously, the water quality of the Korotoa River is evaluated for different parameters. This data is cross-verified by the public health department to ensure accuracy [4].

Selection of study area (medical wastewater from hospitals near Korotoa river): Investigate hospitals, clinics and healthcare facilities located near the river. Collect data on medical waste disposal practices and effluent discharge [5].

Sample collection: Identify key sampling stations along the Korotoa river, considering both upstream and downstream locations. Collect water samples during both wet and dry seasons to capture seasonal variations. Additionally, collect water samples from four hospitals (Figures 1-4). Parameters to measure include Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), alkalinity, acidity, Total Suspended Solids (TSS), Total Solids (TS) and color. Also, gather information on land use patterns, urbanization and industrial zones near the river [6].

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Analysis and data representation: Test the collected water samples for different parameters and present the obtained results in tabular form [7].

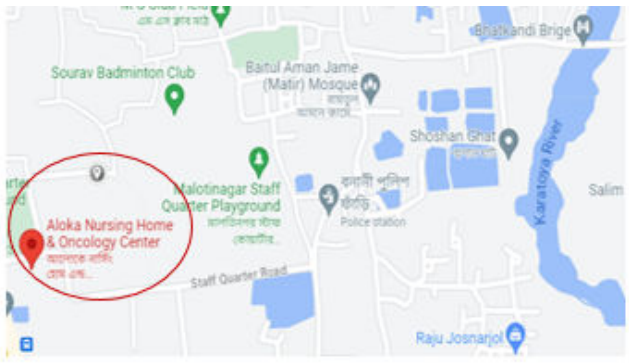

Figure 1. Aloka nursing home and oncology center (24.83 latitude and 89.37 longitude).

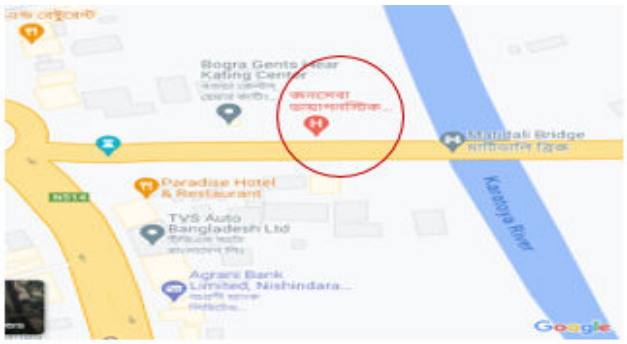

Figure 2. Jonaseba diagnostic center (24.888 latitude and 89.3616 longitude).

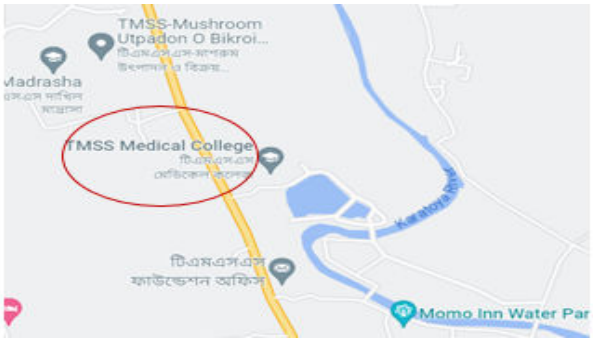

Figure 3. TMSS medical college and hospital (24.908 latitude and 89.35 longitude).

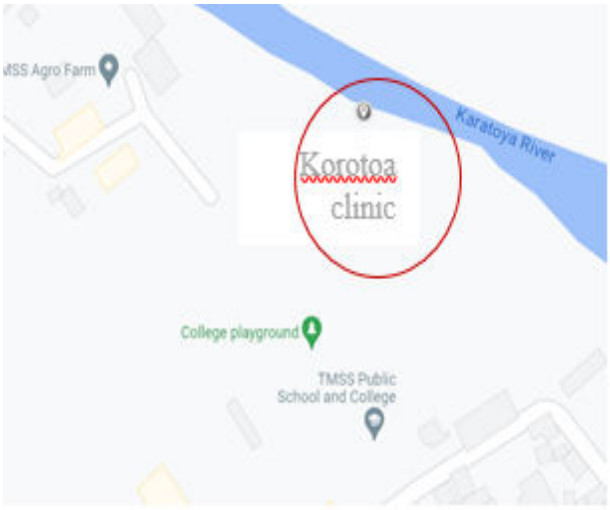

Figure 4. Korotoa clinic (24.879 latitude and 89.368 longitude).

