Vol. 5 Issue No. 2, April - June 2023 e-ISSN 2456-7701
Journal of Science and Technological Researches
A Peer Reviewed Journal
Origin of Innovation
Domain: www.jstr.org.in, Email: editor@jstr.org.in

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Date of Received	**17 May 2023**
Date of Revised	**11 June 2023**
Date of Acceptance	**23 June 2023**
Date of Publication	**30 June 2023**

DOI Link : https://doi.org/10.51514/JSTR.5.2.2023.1-8

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ABSTRACT

A river is a natural flowing watercourse (stream), that is like a vain of the earth. Usually rivers contain freshwater and also flowing on the surface of Earth. Rivers are an important part of the water cycle. Damodar river is a rain fed river and it is shallow, wide and flashy. Its originated from near the Khamarpat hill on Chotanagpur Plateau in the Palamau district of Jharkhand and mouth is Hooghly River, Howrah district, West Bengal. Damodar river flows through the industrial towns of Chandrapura, Ramgarh, Bokaro, Jharia, Sindri, Dhanbad, Asansol, Andal, Durgapur, Burdwan and Howrah. As like water bodies, rivers also serve crucial ecological functions by providing and feeding freshwater habitats for aquatic and semiaquatic flora and fauna. With also help to grow up the terrestrial ecosystems. Rivers are significant to mankind like civilizations, for the purpose of drinking water, irrigation and food supply. Beside the water of the river it's self a natural resources and also contain huge amount of natural resources. Though the river containing huge amount of aquatic plants and animals but the aquatic biodiversity of the river controlled by Physico-chemical parameters of river water like Temperature, pH, conductance, salinity, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), total dissolved solids (TDS) and hardness. The present study shows the seasonal variation of Physico-chemical parameters of Damodar river water during the period of February 2022 to January 2023 and analysed how the Physico-chemical parameters are influence on the lotic ecosystem of Damodar river.

Keywords: *Damodar river, Civilization, Physico-chemical parameters, Seasonal variation etc*

INTRODUCTION

Physico-chemical parameters of river water play vital role in river ecosystem and that are reported in various literatures [1-5]. Damodar river is one of the important river of India that flowing across the Indian states of Jharkhand and West Bengal. Its originated from near the Khamarpat hill on Chotanagpur Plateau in the Palamau district of Jharkhand and mouth is Hooghly River, Howrah district, West Bengal. Damodar river flows through the industrial towns of Chandrapura, Ramgarh, Bokaro, Jharia, Sindri, Dhanbad, Asansol, Andal, Durgapur, Burdwan and Howrah before joining the lower Ganga at Shayampur, 55 km downstream of Howrah (Sen, P.K. 1991; Chandra, S. 2003; Bhattacharyya, K. 2011). Damodar river was earlier known as the "river of sorrow". Because it used to flood many areas of Bardhaman, Hooghly, Howrah and Medinipur districts. The length of the river is 592 km (368 mi) (Damodar Basin Station: Rhondia, UNH/GRDC). In the monsoon season due to heavy rain the river is flooded the adjoining area and in summer the sand beds are almost always dry (River Damodar is called Sorrow of Bengal….2013, Sabharwal, L. R. *et al.* 2002). Damodar river had a number of tributaries and subtributaries, such as Barakar, Konar, Bokaro, Haharo, Jamunia, Ghari, Guaia, Khadia and Bhera. The Damodar and the Barakar trifurcates the Chota Nagpur plateau. When the rivers pass through hilly areas with great force, sweeping away whatever lies in their path. The Damodar Valley is one of the important and divers river valley in India and also one of the most industrialized parts of India. That is spread across Hazaribug, Ramgarh, Koderma, Giridih, Dhanbad and Chatra districts in Jharkhand and Bardhaman and Hooghiy districts in West Bengal and partially covers Palamu, Ranchi, Lohardaga and Dumka districts in Jharkhand and Howrah, Bankura and Purulia districts in West Bengal (Dams & Barrages, 2008). The total catchment area of Damodar river basin is 25,820 km^2 (DVC 1992). The drainage

