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Physio Chemical Analysis of Different Municipal Canal of Muzaffurpur

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Abstract* – *Analysis of the physicochemical parameters of the Municipal Canal Muzaffarpur was performed at various locations where canal water flows with pollution loads from highly commercial and industrial areas. Various physiochemical parameters were analysed during the investigation. The outcomes demonstrated that most of the physicochemical parameters of the Canal framework were inside or at the fringe contrasted with the ISI and WHO passable drinking water limit and may consequently be reasonable for homegrown purposes, yet because of serious atmosphere changes and expanded contamination, it requires noteworthy thought. The mean estimations of these parameters were contrasted and the standard qualities. For the different destinations, the turbidity was recorded over as far as possible. The estimations of the contemplated parameters at site 2 were higher contrasted with site 1 during the storm season and summer season.

Keywords: Physicochemical parameteres, water quality, municipal Canal, Muzaffarpur

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1. INTRODUCTION

Micro industries (like laundries, hotels, hospitals, etc.), macro industries (industrial wastewater) and household activities (domestic wastewater) are the sources of wastewater in the selected area. Wastewater is collected by one or more centralised wastewater treatment plants (STPs) through sewage systems (underground sewage pipes), where the sewage water is ideally treated. However, there are sometimes simply no treatment stations in cities and towns with old sewage systems or, if they exist, they may not be properly equipped for efficient treatment. Even if all facilities are linked to the sewage system, the capacity designed is often exceeded, leading to less efficient sewage systems and occasional leaks (1).

Water is an important life-giving source. In different ecosystems, it plays a significant role in ecological functions. In the world, life, prosperity and civilisation revolve around water. Civilization developed around bodies of water that could support farming, transport and drinking. Approximately 1400 x 10 15 M 3 of water is estimated to exist on Earth, of which 97 percent is in oceans as saline water , 2 percent in frozen ice caps. The availability of fresh water in lakes, streams, rivers and soil makes up far less than 1% of the earth's total water resources. Because of the high withdrawal rates they can usually maintain, surface water from rivers and lakes are important sources of public water supplies. It was observed that most of the ancient cites had developed on the banks of major rivers. This also amply signifies the role of water in the history of civilization's development. One major drawback of using surface water is that it is open to all kinds of contamination. Contaminants from diverse and intermittent sources, such as industrial and municipal waste, urban and agricultural runoff and soil erosion, contribute to rivers. Extensive treatment may be necessary for water with variable turbidity and a variety of substances which contribute to the taste, odour and colour of the water (2).

With this view, an attempt was made to analyse physicochemical canal parameters in different canal areas in Muzzaffarpur. The research gained importance in understanding and recognising water contamination and the reliable management of the quality of Krishna canal water.

2. MATERIAL AND METHODS

2.1 Study Area

Muzaffarpur is a city in the Tirhut region of the Indian state of Bihar, located in the Muzaffarpur district. It serves as the headquarters for the division of Tirhut, the district of Muzaffarpur, and the railway district of Muzaffarpur. It is the fourth most crowded town in Bihar. Muzaffarpur is arranged at 26 ° 07′N 85 ° 24′E. The city lies in the exceptionally dynamic seismic zone of India. During the grievous quake on 15 January 1934, a great part of the town endured extreme harm and numerous lives were lost. It has a normal rise of 47 meters (154 feet). This saucer-formed, low-fixated town lies on the incomparable Indo-Gangetic fields of Bihar, over the Himalayan residue and sand brought by the icy mass took care of and downpour took care of wandering waterways of the Himalayas.

2.2 Sample collection procedure

For monthly sampling, two sampling sites (Site-I (Akharaghat, Muzaffarpur), Site-II (Tirhut, Muzaffarpur) were selected. Tests were accumulated for a time of one year (March to February). Water tests were assembled from the examination territory. The examples were gathered at different locales from all the waterways. Water tests were gathered from the waterway surface at a profundity of 0.5 m utilizing a perfect plastic pail, moved to clean plastic containers and shipped to the lab on ice and put away in a profound cooler (- 20 C) until analysis. Triplicate samples from each site were collected and the average value for each parameter was reported.