Test result

Wastewater from various hospitals located near the Korotoa River is collected and tested for different parameters, as shown in Table 1. Additionally, water samples are taken from different points along the Korotoa River to understand the impact of medical wastewater on the river water. Notably, the Total Dissolved Solids (TDS) in medical wastewater significantly affect the river water, while the effect of other parameters remains moderate (Table 2) [8].

Water quality parameters	TMSS zone (TMSS Hospital Bogura)	Matidali zone (Jonaseba Hospital Bogura)	Jaypurpara zone (Korotoa Clinic Bogura)	Thanthania zone (Aloka Nursing Home Bogura)	Bd. Standard (ECR1997)
pH	7.51	7.2	6.9	6.2	6.5-8.5
Turbidity	13 NTU	12 NTU	11 NTU	17 NTU	10 NTU
BOD	370 (mg/L)	298 (mg/L)	267 (mg/L)	383 (mg/L)	150 (mg/L)
COD	87 (mg/L)	72 (mg/L)	72 (mg/L)	75 (mg/L)	4 (mg/L)
DO	1.2 (mg/L)	1.7 (mg/L)	1.6 (mg/L)	1.1 (mg/L)	6 (mg/L)
Alkalinity	137 (mg/L)	142 (mg/L)	143 (mg/L)	156 (mg/L)	130 (mg/L)

TS	1210 (mg/L)	1112 (mg/L)	1307 (mg/L)	1501 (mg/L)	1010 (mg/L)
TDS	1500 (mg/L)	14567 (mg/L)	1432 (mg/L)	1625 (mg/L)	1000 (mg/L)
TSS	98 (mg/L)	73 (mg/L)	71 (mg/L)	103 (mg/L)	10 (mg/L)
Chloride (Residue)	0.4 (mg/L)	0.3 (mg/L)	0.3 (mg/L)	0.3 (mg/L)	0.2 (mg/L)
Color	23 Hazen	21 Hazen	20 Hazen	25 Hazen	15 Hazen

Table 1. Water quality parameters for hospitals wastewater close to Korotoa Rivers.

At dry session										
Different location of Korotoa river	**BOD5 mg/l**		**DO mg/l**		**Alkalinity mg/l**		**pH**		**TDS mg/l**	
	Test data	**ECR, 1997 Standard**	**Test data**	**ECR, 1997 Standard**	**Test data**	**ECR, 1997 Standard**	**Test data**	**ECR, 1997 Standard**	**Test data**	**ECR, 1997 Standard**
TMSS (Eco Park)	1.195	<3 mg/l	6.905	5 mg/l	138.5	6.5 to 9	7.04	>20 mg/l	2045.5	Varies with fishes
Matidali	0.595		6.605		116		6.94		1884.5	
Jaypurpara	1.395		6.505		143.5		6.64		1813.5	
Dottobari	1.695		6.905		121		6.21		956	
Chelopara	1.095		4.205		63.5		7.05		1198	
Bejora Bridge	0.695		4.805		41		7.01		1037	
Banani	0.445		2.705		77.5		7.09		930	
At rainy session										
TMSS (Eco Park)	0.6		7.58		101		7.11		19980	
Matidali	0.88		7.18		98.5		7.02		18787	
Jaypurpara	1.08		6.68		101		6.84		16405	
Dottobari	1.78		6.88		93.5		6.67		14455.5	
Chelopara	1.21		6.68		33.5		7.01		9245.5	
Bejora Bridge	0.8		4.38		24		7.01		8788	
Banani	1.43		5.58		28		7.61		8239.5	

Table 2. Water quality parameters from different points of Korotoa river.