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e-ISSN 2456-7701
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area of Damodar basin extends from 22º 45'N to 24º 30'N and 84º 45'E to 88º 00'E. The total covering geographical area of Jharkhand and West Bengal state is about 11.8% and 8.6%. However, according to central Pollution Control Board (CPCB) – the total catchment area of the Damodar basin is 23,170 km^2. The origin and development of human civilization are closely related to river (ancient periods to present days). Damodar river is one of the most important river flow in our country. The water of Damodar river is a good habitat of different kinds of aquatic animals and plants, among them phytoplankton are the important microscopic organism and a constitute part of the aquatic floral diversity. Phytoplankton are the autotrophic components of plankton community and play the important role in the aquatic food chain [6-7]. They serve as indicator of water quality and also a key part of ocean and fresh water ecosystem (Sharma, A. 2010). As well as the zooplanktons are the important part of aquatic food chain and it also directly and indirectly related to food web. Different kinds of algae belong to different family are available in the water of Damodar river. The diversity of entire phytoplankton and zooplankton are totally related to the amount and the variation of physico-chemical parameters like Temperature, pH, conductance, salinity, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), total dissolved solids (TDS) and hardness of the water of Damodar river.

MATERIAL AND METHOD

Water sample of Damodar river were collected from five different sampling sites using sterile Plastic bottles (of 500ml and 1000ml capacity) which are namely Chanchai Ghat (East Burdwan), Fakirpur Ghat (East Burdwan), Sadarghat Park (East Burdwan), Chaitrapur jotoram (East Burdwan), Khejurna Ghat (Chaitrapur, East Burdwan). All the sampling sites are located within East Burdwan district, West Bengal, India. The water samples were collected monthly intervals, at least thrice in a month in the above mentioned locations from February 2022 to January 2023 randomly from different depths of sampling sites of River Damodar by the help of expert swimmers.

All the water samples then be analysed through Titrimetric, Spectrophotometric methods etc. Onsite measurements of some physicochemical parameter like Temperature, pH, Conductance (µS/cm), TDS (mg/lt), Salinity (mg/lt) were measured by using Multi-parameter PCS Tester 35 (EUTECH made) and Dissolve Oxygen (mg/lt) was measure by using Dissolved Oxygen Meter, Lutron DO-5509. Those physico-chemical parameters were measured in Environmental Chemistry Research Laboratory of Barrackpore Rastraguru Surendranath College.

The exact location (latitude and longitude) of sampling sites are given below:

SITE	LATITUDE	LONGITUDE
Chanchai Ghat	23.1615°	88.0167°
Fakirpur Ghat	23.2290°	87.8316°
Sadarghat Park	23.211597°	87.849481°
Chaitrapur jotoram	23.191432°	87.922021°
Khejurna Ghat (Chaitrapur, East Burdwan).	23.191723°	87.922122°

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RESULTS

Table 1: Monthly variation of physico-chemical parameters of Damodar river water

Month	Temp (ºC)	pH	TDS (mg/liter)	Conductance (µS/cm)	Salinity (mg/liter)	DO (mg/liter)	Turbidity (NTU)	BOD (mg/liter)	Hardness (ppm)
February 2022	24.67	8.1	287.33	417	194.33	8.23	8.4	2	100.9
March 2022	30.22	8	252.49	370.16	176	7.26	10.2	2.01	107.2
April 2022	33.77	8.24	229.66	327.33	158.33	6.3	107.7	2.06	117.9
May 2022	34.82	8.5	220.1	352.2	170	7.9	19.2	1.8	109.1
June 2022	35.76	8.4	225	340	159	7.2	8	2	100
July 2022	31.1	8.7	266	387	182	8.1	10.6	1.9	114.6
August 2022	31.8	8.3	242.5	367	160	8.5	12	1.1	117
September 2022	32.5	8.21	195	275.5	134	7.25	9.85	1.8	99.81
October 2022	30.45	7.6	212	252	142	7.3	13.6	2.3	105.2
November 2022	28.4	7.78	253	357	172	7.8	16.1	2.1	128.44
December 2022	22.3	8	272	343	166	6.5	7.2	1.7	124
January 2023	20.2	7.9	265	321	162	6.7	5.1	1.5	115