2.3 Analytical methods

On site, physicochemical parameters such as temperature, pH, transparency, oxygen dissolving (DO), free CO2 and velocity, were fixed / recorded. Other parameters such as biochemical demand for oxygen (BOD), chemical demand for oxygen (COD), nitrate, nitrite, phosphorus, turbidity, TS, and TH were analysed in the laboratory following preservation of samples as per (3) and guidelines from the American Public Health Association (APHA 2005). The statistical analysis was conducted using Minitab 16 to determine the correlation between the water qualities parameters selected.

3. RESULTS

Site-I (Akharaghat, Muzaffarpur) and Site-II (Tirhut, Muzaffarpur) physicochemical characteristics analysis is appended to Table 1 and Figs. 2, 3. 3.

In the present study, in the form of a correlation matrix, the correlation coefficient (r) between each parameter for site 1 and site 2 is shown in Tables 2 and 3. For parameters such as pH, turbidity, TH, DO, free CO2 and TS for Municipal Canal Water, the correlation coefficient (r) between any two parameters x and y is calculated. Positive correlations with TS and free CO2 have been found for the turbidity in municipal canal water, whereas TS is positively correlated with free CO2 at both sites. PH showed positive correlations at site 1 with DO / TH and at site 2 with DO only. On both sites, DO show a positive correlation with TH. Turbidity/TS (r = 0.989/1.000) and TS/FCO2 at the two destinations (r = 0.995/0.996) have a solid positive relationship. Additionally huge was the positive connection (r = 0.848) among DO and TH at site 1 and (r = 0.847) among pH and DO at site 2 (p\0.05). At both sites, a strong negative correlation (r = -0.970/0.952) and (r = -0.816/0.872) between turbidity and DO / TH was observed. Moreover, a solid negative connection was found at the two areas among BOD/COD and DO (r = - 0.174/ - 0.794) and (r = - 0.815/ - 0.802). The negative and positive correlation between the parameters reveals seasonal changes in the Municipal Canal water quality.

4. DISCUSSION

In the current study, as compared to site 1, the maximum temperature (18.63 ± 0.63 C) of the Municipal Canal was recorded at site 2 in the summer season (Fig . 2). Increasing rates of pollution and wastewater discharged at site 2 could be due to maximum temperature values. As revealed by Yadav and Srivastava (2011), the Ganga River water temperature in Gazipur went from at least 17 ± 0.55 C at Site 1 in January 2006 to a limit of 33.90 ± 0.58 C in June 2006. The occasional qualities were the best in the late spring season, trailed by the stormy and winter seasons (5).

The diminishing in straightforwardness is the turbidity of any water test because of the presence of particulate issue, for example, dirt or split, finely isolated natural issue, tiny fish and other minute living beings. Water turbidity is a significant boundary that influences the water's light entrance and accordingly influences oceanic life (6, 7). The turbidity proportion of water lucidity shows how much suspended solids entering a water segment scatter light. Suspended solids incorporate things, for example, mud, green growth, waste and fecal material (8). In the ebb and flow study, most extreme turbidity at site 2 (287.72 ± 56.28 JTU) was recorded in the storm season, while least turbidity was seen in the colder time of year season (Table 1).

Straightforwardness is one proportion of how clear the water is. It is fundamental, since amphibian plants need daylight for photosynthesis. The more clear the water, the more profound the daylight can enter. The light penetration of water is directly influenced by transparency and depends on suspended matter and dissolved coloured substances (6). The lowest transparency value (0.12 ± 0.08 m) at site 2 in the monsoon season was recorded in the present study. The higher pollution load is responsible for the lower transparency at site 2. During the winter and summer months, higher values were shown, whereas lower values were found in the monsoon season (Fig. 3).

