Bio-Science Research Bulletin
Volume 40, Number 1
January-June 2024: P.1-5
Original Research Article

Print version ISSN 0970 0889
Online version ISSN 2320 3161
DOI: https://doi.org/10.52710/bsrb-ls.3
http://www.bpasjournals.com

Physiochemical Analysis of Sewage Fed Water in Gandak River in Vaishali District near Hajipur

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Received on 15.01.2024,
Revised on 11.02.2024,
Accepted on 01.03.2024

ABSTRACT

The Gandak River, also known as the Narayani and the Gandak is one ofthe Major River in Nepal and left bank tributary of Ganga in India. Hajipur city, west central Bihar state, northeastern India. It lies on the Gandak River just north of its confluence with the Ganges (Ganga River). The city is in the North Bihar Plains, which are part of the Middle Ganges Plain. The Gandak River has a total drainage basin area of 29750 sq kms. The River flows through the Indian states of Bihar and U.P, and joins theGanges near Patna just downstream of Hajipur. During the investigation,the researcher tried to find out the Physio-chemical Analysis of water across two year. Four sampling sites were selected located at the bank of Gandak River at Hajipur, Vaishali, Bihar. In this study, various analytical techniques were used to study the water quality parameters like BOD, COD, DO, PH, TDS, Hardness, Chloride, Calcium and Magnesium. The findings of the present investigation reflect that most of the water quality parameters are within the acceptable limits in accordance with WHO standards.

KEYWORDS: *Gandak River, BOD, DO, TDS, Narayani.*

How to cite this article: Jyoti G. and Kumar V. (2023). Physiochemical Analysis of Sewage Fed Water in GandakRiver in Vaishali District near Hajipur. *Bio-Science Research Bulletin,* 40(1), 1-5.

INRTODUCTION

North Bihar is very rich in water resources. Water resources is most essential basic resource for human being. The quality of water is crucial concern for mankind since it is directly linked with human welfare. India is the country of rivers and some of the rivers are considerd as sacred and are associated with religious important. However, the rapid increase in population, urbanization and increased anthyopogenic invansions result in the deterioration of the water quality. Bihar is astate in east India boarding Nepal. It is divided by the River Ganges which floods its fertile plains. (Adbarzi, S.S.M., et al., 2020)

Hajipur is the Headquater and largest city of Vaishali district of the state of Bihar in India. Hajipur is the 16th most populous city of Bihar, besides being the 2nd fastest developing city next to Patna. It had a total population of 1.47 lakh as peer census 2011. Vaishali district in Bihar in terms of growth. The area of Hajipur city is spread across 19.64 sq km (7.58 sq mi). The city is divided into 39 wards. Hajipur lies on the north bank of the Ganga while Patna lies on the south, the Gandhi setu connects both cities. Another bridge,the Digha-Sonpur Bridge, which crosses the Ganga north-west of Patna, narrow the distance between Hajipur and Patna. (Singh, et al., 2018)

Figure 1. Sample site of Gandak River, Hajipur, Vaishali, Bihar.

LOCATION OF SAMPLING POINTS

- Four sampling points were selected in Hajipur to monitor thePhysiochemical analysis of the water of the Gandak River.
- These are Club Ghat, Sidhi Ghat, Kaushalya Ghat and Konhara Ghat.
- They are refered as SH1, SH2, SH3 &SH4 respectively. Each sampling site was located nearly 2-3km from its nearest site.


Club Ghat (SH1)


Sidhi Ghat (SH2)


Kaushalya Ghat (SH3)


Konhara Ghat (SH4)

Figure 2. Selected Sampling Site, Hajipur, Bihar

EXPERIMENTAL

Water samples were collected from a selected site in Summer, Winter and Rainy seasons in year 2022-23.

BOD is determined by a standard method. COD, Hardness, Chloride, Calcium and Magnesium were analyzed by standard methods prescribed by APHA 1995. PH, TDS and DO were determined by the VSI-06 water analyzer kit (APHA, 1995; APHA, 1998).

RESULTS AND DISCUSSION

Dissolved Oxygen (DO) is an important parameter that indicates the physical, chemical, and biological activities of the water body. Experimental results clearly show that the Dissolved oxygen (DO) was found to be low during the summer season. Its value was found to be high during the winter season at all the selected four sites as shown in Table 1. It is due to high photosynthetic activity during these periods.

BOD (Biological Oxygen Demand) is one of the important parameters which reflect the status of aquatic pollution. It measures the amount of oxygen used by microorganisms during the aerobic decomposition of organic matter. It was found to be maximum during summer and minimum during the winter season. The obtained data suggest that all the selected sites of the river were moderately polluted. The water having BOD less than 1.0 mg/l is unpolluted; the range between 2.0 - 9.0 mg/l is moderately polluted and above 9.0 mg/l is highly polluted (Table 1). (Kumar, M., 2015; Kumar, S. and Sinha, U., 2005)