Monthly variation of physico-chemical parameters [Temperature, pH, conductance, salinity, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD), total dissolved solids (TDS) and hardness] of Damodar river which are measured from the water, that were collected from five different spots Chanchai Ghat, Fakirpur Ghat, Sadarghat Park, Chaitrapur jotoram, Khejurna Ghat of Burdwan district.

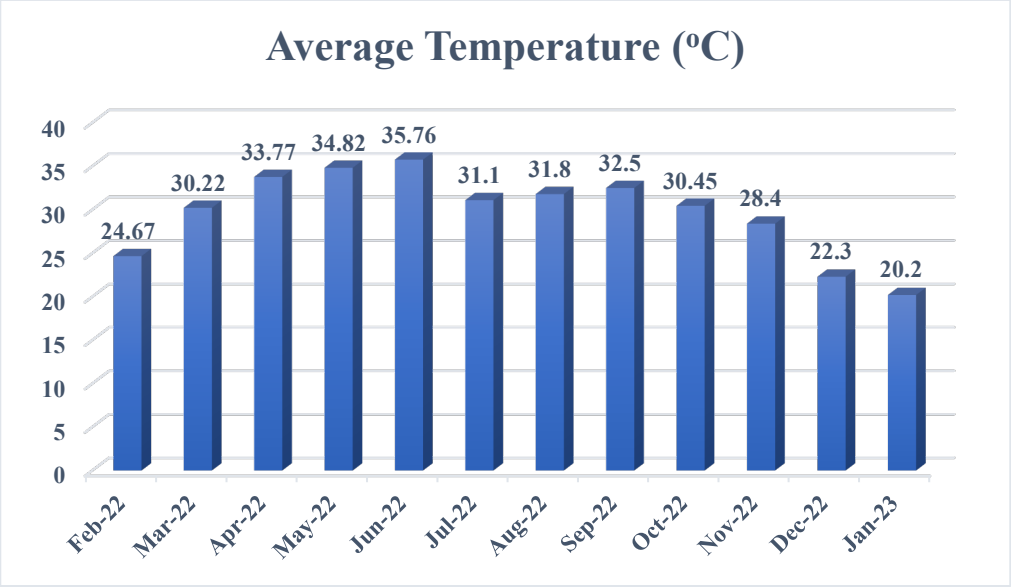

Figure 1: Data of monthly average temperature (ºC) variation

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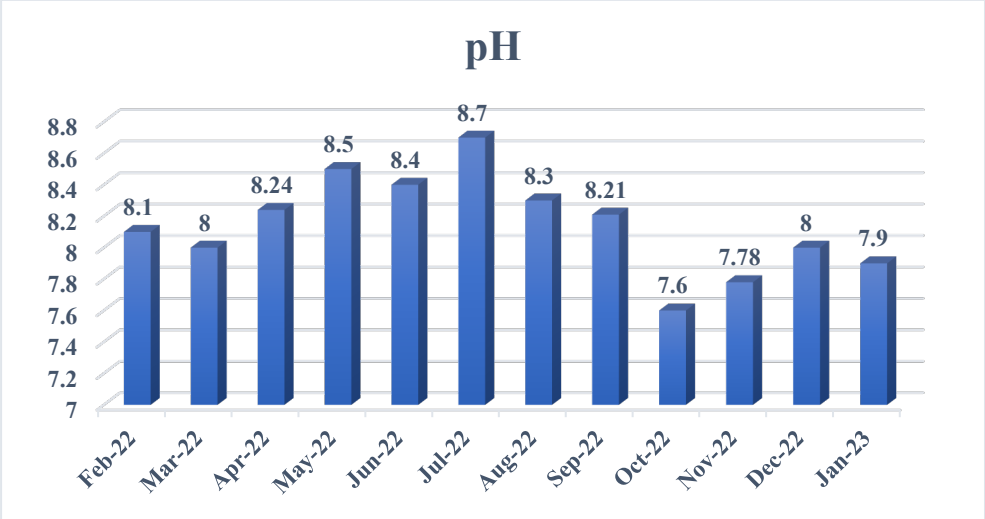