It was found that velocity was directly proportional to the flood level and also to the gradient of the stretch of the river. The water level and its speed started to increment from the colder time of year season onwards because of the liquefying of snow at the waterway's place of inception. Flow can influence the ability of the river to assimilate pollutants; pollutants with a reduced negative effect can be received by larger, quickly moving streams and rivers. Smaller, low-flow rivers are less capable of diluting and degrading potentially harmful contaminants (9). The maximum mean water velocity in the Municipal Canal at site 2 during the current study was recorded to be (1.71 ± 0.19 ms-1) in the monsoon season. Maximum water velocity in the Municipal Canal was observed at both sites in the monsoon season, but lower water velocity was observed at site 2 (Fig. 3). This might be a result of climatic conditions wherein the water level and speed begin to increment from the colder time of year season onwards because of the liquefying of snow at the spot of starting point of the waterway. A most extreme speed of 2.18 ms-1 during the Ganga rainstorm season at Haridwar and a base speed of 0.39 ms-1 throughout the colder time of year season were additionally announced by Joshi et al. (2009a, b) (10, 11).

In a particular example, an absolute solid (TS) implies the complete amount of all out suspended solids (TSS) and all out broke up solids (TDS). The TS is included carbonates, bicarbonates, chlorides, phosphates, calcium, sodium, magnesium, potassium, manganese, natural issue, salts and different particles. Sediment and natural issue (12) are inferable from TS presence. In the current investigation, the most extreme TS (1167.60 ± 303.90 mg l-1) were recorded at site 2 in the rainstorm season (Table 1). In the rainstorm season at site 2, because of the release of all city sewage at this site, higher TS esteems reflect more contamination. In 2014, in examination with the mid-year and winter seasons, Shirin and Yadav watched greatest TS (336.86 ± 149.53 mg l-1) in the water nature of Haridwar municipal canal water in the storm season (13).

The pH of the amphibian framework is a significant pointer of water quality and the degree of contamination in watershed regions (14). There were very few vacillations recorded in pH esteems in the current investigation (Table 1). In any case, at site 2, the general most elevated levels of pH (8.1 ± 0.19) were watched. More prominent pH was recorded in the late spring seasons than in the colder time of year and stormy seasons. The higher pH worth might be because of sewage flood, gushing removal, and low water levels in the late spring season. Pandey et al., in 2014. During the examination time frame at Allahabad River Ganga, the pH detailed went from 8.3 to 8.48 in the mid year, 8.22-8.42 in the storm, and 8.12-8.22 in the colder time of year. Expanded pH has all the earmarks of being connected to the expanding use in modern territories of waste water (15).

Inorganic lessening operators, for example, H2S, smelling salts , nitrite, ferrous iron and certain oxidizable substances (16) likewise will in general be diminished by broke up oxygen in the water. Broken down oxygen information is significant in deciding the water quality standards of a sea-going framework. By and large, the DO esteems remain lower than those of frameworks where the photosynthesis rate is high in the framework where the pace of breath and natural decay is high. In the determination of DO in an aquatic body, temperature also plays a significant role (10).

For the life of plants and microorganisms, carbon dioxide is vital. It is generated by the breathing of aquatic organisms. Maximum free CO2 was recorded at site 2 in the present study (1.88 ± 0.22 mg l-1). During the winter season, lower values of free CO2 were observed and higher values were recorded at site 2 during the summer and monsoon seasons (Table 1). During these months, the increase in the level of carbon dioxide may be due to the decay and decomposition of organic matter due to the addition of a large amount of sewage, which was the main causative factor for the increase in the amount of carbon dioxide in the bodies of water. Free CO2 reported by Singh (2014) varied from 39.3 to 61.7 mg l-1 at various sites in the summer, monsoon and winter seasons. (17).

Water hardness is not a parameter of the pollution indicator, but indicates water quality primarily in terms of Ca2? Mg2 and?, bicarbonate, chloride, sulphates, and nitrates. Water is considered to be soft with less than 75 mg-1 of CaCO3, and above 75 mg-1 of CaCO3 to be hard (Kumar et al. 2010; Singh and Choudhary 2013). Maximum TH (79.31 ± 4.08 mg l-1) was recorded at site 2 in the monsoon season as compared to site 1 in the present study (Table 1). This was in line with the findings of Singh and Chaudhary (2013), who reported that TH 's seasonal behaviours were more or less similar at all locations. It was most minimal in the mid year season at site 1 (90 ppm) and most elevated in winter at site 1 (200 ppm) and in the Ganga River water rainstorm at Bhagalpur (Bihar), India. This was the aftereffect of helpless weakening because of the low precipitation rate (18).