Results and Discussion

In this study, various water quality parameters were tested and compared against standard values, as presented in Table 1. The graphical representation of this comparison is shown in the same Table. Notably, the pH graph revealed that the lowest pH value was found at Aloka nursing home, while the highest pH value occurred at TMSS Hospital in Bogura. Additionally, Aloka Nursing Home had the highest turbidity value. However, the Total Dissolved Solids (TDS) value at Jonaseba Hospital was alarmingly high when compared to the ECR 1997 standard. Furthermore, the Total Suspended Solids (TSS) value across different hospitals was also notably elevated (Figures 5 and 6) [9].

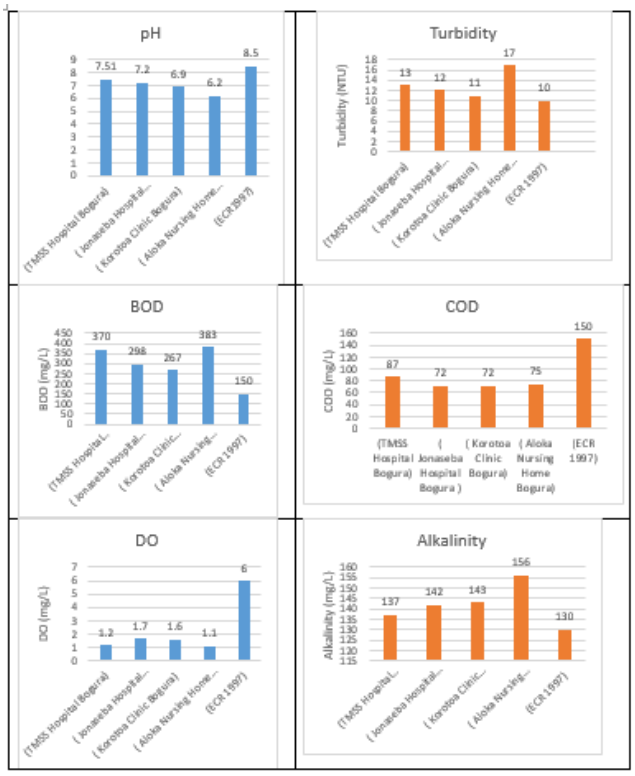

Figure 5. pH graph revealed that the lowest pH value.

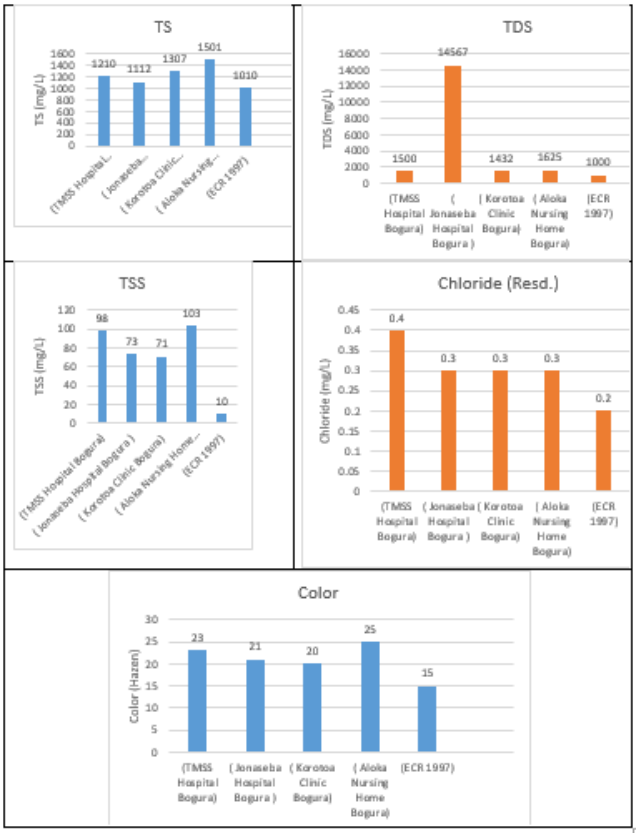

Figure 6. pH value.