Figure 2: Data of monthly pH variation

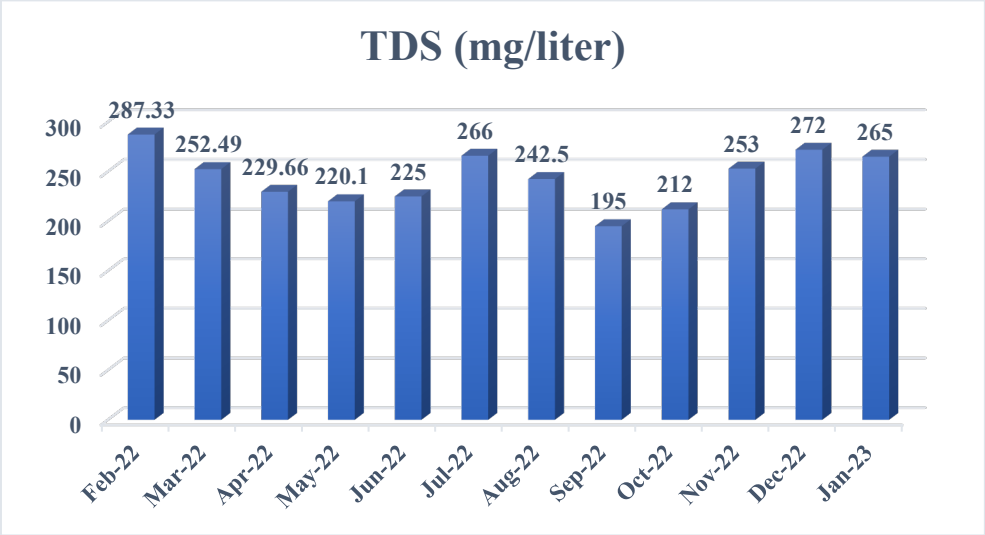

Figure 3: Data of monthly TDS (mg/liter) variation

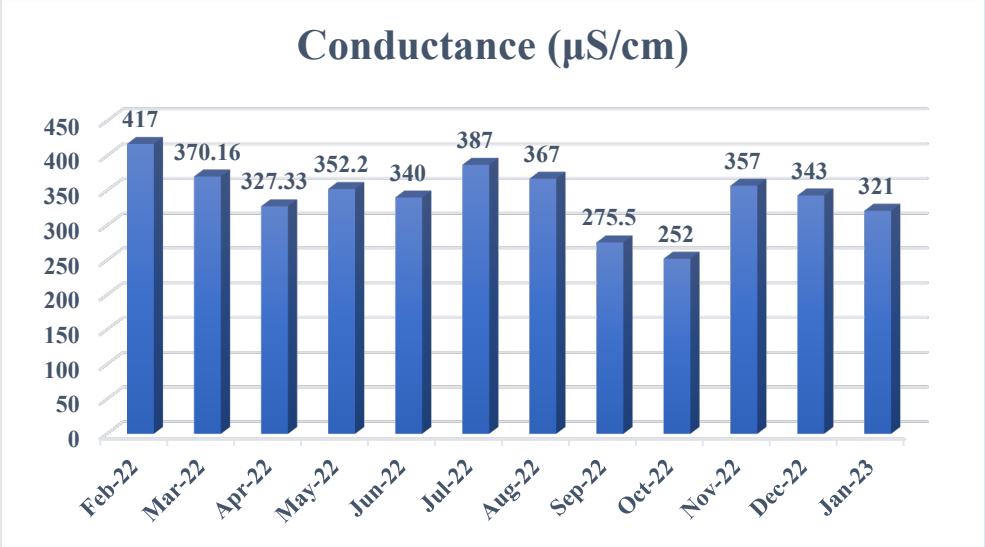

Figure 4: Data of monthly conductance (µS/cm) variation

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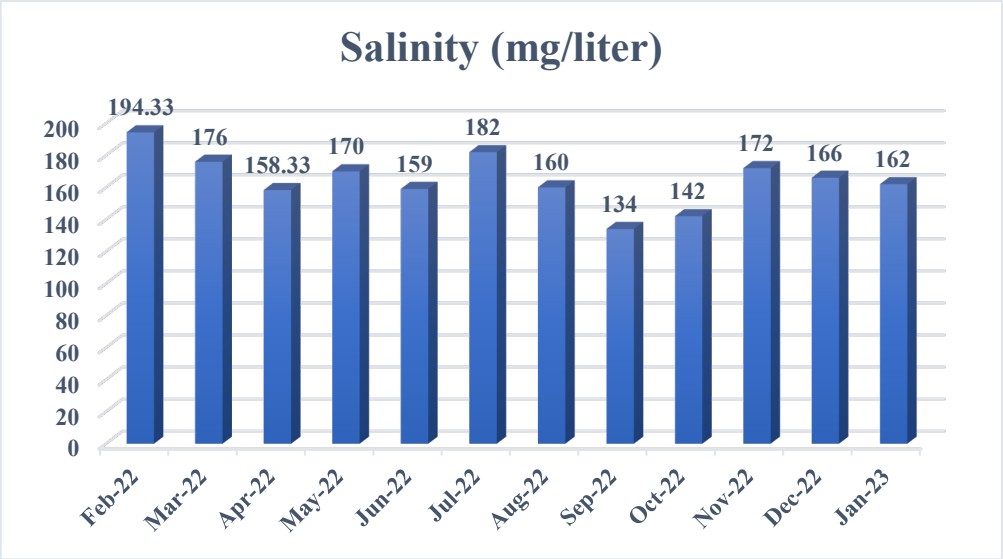