The main cause of poor water quality and aquatic habitat loss in the Municipal Basin is high levels of both nitrogen and phosphate. In terms of nutrient pollution, wastewater discharges, including domestic waste and sewage, waste from commercial and industrial plants and urban runoff, combined with agricultural runoff and aquaculture waste that may also contain fertilisers, are major threats (19).

A phosphorus content going from 0.039 ± 0.019 to 0.141 ± 0.050 mg-1 with a greatest at site 2 was likewise recorded during the investigation. The river is used for the purposes of washing, and the detergents increase the load of this component. A higher amount of phosphate represents a high level of pollution and causes the aquatic body to eutrophy (20).

Table 1: Physicochemical parameters of Municipal Canal water at Site – I (Akharaghat, Muzaffarpur) and Site – II (Tirhut, Muzaffarpur)

Seasons	Turbidity (JTU)	TS (mg l^{-1})	pH	DO (mg l^{-1})	F·CO_2 (mg l^{-1})	TH (mg l^{-1})
Physicochemical parameters of Bhimgoda Barrage (site 1—control Site)						
Winter	22.68 ± 21.48	52.72 ± 12.31	7.6 ± 0.17	10.54 ± 0.61	1.04 ± 0.036	60.89 ± 3.58
Summer	42.39 ± 32.49	193.52 ± 77.19	7.9 ± 0.17	9.82 ± 0.72	1.12 ± 0.08	64.78 ± 5.43
Monsoon	194.36 ± 62.69	597.31 ± 282.53	7.6 ± 0.16	8.48 ± 0.51	1.34 ± 0.160	46.82 ± 3.25
Physicochemical parameters of Bahadrabad (site 2)						
Winter	41.39 ± 60.49	134.56 ± 63.00	8.0 ± 0.192	10.35 ± 1.09	1.19 ± 0.39	70.61 ± 5.38
Summer	52.66 ± 42.59	200.04 ± 44.62	6.9 ± 0.153	8.87 ± 0.92	1.23 ± 0.10	79.31 ± 4.08
Monsoon	287.72 ± 56.28	1167.60 ± 303.90	7.1 ± 0.13	7.95 ± 0.44	1.88 ± 0.22	60.14 ± 1.13
IS	10	–	6.0–9.0	3	–	300
WHO	05	–	6.5–9.2	6	0.5–2.0	500
ICMR	05	–	7–8.5	4	–	600

Seasons	Nitrate (mg l^{-1})	Nitrite (mg l^{-1})	BOD (mg l^{-1})	COD (mg l^{-1})	PO_4 (mg l^{-1})
Physicochemical parameters of Bhimgoda Barrage (site 1—control Site)					
Winter	0.029 ± 0.00	0.009 ± 0.00	2.198 ± 0.24	4.604 ± 0.961	0.051 ± 0.006
Summer	0.039 ± 0.008	0.013 ± 0.001	2.156 ± 1.116	6.244 ± 2.981	0.06 ± 0.004
Monsoon	0.038 ± 0.003	0.009 ± 0.000	2.676 ± 1.082	6.351 ± 2.406	0.048 ± 0.003
Physicochemical parameters of Bahadrabad (site 2)					
Winter	0.025 ± 0.005	0.011 ± 0.001	2.298 ± 0.24	4.604 ± 0.963	0.14 ± 0.016
Summer	0.048 ± 0.010	0.019 ± 0.001	2.19 ± 1.118	5.781 ± 2.759	0.087 ± 0.015
Monsoon	0.047 ± 0.005	0.012 ± 0.001	2.866 ± 1.098	6.8 ± 2.61	0.069 ± 0.007
IS	45	3	–	–	–
WHO	45	45	06	10	0.1
ICMR	50	–	–	–	–

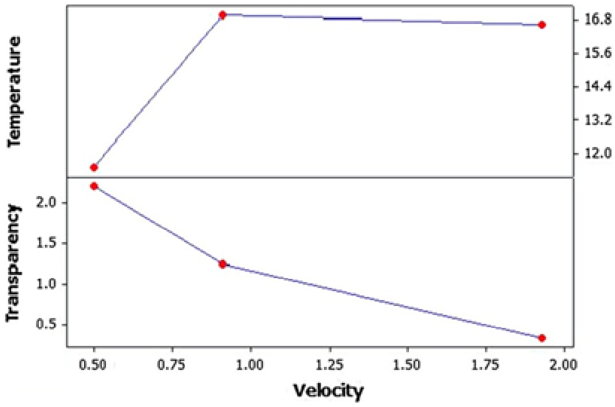

Fig. 2 Matrix plot of temperature, transparency versus velocity in Canal at site 1 (control Site)