Table 1: Physico-Chemical Characteristics of Water Samples

Parameters	Sites	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	WHO(MPL*)
DO	SH1	6.8	6.2	6.7	6.4	6.2	6.2	6.1	6.8	7.1	8.2	7.6	8.2	
	SH2	7	6.1	6.5	7.2	6.1	6.5	7.2	7.4	7.6	8	7.4	7.6	4.0-6.0
	SH3	6.9	7.1	6.9	6.7	6.1	6.3	6.2	7.2	7.3	6.4	8.2	8.1	
	SH4	6.9	7.4	6.4	6.5	6.2	5.7	5.7	6.3	6.7	7.1	7.6	7.3	
BOD	SH1	3.4	2.7	2.4	2.1	2.4	3.4	2.6	2.5	1.9	2.1	2.2	2.3	
	SH2	2.2	2.6	2.1	2	3.1	2.2	1.6	2.3	2.5	3	3.2	3.1	10
	SH3	2.4	3.1	2.5	2.3	2.2	1.3	2.5	3.1	2.1	2.3	1.9	2.6	
	SH4	3.2	3.2	2.8	1.9	2.4	2.6	2.9	2.2	2.5	2.2	2.5	2.7	
COD	SH1	6.6	8.2	9.4	9.6	7	9.3	8.7	8.1	8.1	6.7	9.1	9.6	
	SH2	8.3	8.2	9.5	8.7	8.9	9.1	7.6	8	9.2	9.4	9.5	9.1	10
	SH3	8.2	9.2	9.2	9.5	8.1	8	9.3	8.4	9	8.6	9.6	9	
	SH4	6.5	6.8	8.6	7.6	8.1	7.4	8.6	9.6	7.6	7.5	8.2	8.1	
TDS	SH1	290	230	251	299	209	290	273	281	315	336	340	318	
	SH2	298	222	240	281	193	172	211	245	295	310	314	320	500
	SH3	310	323	296	281	220	274	300	289	333	346	339	380	
	SH4	262	280	316	342	322	292	281	310	361	341	349	345	

pH	SH1	7.5	7.2	7.3	7.2	7.3	7.6	7.3	7.2	7.3	7	7.2	7.4	
	SH2	7.6	7.1	7.7	7.4	7.2	7.9	7.6	7.5	7.4	7.5	8	7.4	6.5-9.2
	SH3	7.3	7.4	7.9	7.3	7.7	8	7.1	7.3	7.6	7.4	8.1	7.7	
	SH4	7.5	7.3	7.8	7.7	7.5	7.9	8	7.2	7.1	7.6	7.5	8	
Hardness	SH1	172	142	130	181	178	164	169	191	133	198	182	175	
	SH2	121	131	113	117	165	136	151	143	155	163	150	167	500
	SH3	141	142	166	118	148	160	180	163	185	176	163	152	
	SH4	180	141	181	216	198	216	169	167	161	181	191	183	
***Cl**	SH1	25.3	27.4	31.1	34.8	22.1	27.3	25.4	49.6	28.2	23.3	35.1	27.3	
	SH2	40.4	45.1	32	49.3	56.1	41.4	47.2	38.6	42.4	51	57.9	57.4	500
	SH3	35	48.3	56.2	57.7	42.9	43.1	49.2	38.4	40	45.4	35.3	37.3	
	SH4	36.1	40.1	48.3	29.6	32.3	43.2	41.1	15.3	36.4	37.5	38.1	40.1	
***Ca**	SH1	37	24.4	20.6	38.1	24.1	49	29.2	28.4	24.1	20.2	35.1	49.1	
	SH2	28.1	32.4	18.2	14.6	19.7	24.8	26.8	21.4	22.3	25.1	35.6	46.2	100
	SH3	20.6	25.6	23.5	31.5	18.5	35.3	35.1	28.6	20.3	25.3	30.4	49.4	
	SH4	22.1	18.5	26.4	27.4	28.6	16.9	23.3	31.8	35.2	28.4	22.1	29.5	
***Mg**	SH1	22.6	19.2	16.2	14.3	12.1	18.4	15.2	17.5	11.1	22.3	21.4	19.5	
	SH2	19.3	21.6	14.1	14.2	16.2	17.6	18.4	12.6	13.5	22	14.5	16.6	150
	SH3	16.9	17.1	18.5	16.2	13.5	17.6	20.5	10.1	11.5	13.5	12.6	10.2	
	SH4	17.3	19.2	20.5	21.4	18.5	19.3	13.2	14.2	18.6	16.2	13.4	17.5	

***Cl-**Chloride, ***Ca-**Calcium, ***Mg-**Magnesium *Maxium permissible limit.

COD (Chemical Oxygen Demand) is defined as the total measurement of all chemicals (organic & inorganic) in the water. It is a measure of the total quantity of oxygen required to oxidize all organic matters. The obtained values were found to be within the permissible value set by WHO of 10mg/l. COD value is maximumduring the summer and minimum during the winter season.

TDS (Total dissolved solids) and Hardness values of the river water were also found within the permissible standard limit, set by WHO. It includes organic salts & small amounts of organic matter. It influences the taste, hardness, and corrosive properties of water. Its high value adversely affects the quality of water. The pH (potential of hydrogen) values were also found within the desirable limits. The data of the present investigation reflects a high value during winter when the water is slightly alkaline. (Ahmed R., 2017)

The magnesium, calcium, and chloride values have a similar range at all the sites and were found to be quite low which is within the permissible limits.

CONCLUSIONS

The findings of experimental observation clearly indicate that all the parameters are under the maximum permissible limit standardized by BIS and WHO. (ISI, 1993; WHO, 1971; BIS, 1982) Conclusively the water quality of Gandak River near Hajipur Subdivision is permissible and suitable for drinking, bathing, and even survival of aquatic life. (Mumtazuddin, S., 2009).

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