Figure 5: Data of monthly salinity (mg/liter) variation

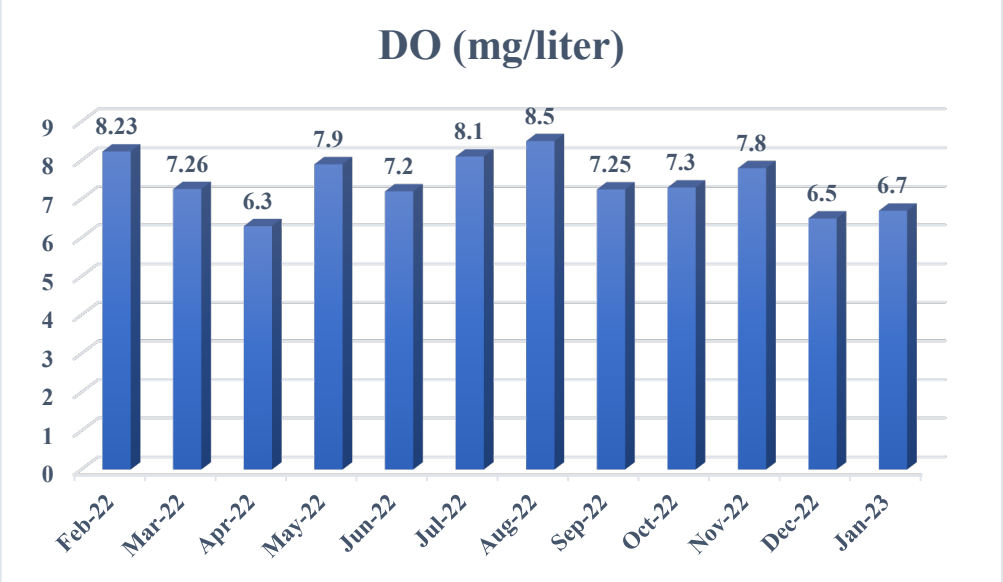

Figure 6: Data of monthly dissolved oxygen (mg/liter) variation