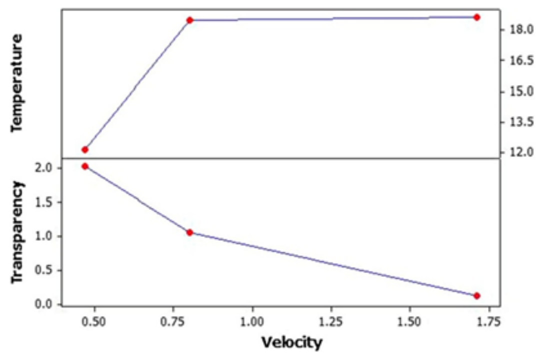

Fig. 3 Matrix plot of temperature, transparency versus velocity in Canal at site 2

Table 2 Correlation coefficients (*r*) of physicochemical parameters of Site – I (Akharaghat, Muzaffarpur)

Parameters	Turbidity	TS	pH	DO	F·CO_2	TH	Nitrate	Nitrate	BOD	COD	Phosphate
Turbidity	1.000										
TS	0.989	1.000									
pH	−0.406	−0.269	1.000								
DO	−0.970	−0.995	0.171	1.000							
F·CO_2	0.988	0.995	−0.260	−0.996	1.000						
TH	−0.952	−0.896	0.668	0.848	−0.893	1.000					
Nitrate	0.512	0.632	0.577	−0.706	0.639	−0.223	1.000				
Nitrite	−0.406	−0.269	1.000	0.171	−0.260	0.668	0.577	1.000			
BOD	0.931	0.868	−0.711	−0.815	0.864	−0.998	0.165	−0.711	1.000		
COD	0.631	0.738	0.452	−0.802	0.744	−0.362	0.989	0.452	0.306	1.000	
Phosphate	−0.614	−0.492	0.971	0.403	−0.484	0.827	0.363	0.971	−0.859	0.224	1.000

Table 3 Correlation coefficients (r) of physicochemical parameters of Site – II (Tirhut, Muzaffarpur)

Parameters	Turbidity	TS	pH	DO	F·CO_2	TH	Nitrate	Nitrate	BOD	COD	Phosphate
Turbidity	1.000										
TS	1.000	1.000									
pH	−0.383	−0.397	1.000								
DO	−0.816	−0.825	0.847	1.000							
F·CO_2	0.997	0.996	−0.393	−0.822	1.000						
TH	0.872	−0.864	−0.118	0.429	−0.867	1.000					
Nitrate	0.502	0.516	−0.991	−0.910	0.511	−0.015	1.000				
Nitrite	−0.360	−0.345	−0.724	−0.246	−0.349	0.770	0.626	1.000			
BOD	0.976	0.973	−0.174	−0.671	0.974	−0.957	0.303	−0.553	1.000		
COD	0.866	0.873	−0.794	−0.996	0.871	−0.510	0.868	0.156	0.737	1.000	
Phosphate	−0.725	−0.736	0.914	0.990	−0.732	0.295	−0.960	−0.382	−0.559	−0.972	1.000

5. CONCLUSION

The surfaces as well as ground water quality are influenced by both natural processes and man-made activities. The pollution status and physical-chemical parameters of canal water samples are influenced directly and indirectly by a large number of factors and conditions. For the winter, summer and monsoon seasons, all physicochemical parameters of Akharaghat's Municipal Canal water are within the maximum permissible limit prescribed by WHO, ICMR and IS, with the exception of turbidity, which was found to be above the permissible limit. We conclude from the results of the present study that Akharaghat's water, although suitable for drinking purposes, is still in need of treatment to minimise contamination, particularly turbidity and TS. The correlation between different physicochemical parameters and their level of significance will help in selecting the correct water treatment methods to reduce pollution levels in order to minimise water contamination in the Akharaghat Canal.

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