Conclusion

The parameters of wastewater in the Korotoa River significantly exceed the standards set by the ECR 1997. This alarming situation affects stakeholders who rely on the river water daily. Additionally, it poses a major obstacle to healthy fish propagation. It is crucial for everyone to recognize the issue of untreated medical wastewater disposal, as random disposal can disrupt the ecological balance severely. The water color has turned dark black due to the impact of wastewater, which further exacerbates the problem.

A recent study investigated hospital wastewater disposal in different zones of the Korotoa river, including the TMSS zone, Matidali zone, Jaypurpara zone, and Thanthania zone. Here are some critical findings:

Variations in water quality: The study revealed significant variations in water quality parameters among the zones. These differences highlight the diverse characteristics of hospital wastewater discharge. Targeted approaches are necessary to address local challenges and mitigate environmental risks.

Exceedance of standards: Various water quality parameters, such as turbidity, BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), and TSS (Total Suspended Solids), exceeded permissible limits defined by regulatory standards and guidelines. Effective wastewater treatment and management practices in hospital settings are essential to protect the receiving water body.

Low dissolved oxygen: The river's water contains low levels of dissolved oxygen, posing a threat to aquatic life. Oxygen depletion could have detrimental effects on the river's ecosystem.

Color and alkalinity: Elevated color and alkalinity levels indicate the presence of color-inducing contaminants and an excess of carbonate, bicarbonate and hydroxide ions in the water.

High total solids and total dissolved solids: The elevated levels of total solids and total dissolved solids underscore the diverse composition of dissolved and suspended matter in the river, emphasizing the necessity for effective treatment.

Recommendations

Based on the findings of the study, several crucial recommendations are proposed to address the water quality challenges and promote sustainable environmental practices in the study areas: Water quality challenges and sustainable environmental practices in the study areas:

Enhancing hospital wastewater treatment: Hospitals within the study zones should prioritize the establishment and improvement of wastewater treatment facilities. Implementing effective treatment processes can significantly reduce the discharge of contaminants. This effort ensures that water quality parameters, including Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and turbidity, meet regulatory standards.

Continuous monitoring and compliance: Establishing a robust system for ongoing monitoring of water quality parameters is crucial, especially in areas with hospital wastewater discharges. Regulatory authorities must rigorously enforce compliance with water quality standards and guidelines. Ensuring that hospitals meet their environmental obligations contributes to maintaining water quality.

Promoting public awareness and training: Raising public awareness about responsible wastewater disposal and its impact on the environment is essential.

Research and Development (R and D): Investing in R and D is crucial for exploring innovative wastewater treatment technologies tailored to the specific needs of hospital settings. Collaborative efforts among academic institutions, healthcare facilities and environmental agencies can lead to more efficient and cost-effective solutions.

Community involvement: Engaging local communities in environmental stewardship is essential. Establishing community-based organizations and initiatives focused on river conservation and clean-up efforts can contribute to long-term sustainability.

Multi-stakeholder collaboration: Government bodies, hospitals, environmental organizations and local authorities should collaborate to formulate and implement policies, regulations and best practices for hospital wastewater management. Effective coordination among these stakeholders is critical to address the complexity of the issue.

Data sharing and transparency: Promoting transparency and data sharing among healthcare facilities and regulatory agencies is fundamental. Access to accurate and up-to-date data on wastewater discharge and its impact on the river is essential for informed decision-making.

Research extension: To gain a comprehensive understanding of the water quality dynamics in the Korotoa River, further research and long-term monitoring are recommended. These efforts should focus on assessing the ecological and health impacts of wastewater discharge and identifying potential emerging contaminants.

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