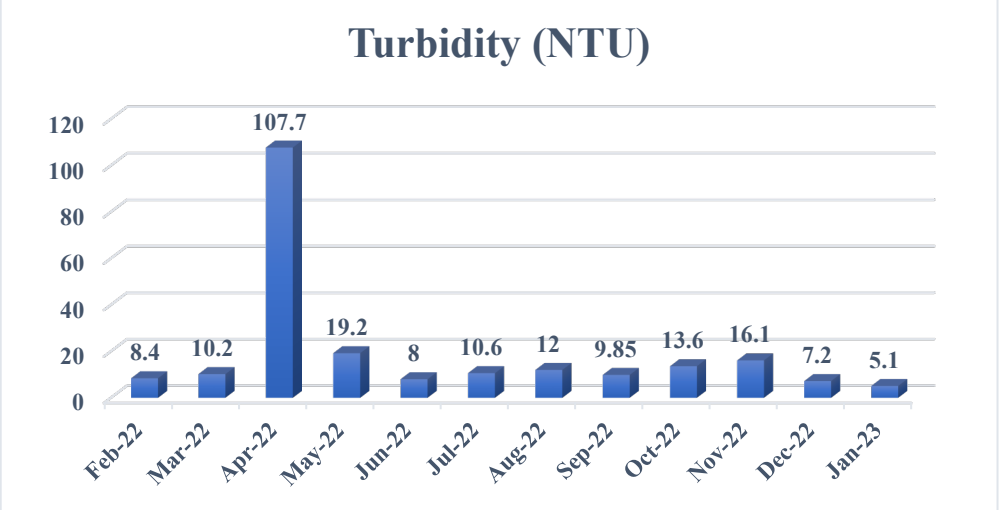

Figure 7: Data of monthly turbidity (NTU) variation

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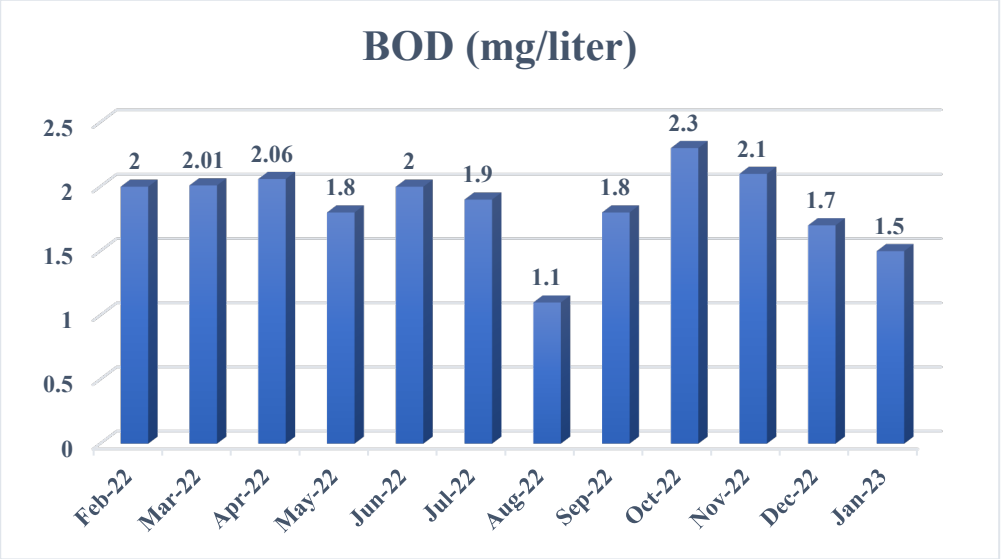

Figure 8: Data of monthly biological oxygen demand (mg/liter) variation

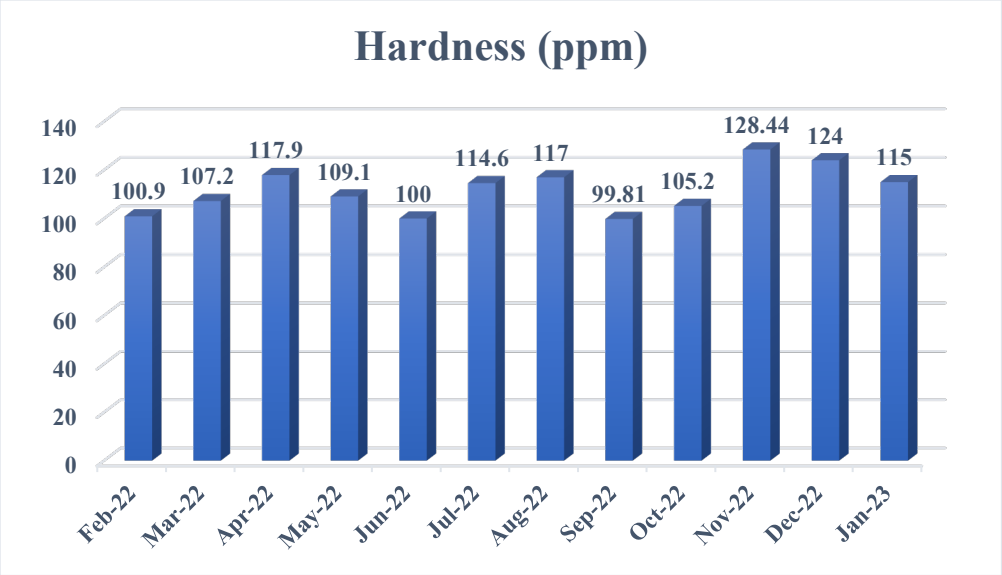

Figure 9: Data of monthly hardness (ppm) variation

DISCUSSION

Generally, the river water pH, salinity, conductance, hardness, TDS etc. remain high during winter, reaches maxima before summer and moves to minima during monsoon. These are the general trend and reported in literatures [1-5,8-12]. pH denotes acidity or alkalinity of water. pH is maximum during July 2022 (8.6) and minimum during October 2022 (7.6). Total dissolved solid is found maximum during February 2022 and minimum during September 2022. Conductance data found highest during February 2022 and lowest during October 2022. High salinity is observed during February- March 2022 whereas low salinity found during September -October 2022. DO found below 7 mg/Liter during April 2022, December 2022 and January 2023. Hardness remain around 100 ppm throughout the year (study period). Except April the turbidity of river water found low. BOD value lies between 1.1 to 2.3 mg/litre. The study of Physico-chemical parameters of any river greatly affect the flora and fauna diversity of river eco system.

CONCLUSION

Throughout the year river water remain alkaline, specifically during summer and monsoon (April 2022 to Sept 2022) pH were found always above 8.2. Hence it is expected that sufficient blue-green algae should be present in river. Total dissolved solid (TDS) remain always above 190

mg/lit throughout the year. Conductance data always remain above 250 µS/cm indicating the presence of sufficient ions in river water. Salinity remains relatively low in monsoon due to high rainfall and enhanced river flow rate. However, salinity always remain below 200 mg/lit, suggests that the river must be characterised by an ecosystem having narrow species diversity. DO remain low during April 2022 perhaps due to high turbidity. The river water may be considered as soft water. BOD value suggests the river is not too much polluted and pollution is less specially during monsoon. The biodiversity, flora and fauna distribution within river Damodar must be dependent of the physico-chemical parameters of the river water.

ACKNOWLEDGEMENT

T Debnath and M Ray are grateful to the Governing Body and R M Committee of BRS College for financial support. Acknowledgement is also due to all the staff of Environmental Science laboratory of BRS College for analytical and instrumental support.

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